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## ACRONYMS

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<th>Description</th>
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<tbody>
<tr>
<td>AEP</td>
<td>Annual Exceedance Probability</td>
</tr>
<tr>
<td>ARI</td>
<td>Average Recurrence Interval</td>
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<tr>
<td>CMA</td>
<td>Catchment Management Authority</td>
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<tr>
<td>EGCMA</td>
<td>East Gippsland Catchment Management Authority</td>
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<tr>
<td>LGA</td>
<td>Local Government Authority</td>
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<tr>
<td>MFEP</td>
<td>Municipal Flood Emergency Plan</td>
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<td>MEMPC</td>
<td>Municipal Emergency Management Planning Committee</td>
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<td>PSA</td>
<td>Planning Scheme Amendment</td>
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<td>RCS</td>
<td>Regional Catchment Strategy</td>
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<td>Total Flood Warning System</td>
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<td>Victorian Flood Database</td>
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<td>VFMS</td>
<td>Victorian Floodplain Management Strategy</td>
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<td>Victorian State Emergency Service</td>
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EXECUTIVE SUMMARY

The West Gippsland Catchment Management Authority (WGCMA) has been working collaboratively with local communities, Traditional Owners, councils, the Victorian State Emergency Service (VICSES) and other regional agencies to prepare the draft West Gippsland Floodplain Management Strategy (‘the Strategy’) as an outcome of the 2016 Victorian Floodplain Management Strategy (VFMS). The Strategy:

- Identifies those parts of the region with significant flood risk;
- Identifies possible actions to mitigate those risks; and
- Establishes a list of priority actions to be implemented over the duration of the Strategy.

The possible mitigation actions identified in this draft Strategy will be revised based on feedback from a period of public exhibition. The revised actions will then be further prioritised into an initial three-year Regional Work Program to commence implementation of the actions. The work program will be reviewed each year and updated as a rolling three year work program, with two subsequent work programs to be developed over the term of the Strategy.

The vision for the strategy is that West Gippsland communities are aware of flooding and are actively taking measures to manage their flood risks to minimise the consequences to life, property, community wellbeing, the economy and the environment.

The strategy seeks to:

- Build a flood resilient community – through effective sharing of current information about flood behaviour;
- Reduce existing flood risks – through emergency management, flood mitigation infrastructure works and activities, and risk management;
- Avoid future flood risks – through effective land use planning and building controls that account for the impacts of climate change; and
- Manage residual flood risks – through flood insurance, provision of flood risk information, integrated flood emergency management and incident control.

Flooding is a natural hazard in West Gippsland that can severely disrupt communities by causing injury, loss of life, property damage, personal hardship, and disruptions to regional economies. The location, the scale of effects and the probability of occurrence can be estimated with reasonable accuracy for a range of floods. Understanding flood behaviour enables us to assess the likely costs of flooding and the benefits of different options for managing the community’s exposure to flood risk.

The development of this Strategy has involved an assessment of flood risks across the region, resulting in a list of locations with significant flood risk, relative to other locations across Victoria. Options for mitigating these flood risks were then investigated to produce a list of actions that the responsible agencies consider to be feasible over the term of the Strategy, subject to funding and further investigation.

The flood mitigation actions proposed can be grouped into four categories.
1. **Land use planning** relates to tools such as Planning Schemes and building regulations, which manage development in flood-prone areas to reduce risk to life and property associated with new development. An example action is updating Planning Schemes to reflect current flood mapping.

2. **Flood mitigation infrastructure** involves the construction and management of physical works designed to reduce the impacts of flooding, such as levees, floodways and retarding basins. Example actions include managing waterways, developing retarding basins and developing or managing levees.

3. **Flood warning** involves community education and awareness in support of flood preparedness to reduce existing flood risks. Example actions include the installation of flood warning systems on roads prone to regular flooding and sharing flood mapping with communities.

4. **Flood response** involves emergency management planning in order to manage the risks that cannot be managed by actions in the first three categories. Example actions include updating Flood Emergency Management Plans and developing local Flood Guides.

Considerable engagement with the relevant Councils, the Victorian SES, impacted communities and relevant agencies has taken place to both assess flood risks and identify possible actions to mitigate those risks. Feedback on the draft Strategy is now being sought and will be incorporated into the final Strategy, anticipated for release by December 2017.

The final Strategy will be accompanied by a Development and Improvement Plan which includes the Regional Work Program for 2018-20 and a plan for implementation and evaluation of the Strategy.
PART 1 – INTRODUCTION AND STRATEGIC CONTEXT

The West Gippsland Catchment Management Authority (WGCMA) has been working collaboratively with local communities, Traditional Owners, Councils, the Victorian State Emergency Service and other regional agencies to prepare this draft West Gippsland Floodplain Management Strategy (VGFMS). The Strategy aims to:

- Identify those parts of the region with significant flood risk;
- Identify possible actions to mitigate those risks; and
- Establish a set of priority actions to be implemented over the duration of the Strategy (that will later be prioritised into a three-year work program).

This draft Strategy continues on from previous work including the West Gippsland Regional Floodplain Management Plan (Sinclair Knight Mertz, 2000) and the Victorian Floodplain Management Strategy (Victoria State Government, 2016).

Part 1 outlines the background and context of this Strategy and provides an overview of the West Gippsland region.

Part 2 summarises the history of flooding in the region, discusses various aspects of flooding, assesses the existing flood risks and flood risk treatments in the region and summarises the flood risks in each Local Government Area (LGA).

Part 3 sets out the Strategy vision and process, including stakeholder engagement, implementation of the Strategy and the list of priority flood mitigation actions.

1.1 The Victorian Floodplain Management Strategy

The 1998 Victoria Flood Management Strategy compiled the accumulated wisdom of best practices in floodplain management at the time. The 1998 state strategy remains directly relevant to the current challenges of floodplain management in Victoria. Its technical basis is still sound and will continue to be used into the future. This enduring foundation means that the challenges for the 2016 Victorian Floodplain Management Strategy (Victoria State Government, 2016) (VFMS) were around institutional arrangements rather than technical matters.


In particular, the floods of 2010-12 revealed institutional weaknesses in the management of flood warning systems and flood mitigation infrastructure. The Victorian Floods Review and the Parliamentary Environment and Natural Resources Committee Inquiry into Flood Management Infrastructure enabled the Victorian Government to set processes in train to ensure Victoria is better protected for the future. The 2016 Victorian Floodplain Management Strategy (Victoria State Government, 2016) sets out actions and policies that will help to implement the Victorian Government’s response to those inquiries. It also clarifies institutional arrangements to ensure continual improvement in all aspects of floodplain management.
The Department of Environment, Land, Water and Planning (DELWP) developed the 2016 strategy with input from key stakeholders in floodplain management and the broader Victorian community.

The **Victorian Floodplain Management Strategy** (Victoria State Government, 2016) (VFMS) requires Catchment Management Authorities (CMAs) and Melbourne Water to develop and periodically review Regional Floodplain Management Strategies (RFMSs) in partnership with Local Government Authorities (LGAs), Victorian State Emergency Services (VICSES), regional agencies and local communities. The RFMSs are regional documents that are jointly prepared and implemented by all relevant agencies.

### 1.2 Aligning the Victorian and national approaches to managing flood risk

The 2009 National Strategy for Disaster Resilience describes a disaster-resilient community as one that works together to understand and manage the risks it confronts. It further states that disaster resilience is the collective responsibility of all sectors of society, including all levels of government, business, the non-government sector and individuals.

The National Strategy initiated a national review of land use planning and building codes to consider ways to enhance disaster resilience in the built environment.

The VFMS responds to the National Strategy by:

- Developing systems and processes to improve the quality of flood maps;
- Developing maps that show a range of flood probabilities, to better regulate land use in areas liable to flooding;
- Considering appropriate changes to land use planning and building codes; and
- Ensuring that local inputs are considered when developing solutions to local issues.


The **Emergency Management Act 2013** implements many of the reforms from the White Paper, repealing most of the 1986 Act. The reforms in the 2013 Act include:

- Formally establishing the State Crisis and Resilience Council as Victoria’s peak emergency management advisory body;
- Establishing Emergency Management Victoria as the responsible agency for the coordination and development of whole-of-government policy for emergency management in Victoria;
- Establishing the State and Regional Emergency Management Committees;
- Establishing the Emergency Management Commissioner as the successor to the Fire Services Commissioner with an over-arching management role for major emergencies; and
- Establishing the Inspector General for Emergency Management to provide assurance to the Government and the community regarding Victoria’s emergency management arrangements.

Victoria follows the national approach set out in the **Australian Emergency Management Handbooks** from flood studies to on-ground action. In West Gippsland this will be achieved by local agencies coordinating their activities through approaches including this Strategy.
1.3 Purpose and scope of the West Gippsland Floodplain Management Strategy

The West Gippsland Floodplain Management Strategy (‘The Strategy’) aims to provide a single, regional planning document for floodplain management as well as a high-level regional work program to guide future investment priorities. The Strategy has been prepared by and is targeted for the relevant agencies involved in floodplain management in the region.

The Strategy focuses on the management of floodplains and flood risk. It seeks to interpret and apply the policies, actions and accountabilities of the Victorian Floodplain Management Strategy (Victoria State Government, 2016) at the regional and local level.

The Strategy seeks to:

- Identify areas in the region with a significant flood risk;
- Identify possible actions to mitigate those risks;
- Establish a set of priority actions to be achieved over the term of the Strategy, subject to feasibility and available resources;
- Refine the priority actions into an initial three-year work program; and
- Establish a monitoring and evaluation framework to determine the success of implementing the Strategy.

The first three items above have been undertaken as part of this draft Strategy, with the final two items to be undertaken at a later stage as part of the final Strategy.

The Strategy’s development has been led by the WGCMA in collaboration with local communities, LGAs, VICSES and other regional agencies.

Priority actions are those that have been identified as economically, socially and environmentally feasible measures that do the most to narrow the difference between existing flood risks and the community’s willingness to accept those risks, and where the responsible parties are willing to take action.

The priority flood mitigation actions identified in Table 2 are proposed to be implemented over the term of the Strategy, and will be further prioritised into an initial three-year Regional Work Program for implementation.

1.4 Relationship to other strategies and plans

This Strategy relates to other State, regional and local strategies and plans as outlined in Figure 1 below.
Figure 1 - Relationship between various State, Regional and Local activities (Source: Victorian Floodplain Management Strategy Table 3)

<table>
<thead>
<tr>
<th></th>
<th>Minister for Environment, Climate Change and Water</th>
<th>Minister for Planning</th>
<th>Minister for Emergency Services</th>
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<tr>
<td><strong>STATE</strong></td>
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<td>DELWP</td>
<td>DELWP</td>
<td>VICSES</td>
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<td>Coastal Boards</td>
<td>CMAs</td>
<td>CMAs &amp; DELWP</td>
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<td>Regional Floodplain Management Strategies</td>
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<td>Plans</td>
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<td><strong>LOCAL</strong></td>
<td></td>
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<tr>
<td>Local Councils</td>
<td>CMAs</td>
<td>CMAs and/or local councils</td>
<td>Local Councils</td>
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<tr>
<td>Coastal Management</td>
<td>Works on Waterways permits</td>
<td>Local flood studies</td>
<td>Local Planning Policy Framework and local planning scheme controls</td>
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<tr>
<td>Plans</td>
<td></td>
<td></td>
<td>Municipal Emergency Management Plans</td>
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In addition to those listed in Figure 1, the Victorian Government is currently developing the Victorian Rural Drainage Strategy, which aims to establish a framework for the management of dryland rural drainage in Victoria by clarifying institutional arrangements and identifying roles and responsibilities.

Development of this Strategy has been guided by the West Gippsland Regional Catchment Strategy 2013-2019 (West Gippsland Catchment Management Authority, 2012) (RCS). The RCS identifies significant natural assets within the region and outlines 20-year objectives to support the Vision Statement. It sets direction for how the region’s land, water and biodiversity resources should be managed in order to maintain or improve their condition over time.

The West Gippsland Waterway Strategy 2014 - 2022 (West Gippsland Catchment Management Authority, 2014) seeks to ensure the future management of waterways (rivers, estuaries and wetlands, including floodplain wetlands) provides the appropriate environmental conditions to support a range of environmental, social, cultural and economic values. It identified high value waterways in West Gippsland and used regional goals to develop a work program of management activities for priority waterways. The management of floodplains and flood risk was not within the scope of that Strategy, and has instead been investigated within this Strategy.

The Gippsland Regional Coastal Plan 2015-2020 (Gippsland Coastal Board, 2015) is a statutory Coastal Action Plan endorsed under Part 3 of the Coastal Management Act 1995. It provides a framework for agencies on emerging strategic regional priorities for the Gippsland coastal region, and identifies and prioritises management actions that cannot be achieved more effectively at either the local or state level.
1.5 Review of the previous regional strategy

In 2000, Sinclair Knight Mertz prepared a Regional Floodplain Management Plan (Sinclair Knight Mertz, 2000) for the WGCMA. Its intent was to provide a planning framework for a number of programs and incorporate the vision, objectives and targets necessary for their successful implementation. It was underpinned by a comprehensive consultation process.

The WGCMA’s floodplain management vision at that time was ‘In partnership with the community, ensure responsible and sustainable management of the region’s floodplains for the benefit of current and future generations’.

The 2000 Strategy had similar objectives to this current Strategy, mostly focused around addressing flood risks, improving flood information and increasing community awareness of flooding.

The 2000 Strategy and Implementation Plan were reviewed prior to the commencement of this Strategy development.

Most action items in the Implementation Plan have been completed. Of the 84 tasks, 66 have been completed, 10 have been partly completed, 1 was not undertaken and 7 are no longer applicable. Implementation of these actions involved a number of partners, including LGAs undertaking Planning Scheme Amendments and enforcing Planning Scheme controls, VICSES preparing and updating flood emergency plans, the Bureau of Meteorology and the Gippsland Regional Water Monitoring Partnership upgrading flood warning systems and the WGCMA undertaking flood studies and collecting data as floods occur.

The major impediments to the completion of all the tasks were the historic confusion around management responsibilities for flood mitigation infrastructure and a lack of funding. In that context, the completion rates are positive, especially given the limited resources made available for floodplain management during the Millennium Drought.

1.6 The West Gippsland region

This Strategy applies to the West Gippsland region shown in Figure 2. The region includes the entire Latrobe City municipality, significant portions of Bass Coast, Baw Baw, South Gippsland and Wellington Shires and a small section of East Gippsland Shire. The West and East Gippsland CMAs share responsibilities across the Gippsland Lakes. Each Regional Floodplain Management Strategy is being developed separately but wherever possible, alignment is being sought across both regions. The most significant example of alignment across the regions applies to the Gippsland Lakes where the assessment of flood risks and proposed actions to mitigate them should be applied consistently across the Lakes area.
The West Gippsland region covers an area of 19,639 square kilometres including the marine environment (out to three nautical miles from the coast). The region accounts for almost 8% of Victoria’s total land area and includes a broad range of bioregions, flora and fauna. Corner Inlet and the Gippsland Lakes are wetlands of international importance under the Ramsar convention.

1.7 The cultural significance of floodplains for Traditional Owners

Aboriginal Australians have strong cultural connections to Country and there are many sites of cultural heritage significance within West Gippsland, particularly around waterways and floodplains.

Involving Traditional Owner groups in the development of the Strategy is recognised as an important part of the process, in order to:

- Further develop partnerships between the WGCMA and Traditional Owner groups by engaging in meaningful and respectful ways; and
- Increase WGCMA understanding of Traditional Owner values, needs and aspirations in relation to floodplain management.

The West Gippsland Regional Catchment Strategy 2013-2019 (West Gippsland Catchment Management Authority, 2012) recognises the significance to Traditional Owners of the preservation of cultural heritage. It outlines the importance of engaging with Traditional Owners when planning natural resource management works to ensure they are carried out in accordance with the Aboriginal Heritage Act 2006 and the Aboriginal Heritage Regulations 2007.
Within the West Gippsland Region, the Gunaikurnai people are the largest Traditional Owner group, followed by the Bunurong / Boon Wurrung groups and the Wurundjeri people.

Flood behaviour is likely to have altered since European settlement. Consultation with the Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC) and the Bunurong Land Council (BLC) during the development of this Strategy has identified that knowledge about historical flood behaviour would assist in identifying Cultural Heritage sites which may be impacted by future flooding events. Based on this, it is recommended that the WGCMA investigate a project outside of this Strategy to develop historical flood maps.

In addition, current flood mapping will be made available to all Traditional Owner groups to assist them in identifying where their cultural heritage sites are at risk of flooding.

1.7.1 Gunaikurnai

The WGCMA has entered into a Memorandum of Understanding (MoU) with the Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC) which guides their involvement as a partner in all WGCMA projects from the inception stage. The protocols in this MoU will be followed in our work together on this strategy.

The Gunaikurnai have lived, worked and hunted on waterways and floodplains for generations. They have cared for waterways as part of ongoing cultural maintenance and to have access to fresh water and surrounding land which ensured food and working materials are readily available. Waterways are highly significant to the Gunaikurnai people, making up many of their traditional stories, and the borders between the five clans of the Brayakaulung, Brabralung, Krauatungalung, Tatungalung and Brataualung. The Gunaikurnai people have a strong connection to Country and a desire to keep their lands and waterways in good condition. They understand the significance of flood events in flushing the environment, and hope to have their own people working in this area, looking after country and cultural sites.

1.7.2 Bunurong

The Bunurong Land Council applied to become a Registered Aboriginal Party in 2017.

The Bunurong Land Council was restructured around the time that planning for this Strategy commenced, therefore this strategy is the first where the WGCMA has engaged with the Bunurong Land Council from project inception.

Water and its uses have been vital to the Bunurong / Boon Wurrung people since creation, and continue to provide rich cultural connections. Waterways and flooding provided both significant cultural values and natural resources, including permanent settlements around floodplains such as the Powlett River where crops were grown.

Flooding impacted significantly on the Bunurong / Boon Wurrung people. They used their knowledge of the behaviour of certain animals, including insects to warn of impending floods. They understood the extent of floodplains and used this knowledge to determine sites for burials,
settlements and gatherings. It is very important to the WGCMA that with their consent, this type of traditional ecological knowledge become part of our work with Traditional Owners.

Bunjil is the creator spirit, the headman or ngurungaeta of a race of spirit men who had originally inhabited the Earth. He went to the sky on a great wind which Bellin-Bellin the Musk Crow let out from his skin-bags. Bunjl became Altair, the star and his two wives are the stars that sit on either side. From his position in the stars, Bunjl took his largest knife and slashed at the land and formed ridges that became mountains, the land between became the valleys. He let the rain fall to the land and formed rivers to give the Kulin water. He made a man out of clay, used stringy bark as hair and blew his breath into its mouth. The clay man stirred and Bunjl danced around him. Bunjl's son Binbeal made women out of the water and went on to become the rainbow, Binbeal's wife is what we sometimes see as a second rainbow. Merndai the serpent had made many of the creeks with his long body and inquiring head poking into all corners. On occasion he had brought word for all the little creeks to join up.

*Kurukurook* was responsible for giving the lore and a form of government to the tribal ancestors. She gave the first women their tools and digging sticks. She was the only one who could make fire, initially. She would not share it with anyone and kept it in the end of her yam stick. Waa, the crow, knew she was fond of ant eggs and so buried many snakes under an ant hill and invited Kurukurook to come and dig up their eggs. As she dug, the snakes popped out and she dropped her stick, some of the fire fell out. Waa was nearly as selfish as Kurukurook and took the fire away for himself. He would not share it but offered to cook the peoples food for them with it instead, always keeping the best parts of the food for himself. Bunjl was angry at this, he gathered all the people who spoke harshly at Waa and he became afraid. He threw the fire on the ground to burn the people, many of whom took some of the fire. Two of Bunjl's sons took some fire and threw it near Waa, the grass around him burned fast and he was burnt black. Bunjl turned him into a crow, never to be a man again. Bunjl's two sons were also burnt in the fire and turned to stone.

During times of tremendous rain the land had often become saturated, drowning the trees and often cutting off certain paths through the land, limiting people's ability to access certain spaces or trapping them altogether. Aboriginal people learned to read the signs shown to them by the many insects, warning them of the impending rain.

Once, back in the Dreaming, during a time of great rains, the land had flooded and only a small part of the land remained dry. Many of the people were stuck on a hill, now an island, surrounded by wild water, wet and cold. All the Ancient Beings congregated there with them. Merndai the serpent informed the tribes that certain men must return to the bird form of their totems to save those gathered on the island from starvation. The water was rising, it had wet their feet and put out their fires. It crept up until they were marooned and there was no food at all. They needed to act swiftly. The men assumed their bird forms, flew away and came back with lots of food. The eaglehawk returned with a goanna in his beak, dropped it on the dry land and flew away again to return with a broad toothed rat. He repeated this over and over. The Tawny Frogmouths returned with Marsupial Mice in their wide mouths. Kooring-kooring the Kookaburra Men returned with long brown snakes. They all repeated this until there was enough food for everyone. The food was eaten raw as there was no fire, the dry kindling stored on high land in tree hollows was too far away to get to. The bird men returned to their Kulin form and joined in with the feast. The rivers and creeks all widened as a result of this flood.
Floods have always happened here and though this story is ancient, the rain will again team down.

(Sources are The Journals of William Thomas and Muriel McGivern - The Aboriginal of the Dandenong Mountain)

1.7.3 Boon Wurrung

The WGCMA has been working with The Boon Wurrung Foundation for several years now. In the past they have contributed to our Regional Waterway Strategy. Information regarding this Strategy has been provided to them so that they can provide their valuable input for the final Strategy.

1.7.4 Wurundjeri

There is a small area of the Wurundjeri Registered Aboriginal Party (RAP) land within the West Gippsland catchment. This land is located in the high country and is not subject to flooding, and therefore this group has not been consulted during the development of this strategy.
2. PART 2 – ASSESSMENT OF REGIONAL FLOODING

2.1 Recorded flooding in the region

Flooding is a natural hazard in West Gippsland. Whether floods are caused by high rainfall or coastal storm surges, they can severely disrupt communities by causing injury, loss of life, property damage, personal hardship, and disruptions to regional economies.

It is a question of when, not if, floods will occur. Fortunately, the location, the scale of effects and the probability of occurrence can be estimated with reasonable accuracy for a range of floods. Understanding flood behaviour enables an assessment of the likely costs of flooding and the benefits of different options for managing the community’s exposure to flood risk.

Flooding has been recorded throughout the region, with varying levels of detail, since the 1930s. Major floods are also known to have occurred in the 1890s and early last century but there is little recorded data from these events.

Gippsland was severely impacted by widespread floods across Victoria in 1934. Significant flooding occurred on the Latrobe, Thomson, Tarwin and Powlett Rivers. The Yallourn open cut flooded when the Latrobe River burst its banks. Roads were impassable, and railway lines and telephone lines were washed away across the region. Many people drowned and hundreds of homes were flooded. The Wilson’s Promontory lighthouse was used to send out wireless messages to provide flood warnings about the Tarwin Lower area and appeal for boats to undertake rescues (Launceston Examiner, n.d.).
Figure 3 - Flooding on the Tarwin River near Koonwarra, 1934 (Source: Unknown)

Figure 4 - Latrobe River flooding at the Traralgon-Maffra railway, 1934 (Source: Traralgon & District Historical Society [Catalogue number 10275])
The Latrobe River has also experienced significant floods in 1978, 1993 and 2012. These floods caused widespread damage to private property and infrastructure such as roads and railway lines, as well as significant livestock losses.


1978 saw flooding in Sale, Traralgon, Seaspray and Rosedale, with dwellings flooded in Sale and Rosedale, and Seaspray being subject to two major floods within three weeks. 2007 saw major flooding on the Macalister and Avon Rivers, with those on the Macalister being the largest recorded. The presence and operation of Glenmaggie Dam on the Macalister River reduced the 2007 flood from an estimated 300 year ARI event upstream of the dam to about a 100 year ARI event downstream of the dam wall.

The urban areas of Traralgon have experienced flooding from Traralgon Creek in 1978, 1993, 1995, 2011 and 2012. Many properties experienced over-floor flooding and a number of roads were inundated during these events.

*Figure 5 - Shakespeare Street, Traralgon, 2012 (Source: WGCMA)*
The nature and relatively lower level of development on floodplains in South Gippsland means that flood damages and trauma are generally less than in other parts of Gippsland. Nonetheless, roads are frequently cut and rural land inundated. Many areas in South Gippsland also suffer from coastal inundation and/or storm surge influences. The Powlett and Tarwin Rivers are examples of where riverine and coastal inundation combine to cause low lying land and roads to be inundated for reasonably long periods of time.

**Figure 6 - Lower Powlett River, 2013 (Source: WGCMA)**

Significant flooding occurred across the South Gippsland and Bass Coast areas in 1934 with high rainfall resulting in road closures, landslides and evacuations. A number of roads were again inundated in 1951 and the town of Wonthaggi was isolated along its north. A very large flood in 2012 resulted in a large number of road closures in the Wonthaggi area and a number of people rescued from cars on the Bass Highway.

In March 2011, an extreme rainfall event occurred at Wilsons Promontory National Park which caused landslides and flooding in waterways including Tidal River and Darby River. The Wilsons Promontory Road crossing at Darby River was destroyed, trapping people located south of the bridge in the park’s main visitor facilities area. The park sustained extensive damage to roads, walking tracks and buildings, which resulted in months of repair works and significant disruption to the local economy, for which tourism at the Park is a major contributor.
Large-scale floods occurred across the region in 2007 and 2012. In both cases, a number of river systems were in flood, resulting in flooding over an extensive area for a number of days. The 2007 flood, which had a lower peak level than a 1% AEP flood, caused widespread damage and was a significant burden on emergency services. VICSES personnel were deployed to the area from other parts of Victoria, which fortunately were not also in flood at the same time (Molino Stewart, 2008).

The 2012 flood resulted from a severe weather event with heavy rainfall and widespread flooding across a number of municipalities. Its impact was made worse by the rainfall and flooding a few weeks earlier that had saturated catchments. Emergency services were also challenged by concurrent windstorms. The report *2012 Gippsland Flood Event – Review of Flood Warnings and Information Systems* (Office of the Emergency Services Commissioner, Department of Justice Victoria, 2012) states that: ‘For a rapidly escalating event in Gippsland, local resourcing provided very limited capacity and minimal contingency for a protracted event’. In the later stages of this flood event, personnel from other regions in Victoria reinforced key functions in the Incident Control Centre (ICC).

The significant burden imposed by widespread flooding in Gippsland can be managed to some extent by the ability to predict flood risks and consequences across the region, and the potential to focus on the dissemination of information about flooding to the wider community as well as the affected local communities.

The West Gippsland coastline is vulnerable to coastal inundation during significantly high tides, often in conjunction with storm surges. The severity of impacts varies depending on factors including geomorphology, estuary characteristics and population and infrastructure inundated. In addition, individual weather events can vary due to precedent conditions, direction and severity. In some locations, assets such as roads, boardwalks, life saving towers, foreshores and jetties have been damaged as a result of coastal inundation.
In recent times, a storm surge in June 2014 resulted in inundation at a number of locations along the coast from Inverloch to McLoughlin’s Beach.

A number of coastal levees, also known as sea walls have been constructed, mostly by private landowners, to protect large areas of land around Corner, Shallow and Andersons Inlets. Much of the land is farmland that would be regularly inundated without the existence of the sea walls. Sea walls for flood mitigation purposes protect the area behind them from sea water intrusion, as opposed to those that protect banks from erosion caused by wave action. Inundation currently occurs where these walls have been damaged or breached, and this will increase into the future as sea level rises and the incidence and severity of storm surges increases.

### 2.2 Climate change

Future changes to the climate in West Gippsland are predicted to create hotter and drier conditions and an increase in severe weather events, including more bushfires, storms, droughts and floods. Each of these will have consequential effects on water quality, air quality, crops, soils, livestock, biodiversity and the local economy.
A number of steep and forested catchments in the region are likely to experience more severe flooding following bushfire and high intensity rainfall events, as evidenced by relatively recent events in the Macalister River and Traralgon Creek catchments.

**Figure 8 - Wellington River, 2007 (Source: WGCMA)**

Along the Gippsland coastline, the increase in frequency and intensity of storms is likely to interact with sea level rise causing greater inundation and erosion. These effects will be most severe in those areas already subject to coastal inundation and/or erosion such as the Nooramunga Coast, the Gippsland Lakes and Corner Inlet.

Effective adaptation to climate risks is guided by *Victoria’s Climate Change Adaptation Plan 2017-2020* (State Government Victoria, 2016), which outlines the Victorian Government’s role of providing current information to assist communities in managing their risks and coordinating state-wide action. The plan discusses that improving the resilience of the built environment involves factoring climate change risks into land use planning via tools including planning overlays and coastal hazard assessments. The Government has integrated climate change risks into coastal management through the *Victorian Coastal Strategy 2014* (State Government Victoria, 2014) and is developing a new *Marine and Coastal Act*.

The *Gippsland Regional Coastal Plan 2015-2020* (Gippsland Coastal Board, 2015) includes a discussion around climate change and coastal hazards along the Gippsland coast. It recognises the
many significant changes to the region’s coastal and marine environments, including sea level rise (and the resulting increases in inundation and flooding, coastal erosion and storm surges), ocean acidification, higher ocean temperatures and atmospheric changes leading to changes in rainfall patterns.

The Plan outlines actions to improve regional and local planning for hazards that are unique to the coast. Regional and local adaptation planning involves the use of coastal hazard assessments to identify areas of public and private land vulnerable to inundation, erosion or recession and understanding how the community’s values are affected to inform the assessment of future risks and adaptive management responses.

Actions identified in the Gippsland Regional Coastal Plan 2015-2020 (Gippsland Coastal Board, 2015) that are relevant to this Strategy include that the Department of Environment, Land, Water and Planning (DELWP) lead the development of a ‘systematic approach to prioritise areas for detailed coastal hazard assessments and adaptation planning’ and ‘…clarify the role of flood studies in the hazard assessment process’.

Actions to be led by local councils include ‘Continue or undertake new, detailed coastal hazard assessments and adaptation planning’, particularly for areas identified as a priority, and ‘Implement identified adaptation responses through local decisions’, which may include planning scheme updates, emergency plans and future works.

Non-coastal areas will also be impacted by a changing climate, particularly by a change in flood regime. The variability in average stream flows and storm intensity is likely to increase over time, which will alter the likelihood and consequences of floods for a specific location. To prepare for a range of climate conditions, modelling a range of flood events provides information about a floodplain’s sensitivity to changes in climate. Policy 9a in the Victorian Floodplain Management Strategy (Victoria State Government, 2016) stipulates that flood studies use rarer flood events to assess sensitivity to climate change, and that further climate change scenarios may be considered where this sensitivity is significant.

2.3 Integrated catchment management

Integrated catchment management (ICM) involves managing floodplains in a responsible and sustainable way, considering their economic, social and environmental values. ICM coordinates agencies, stakeholders and the community to promote the sustainable management of land and water resources from a catchment wide perspective, recognising the impact of land use within catchments on land, water and biodiversity. ICM is established under the Catchment and Land Protection Act 1994 in Victoria.

Our Catchments Our Communities – Integrated Catchment Management in Victoria 2016-19 (Victoria State Government, 2015) recommends the following ICM approach:

- Strengthen community engagement in regional planning and priority setting;
- Clarify roles and responsibilities of key agencies;
- Strengthen coordination between key management partners;
• Improve accountability of partners implementing Regional Floodplain Management Strategies; and
• Improve state and regional floodplain management reporting using a consistent set of indicators.

Both the Victorian Floodplain Management Strategy (Victoria State Government, 2016) and this Strategy adopt this recommended approach.

Identification of threats to floodplains is critical in determining appropriate management responses.

The key threats to floodplains in the region are:

- Development within floodplains which increases the flood risk to life and property;
- Extractive and other industries which can alter flood behaviour and damage environmental values such as water quality and river banks;
- Land clearing which can increase runoff and decrease the quality of water being received by waterways;
- Agricultural activities which can result in land clearing, modification of land form and waterways, introduction of chemicals, loss of native habitat and changes to groundwater;
- Changes to natural flow regimes via regulating structures;
- Floodplain management activities such as channel modification and construction of levees; and
- Climate change which can reduce rainfall overall, increase the severity of flood events and lead to rising sea levels.

Waterways are dynamic as they are acted on by complex geomorphological processes which alter their form and capacity over time. In general, waterways will meander more over time, which cuts into adjoining land, damaging property, buildings and roads. Bank erosion and changes in flow capacity can increase flooding on adjoining land. Integrated catchment management seeks to strike a balance between the socio-economic impacts of flooding and waterway health.

In the past, flood mitigation relied heavily on channel modification and levee construction. Towards the end of the 20th century, it became apparent that activities like these are often expensive, have negative impacts on the environment and flood behaviour, and create significant problems when they fail or are overtopped (Western, 2011). Channel deepening and straightening generally increases flood height and velocity downstream, which exacerbates flood impacts and erosion there. It also disconnects the waterway from its floodplain, which impacts on riparian vegetation and habitat.

Levees have similar impacts to channel deepening, by transferring floodwaters to other locations. They also require maintenance and are at risk of overtopping or failure.

There is some concern in the region around the impact of in-stream vegetation on flooding, with some landholders requesting the removal of vegetation from waterways in order to reduce localised flooding. As with channel deepening and straightening, clearing of in-stream vegetation generally increases flood height and velocity downstream, and it also causes erosion of waterway banks both where the vegetation has been removed and downstream where flow velocities are increased. The
VFMS allows for vegetation management to occur along waterways where it can be demonstrated that this will significantly reduce the impacts of flooding, the benefits outweigh the costs to river health and the beneficiaries are willing to fund the works.

Opportunities can strengthen floodplain management, and may arise from policy changes, emerging technology, collaboration within CMAs and improved stakeholder engagement. Tangible examples include environmental watering, vegetation management and protection of floodplains for environmental values, which support floodplain management by slowing floodwaters which reduces their downstream impacts. When undertaken at a floodplain scale, all landowners benefit, however, if undertaken locally or at a small scale, benefits may not be as great. The exception to this is removal of riparian vegetation, which generally at a small scale may provide local benefits in some circumstances, but should be minimised to maintain the floodplain scale benefits.

Development and implementation of this Strategy provides an opportunity to strengthen floodplain management. In particular, this includes improved stakeholder engagement in regional planning, coordination between partner agencies, and accountability of partner agencies based on the roles and responsibilities outlined in the *Victorian Floodplain Management Strategy* (Victoria State Government, 2016).

### 2.4 Regional risk assessment

In prioritising floodplain management activities, the first task is to assess flood risks. In West Gippsland, this was done in two phases:

I. A rapid appraisal of flood risks; and
II. Stakeholder consultation.

I. **Rapid appraisal of flood risk**

The Victorian Department of Environment, Land, Water and Planning’s (DELWP) rapid appraisal of flood risk methodology was used to assess flood risks at a regional level. The methodology has been developed with the intention of providing a simplified appraisal tool that can be used to rapidly gain an understanding of flood risk with an appropriate level of reliability.

This assessment was undertaken across the West Gippsland region in early 2016. This was a limited analysis, designed to identify areas with the highest risk as an initial input for regional priority setting. Its purpose was to quantify and compare the relative flood risk for all management units throughout the WGCMA region. The rapid appraisal flood risk methodology is ‘fit for purpose’. It produces a relative measure of risk between discrete areas or regional ‘management units’ to quantify and compare relative flood risk.

The catchment was divided into a number of ‘management units’ based on features including catchments, towns and local government boundaries. Flood risk was assessed for both riverine flooding and coastal flooding. Coastal flood risk was estimated assuming the current flood extent, and a future flood extent based on 0.8 metres of sea level rise.

Flood damages within each management unit were assessed using three risk metrics:
i. **Absolute damage** - Average Annual Damages (AAD). This risk metric measures the absolute size of the flood risk.

ii. **Town resilience** - the average annual population affected (AAPA) divided by the town population. This risk metric takes into account the proportion of a town that is flooded.

iii. **Damage density** - flood risk calculated as average annual damage (AAD) divided by the flood extent for the 1% annual exceedance probability (AEP) event. This risk metric takes into account the different sizes of the management units.

This assessment considered factors including known 1% AEP flood extents and floodway extents, existing and future 1% AEP coastal inundation, rural buildings, planning zones, residential, commercial and industrial damage and agricultural damage based on area of land inundated and the losses by land use type.

While the rapid appraisal of flood risks is useful, it is also important, in the medium and long terms, to address those areas where flood information is lacking. For example, the nature of the rapid appraisal means that it is unable to consider factors such as critical infrastructure, vulnerable populations, flood risk where flood hazard data is absent, areas of high risk to life (e.g. floodways), areas intended for future development, community values and tolerance to flood risk, and existing mitigation. In addition, areas where there is no information about flooding will return a zero risk rating, which artificially skews the ranking of management units (ranking those with flood data higher than a unit with no flood data with a potential equivalent flood risk). A large number of management units in the region do not have any flood data, therefore information about their flood risk was absent and needed to be incorporated during the second phase of the regional flood risk assessment.

### II. Stakeholder consultation

During a series of workshops held during September 2016 with the WGCMA, the five major LGAs in the region (Bass Coast, Baw Baw, Latrobe, South Gippsland and Wellington), VICSES and regional agencies, further information was sought regarding (i) the logic of the outcomes of the rapid appraisal flood risk assessment and (ii) additional factors which were not previously considered. Risk metrics were adjusted based on local knowledge.

In addition to the targeted workshops, information about flood risk was sought publicly via the websites of the WGCMA and relevant LGAs and the WGCMA Facebook page. An online mapping tool was made available to the public whereby points could be added in specific locations and a range of fields populated to describe the nature and impacts of the flooding. Information was sought regarding important regional and community infrastructure as described in Section 2.5.

Information obtained from both phases of the regional flood risk assessment was consolidated for each management unit. Adjacent rural management units with similar characteristics and risks were considered as a cluster. The adjusted risk metrics were then used to identify areas with significant flood risks relative to the overall risks in the West Gippsland region. Absolute damage (AAD) and damage density were most useful of the three risk metrics, and one may be more useful than the other for an area depending on the nature of the management unit and the flooding.

The management units with the highest flood risk in the region as a result of both phases of the flood risk assessment are outlined in **Table 1**. Units listed as ‘Coastal’ are those areas, both urban
and rural, with a flood risk from coastal inundation only and not from riverine or overland flooding. Coastal areas are listed as ‘Urban’ if they experience flood risk from riverine or overland flooding, possibly in addition to coastal inundation.

The ‘ID’ numbers are for reference only and do not represent risk. The ‘Management Unit’ names are not fully representative of the unit location and extent for the sake of succinctness. Specific locations that are commonly known as being within a locality may not be included in that management unit due to the way the management units were defined. Each unit in Table 1 is mapped in the relevant municipality discussion in Section 2.9.

Table 1 - Management units identified as having a significant flood risk

<table>
<thead>
<tr>
<th>ID</th>
<th>MANAGEMENT UNIT</th>
<th>LGA</th>
</tr>
</thead>
<tbody>
<tr>
<td>URBAN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>218</td>
<td>Traralgon</td>
<td>Latrobe</td>
</tr>
<tr>
<td>199</td>
<td>Loch Sport</td>
<td>Wellington</td>
</tr>
<tr>
<td>212</td>
<td>Seaspray</td>
<td>Wellington</td>
</tr>
<tr>
<td>188</td>
<td>Warragul</td>
<td>Baw Baw</td>
</tr>
<tr>
<td>231</td>
<td>Trafalgar</td>
<td>Baw Baw</td>
</tr>
<tr>
<td>247</td>
<td>Morwell</td>
<td>Latrobe</td>
</tr>
<tr>
<td>205</td>
<td>Moe</td>
<td>Latrobe</td>
</tr>
<tr>
<td>234</td>
<td>Rosedale</td>
<td>Wellington</td>
</tr>
<tr>
<td>230</td>
<td>Yarragon</td>
<td>Baw Baw</td>
</tr>
<tr>
<td>216</td>
<td>Toongabbie</td>
<td>Latrobe</td>
</tr>
<tr>
<td>209</td>
<td>Sale</td>
<td>Wellington</td>
</tr>
<tr>
<td>202</td>
<td>McLoughlin’s Beach</td>
<td>Wellington</td>
</tr>
<tr>
<td>235</td>
<td>Tarwin Lower</td>
<td>Wellington</td>
</tr>
<tr>
<td>240</td>
<td>Glengarry</td>
<td>South Gippsland</td>
</tr>
<tr>
<td>215</td>
<td>Tinamba</td>
<td>Wellington</td>
</tr>
<tr>
<td>RURAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>58, 61, 38</td>
<td>Avon River - Wombat Flat Bridge to Clydebank</td>
<td>Wellington</td>
</tr>
<tr>
<td>93, 73</td>
<td>Moe River and Shady Creek – Darnum to Latrobe River</td>
<td>Baw Baw</td>
</tr>
<tr>
<td>128, 141</td>
<td>Tarra River – Macks Creek to Brewery Road</td>
<td>Wellington</td>
</tr>
<tr>
<td>74</td>
<td>Rainbow Creek</td>
<td>Wellington</td>
</tr>
<tr>
<td>3</td>
<td>Ninety Mile Beach - East of Merriman's Creek</td>
<td>Wellington</td>
</tr>
<tr>
<td>53, 70</td>
<td>Macalister River - Glenmaggie Weir wall to Thomson River</td>
<td>Wellington</td>
</tr>
<tr>
<td>78</td>
<td>Thomson River - Macalister River to Park Street, Sale</td>
<td>Wellington</td>
</tr>
<tr>
<td>79</td>
<td>Latrobe River - Flynn to Rosedale</td>
<td>Wellington</td>
</tr>
<tr>
<td>66</td>
<td>Boggy Creek</td>
<td>Wellington</td>
</tr>
<tr>
<td>94</td>
<td>Latrobe River lower - Swing Bridge to Lake Wellington</td>
<td>Wellington</td>
</tr>
<tr>
<td>COASTAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>195</td>
<td>Inverloch</td>
<td>Bass Coast</td>
</tr>
<tr>
<td>239</td>
<td>Port Albert</td>
<td>Wellington</td>
</tr>
<tr>
<td>238</td>
<td>Port Welshpool</td>
<td>South Gippsland</td>
</tr>
</tbody>
</table>

2.5 Important regional and community infrastructure
Important regional and community infrastructure includes infrastructure and assets that are essential for the ongoing functionality of a town, locality, region or broader area. These were identified and considered to enable the assessment of risk for an area, with a focus on loss of access to that infrastructure and its susceptibility to flood damage.

They include categories such as emergency management facilities, utilities, transport, major industry, food supply, finance, education, security, recreation facilities, health services and community facilities.

The WGCMA held a workshop in September 2016 with infrastructure providers and managers from across West Gippsland. The WGCMA provided maps of the 1% AEP flood extent and sought information regarding important infrastructure where either the infrastructure or its access is within this extent. In addition to this workshop, the Regional Emergency Management Planning Committee and Councils via the project Steering Committee have been engaged in a similar manner with a request for feedback around important infrastructure at risk of flooding. Information from these sources has been incorporated into the assessment of risk for relevant areas.

Critical infrastructure at risk of flooding in each municipality is discussed in Section 2.9. It is the responsibility of critical infrastructure operators to understand and manage risks to their infrastructure, including that due to flooding.

### 2.6 Stormwater management

Urban stormwater flooding impacts a number of towns in the region, usually resulting from inadequate drainage infrastructure and planning practices. Stormwater flooding includes flooding due to inundation by local runoff caused by heavier than usual rainfall. Local Government Authorities are accountable for managing urban stormwater outside the Port Phillip and Westernport catchments. Urban stormwater assets within the Port Phillip and Westernport catchment are managed by Melbourne Water, funded by a drainage rate.

The improved management of urban stormwater flooding represents an integrated approach to the management of all forms of flooding, and results in resilient urban water systems which address the impacts of climate change, population growth and new development.

This Strategy identifies, through stakeholder engagement, areas with a history of stormwater flooding. However, it does not recommend treatment options for stormwater flooding. This should occur through existing processes such as local LGA stormwater management plans or capital works programs.

Stormwater flood risks have been identified at a number of urban areas in the region, and will be discussed for each municipality in more detail in Section 2.9.

### 2.7 Rural drainage

Rural drainage relates to the removal of local rainwater from rural land via systems such as drains and channels. Flooding of land caused by local rainfall is a separate issue to flooding of land from waterways where rain has fallen elsewhere in the catchment, and the two are dealt with in different ways.
There are up to 130 known rural drainage systems across Victoria with many more informal systems at a property level. These systems are designed to move water off the land after local rainfall events to maintain agricultural productivity. They range from those constructed by individual landowners to formal drainage schemes. The scale, type and management of these systems varies greatly. One example, discussed further in Section 2.9.2, is the Yarragon - Trafalgar Flats Drainage Area in which the Moe River was straightened and channelized during the 1890s to reduce inundation of adjacent farmland.

Drainage systems impact on the receiving waterway and downstream water bodies, floodplains and wetlands.

The Victorian Government is currently developing a state-wide strategy which will establish a framework for the management of dryland rural drainage in Victoria. It will focus on supporting landholders to manage agricultural productivity and identify opportunities to provide positive environmental and cultural outcomes from improved management of rural drainage.

Rural drainage systems can impact negatively by increasing the flow of water downstream leading to erosion, impact on other landowners and damage to infrastructure, and by transporting high levels of nutrients, chemicals and sediment to receiving waterways.

Issues relating to rural drainage in the region have been identified and considered during the development of this Strategy, in particular where they intersect with floodplain management, such as along the Moe River in the Yarragon – Trafalgar Flats Drainage Area. This strategy will deal with the floodplain management activities required to manage the flood risk for these areas but the rural drainage matters will be dealt with in the state-wide strategy for rural drainage.

2.8 Existing flood risk treatments

2.8.1 Planning Scheme controls

Land use planning seeks to ensure that future development is appropriate. The Victorian Planning Provisions (VPP) set out a framework from which all Victorian Planning Schemes are constructed. Planning strategies are developed to assist communities in establishing a framework for minimising long term risks, and these strategies guide the application of various Planning Scheme controls.

Flood controls in Planning Schemes include local policies addressing flood risks within a municipality, zones and overlays and their schedules. These are detailed in Planning Practice Note 12: Applying the Flood Provisions in Planning Schemes (Victoria State Government, 2015).

The overall objectives of floodplain management, in Clause 13.02-1 of the VPP, are to 'assist the protection of:

- Life, property and community infrastructure from flood hazard;
- The natural flood carrying capacity of rivers, streams and floodways;
- The flood storage function of floodplains and waterways; and
- Floodplain areas of environmental significant or of importance to river health’. (Victoria State Government).

Effective land use planning in relation to floodplain management seeks to ensure that development is compatible with flood risk. It is widely recognised that land use planning and building controls are generally more cost effective than other flood mitigation options including flood mitigation infrastructure. This is discussed in more detail in Section 3.1.

Flood risk is based on the design flood event of the 1% Annual Exceedance Probability (AEP) (known in the past as the 1 in 100 year flood). This is a flood that has a 1% chance of occurring every year. The extent and depth of the 1% AEP flood for an area is determined by the use of tools including flood modelling, recorded flood extents and levels and on-ground verification. This flood information is then incorporated into the relevant Planning Scheme in the form of local policy and zones or overlays applying to affected land.

The various impacts of climate change are a significant long term risk in the region. As outlined in Section 2.2, effective adaptation to climate risks is guided by Victoria’s Climate Change Adaptation Plan 2017-2020 (State Government Victoria, 2016), which outlines the Victorian Government’s role of providing current information to assist communities in managing their risks and coordinating state-wide action. The plan discusses that improving the resilience of the built environment involves factoring climate change risks into land use planning via tools including planning overlays and coastal hazard assessments.

The Gippsland Regional Coastal Plan 2015-2020 (Gippsland Coastal Board, 2015) outlines actions to improve regional and local planning for hazards that are unique to the coast. This plan outlines actions including that local Councils ‘Continue or undertake new, detailed coastal hazard assessments and adaptation planning’, particularly for areas identified as a priority, and ‘Implement identified adaptation responses through local decisions’, which may include planning scheme updates, emergency plans and future works. The development and implementation of this West Gippsland Floodplain Management Strategy will support the identification of priority areas and the inclusion of information about coastal risks into planning schemes.

Policy 15e in the VFMS requires that planning scheme controls be applied to all priority coastal areas which are expected to be at risk of inundation by the 1% AEP flood, and that those controls account for a rise in mean sea level due to climate change of at least 0.8 metres (Victoria State Government, 2016). As discussed further in Sections 2.9.1 and 2.9.4, the planning schemes in Bass Coast and South Gippsland shires have recently been updated to include sea level rise mapping within the Land Subject to Inundation Overlay (LSIO).

The statutory land use planning system operates through planning schemes. Most proposals to subdivide land, construct a building or undertake works in an area subject to a relevant planning control require a planning permit. Where flood information is available and LGAs have been willing and have capacity to include this information in planning schemes, proposals subject to flood controls (i.e. in locations within a flood zone or overlay) are referred to the WGCMA to assess. However, there are large areas of the region where detailed flood mapping is either not available or has not been incorporated into the planning scheme. In some locations where flood mapping has been incorporated into the planning scheme, it may have been superseded by physical changes in
the location (e.g. changes to landform or waterways) or by updated flood mapping using improved information or techniques.

LGAs are required to consider flood risk in making land use planning decisions. The WGCMA, like all other Victorian CMAs other than Melbourne Water, is a recommending referral authority under the Planning and Environment Act 1987 for proposals in areas subject to flood controls. This means that the WGCMA’s referral advice is not binding on the LGA. This allows the LGA to make a decision on the proposal that is contrary to the WGCMA’s referral advice, although this rarely occurs in West Gippsland.

When assessing proposals for development or subdivision in locations subject to flooding, the WGCMA refers to relevant policies, provisions and guidelines. These include Planning Provisions, Planning Practice Notes, emergency management guidelines and various state strategies.

The West Gippsland Regional Catchment Strategy 2013-2019 (West Gippsland Catchment Management Authority, 2012) includes a management measure to ‘Develop and implement guidelines for development in flood prone areas’ to achieve the objective to ‘Minimise flood damage to the floodplain and its occupants’. Implementation of this management measure resulted in the preparation of Flood Guidelines - Guidelines for development in flood prone areas (West Gippsland Catchment Management Authority, 2013). These guidelines are used to assess proposals for development or subdivision in locations subject to flooding, in addition to the range of other documents mentioned above.

The principles of the WGCMA Guidelines are to:

- Reduce risk to people and property;
- Identify and stop negative impacts on waterways and floodplains;
- Ensure that development is designed appropriately for a flood prone area;
- Reduce the reliance on emergency services; and
- Ensure developments maintain or improve waterway condition.

The objectives in order to achieve these principles are:

1. Works or structures must not affect floodwater flow capacity or the physical form of the waterway;
2. Works or structures must not reduce floodwater storage capacity;
3. Development must not be allowed where the depth and flow of floodwaters is hazardous;
4. Development must not be allowed where the depth and flow of floodwaters along the access to or from the property is hazardous;
5. Development must be designed to minimise the potential damage to property due to flooding;
6. Development must maintain or improve waterway condition; and
7. Development must maintain or improve the quality of stormwater and catchment runoff in urban areas.

Assessment of a proposal against these objectives assists in determining its viability. If considered to be viable, support may be subject to conditions such as minimum floor level requirements.
The key issues relating to land use planning in West Gippsland can be summarised as:

- The legacy of existing development in flood prone areas;
- Lack of detailed flood mapping for large areas of the region;
- A delay in the development of flood mapping and its incorporation into the planning scheme;
- Timely and complex process required to update flood mapping and planning schemes; and
- The potential for proposals to be allowed by a LGA in contradiction of the WGCMA’s referral advice.

Specific issues relating to each LGA planning scheme are detailed in Section 2.9.

2.8.2 Structural flood mitigation infrastructure

The benefits of well-managed flood mitigation infrastructure were demonstrated in the 2010-12 Victorian floods in locations such as Kerang and Nathalia. If mitigation infrastructure is not managed and maintained however, it is liable to fail during a flood creating significant downstream impacts by flooding homes and businesses whose owners and occupants may otherwise have assumed were not exposed to flood risks.

The VFMS seeks to remove uncertainty and inconsistency in the management of flood mitigation infrastructure to improve its performance during a flood, as outlined in more detail in Section 3.1.

New flood mitigation infrastructure identified through Regional Floodplain Management Strategies must provide both community and environmental benefits. The ‘beneficiary pays’ principle will determine the management and funding arrangements. Large scale flood mitigation infrastructure is not considered best practice but there may be limited circumstances where it may be supported after a thorough evaluation taking into account social, cultural, economic and environmental costs and benefits.

Existing flood mitigation infrastructure may be brought into formal management arrangements including Water Management Schemes if considered feasible. Investigation into this will need to consider the current governance arrangements, the costs and benefits of restoring (if required) and maintaining the infrastructure, the costs and benefits if alternative solutions and the community’s willingness to pay. The maintenance and management of existing flood mitigation infrastructure under formal management arrangements will be funded by beneficiaries.

A number of structural works that perform flood mitigation functions are located within the region, mostly in the form of levees. It should be noted that coastal levees, also known as sea walls, are considered within the scope of this Strategy if they provide flood mitigation benefits (i.e. they protect the area behind them from sea water intrusion) as opposed to erosion management benefits (i.e. they protect banks from erosion caused by wave action). Of note are the following:

- Rural levees which offer protection from small flood events (nuisance flooding) only.
- A series of sea walls along the Corner, Shallow and Anderson Inlet coastline, which provide some protection from coastal inundation of farmland. These walls have been damaged or breached in sections, resulting in inundation which will increase into the future as sea level rises and the incidence and severity of storm surges increases.
• A regulating structure and floodway system at Seaspray, which is operated by Wellington Shire Council in response to waterway flooding. It was constructed following flooding in 1978.
• An earthen levee protecting parts of Seaspray. The Seaspray Flood Study (Water Technology, 2016) determined that the levee does not offer protection from a 1% AEP flood event.
• The Peterkin Street levee in Traralgon which protects a residential area along Gwalia Street. The levee was constructed and is managed by the Latrobe City Council. It includes sections of earthen levee through parkland and brick walls on private property boundaries.
• An earthen levee to the north-west of Tinamba which was constructed by a property owner on private land in 2014.
• A sea wall that provides some protection from coastal flooding for the township of Port Albert. The sea wall is not continuous and allows seawater to enter the town from the rear.

The levee and regulating structure at Seaspray and the Peterkin Street levee in Traralgon are both managed by the relevant LGA. It is not proposed to formally manage any of the other structures due to their low flood risks.

The West Gippsland Regional Catchment Strategy 2013-2019 (West Gippsland Catchment Management Authority, 2012) includes management actions to ‘Investigate the ownership and management of seawalls, including maintenance requirements’ and ‘Undertake an investigation into the threats that seawalls may pose to the long term adaptation of the Corner Inlet coast and marine system’ to achieve the objective to ‘Understand the threats that seawalls pose to the coast and marine system in the long term’.

The Victorian Floodplain Management Strategy (Victoria State Government, 2016) in Section 17 sets out a number of policies relating to flood mitigation infrastructure. Existing flood mitigation infrastructure that is not formally managed should remain that way unless the Local Government Authority determines that it should be brought into formal management arrangements. Infrastructure that is not formally managed should not be recognised as being functional in planning schemes, and Municipal Flood Emergency Plans must allow for the potential failure or overtopping of that infrastructure.

While a particular levee may not meet the Government investment criteria outlined in the VFMS, individuals who benefit from a levee may wish to maintain it. For levees on private land, beneficiaries will need to negotiate with landholders regarding management. For levees on Crown land, a new permit scheme created in 2014 allows beneficiaries to access the Crown land and maintain that levee, in accordance with any conditions, under a permit issued by the CMA. Permit holders will not be authorised to change the levee’s location, dimensions or extent, build a new levee or remove an existing one.

Decisions regarding investment by the three tiers of government in flood mitigation infrastructure will be guided by the principles outlined in the Government’s investment criteria in Section 17.2 of the Victorian Floodplain Management Strategy (Victoria State Government, 2016). The principles most relevant to the region are those that relate to community benefits: due process, due diligence, cost effectiveness (benefits are greater than both capital and ongoing costs), supporting analysis,
community benefits and accountability for ongoing management. It is noted in this Section that ‘large-scale flood mitigation infrastructure is no longer considered best practice for rural areas’.

Key flood mitigation infrastructure in each municipality is detailed in Section 2.9.

### 2.8.3 Total Flood Warning System services

Flood warnings provide communities and emergency management agencies with information about when flooding may occur, its likely impacts and how to reduce damages. A Total Flood Warning System (TFWS) contains a number of elements vital to flood response, as shown in Figure 9.

**Figure 9 - Elements of a Total Flood Warning System (Source - Victorian Floodplain Management Strategy Figure 13)**

The routine catchment monitoring and river height prediction activities necessary for a Total Flood Warning System are outlined in Section 3 of the Bureau of Meteorology’s *Service Level Specification for Flood Forecasting and Warning Services for Victoria* (Bureau of Meteorology, 2013). The Schedules in this report specify the level of service provided across a range of monitoring and information locations in Victoria. The locations where river height, dam, weir or lake level, and tidal observations are made are categorised into three types:

i. **Forecast location** is a location for which the Bureau provides a forecast of future water level either as the class of flood that is predicted (minor, moderate or major) or as a level and class. At these locations observed data, flood classifications and additional qualifying information will also be available.
ii. **Information location** is a location at which flood classifications are defined and observations of water level data are provided. At these locations forecasts of future water level are not produced. Other key thresholds may be defined and reported against.

iii. **Data location** is a location for which just the observed water level data is provided. Flood classifications are not available for these locations and forecasts of future water level are not produced.

A TFWS requires the combined efforts of a number of agencies to deliver an effective service. In many locations, some but not all of these elements may be present.

All Victorian communities receive Bureau of Meteorology (BoM) warnings including Flood Watches and Severe Weather Warnings, as well as general safety messages from VICSES. More comprehensive flood warning services can include local predictions about flood behaviour and other information outlined in Municipal Flood Emergency Plans as described in Section 2.8.4.

The *Victorian Floodplain Management Strategy* (Victoria State Government, 2016) requires TFWS levels to be tailored to flood risk and the needs of the community. This Strategy has assessed the existing TFWS service provided to flood prone communities against their needs. This involved comparing the results of the rapid appraisal of flood risk described in Section 2.4 against the existing TFWS service. Locations where risk exceeds the service were identified and actions to improve the service are proposed, based on a prioritisation process.

TFWS systems were assessed based on the following factors:

1. Data collection network (rain gauges and stream gauges);
2. Prediction (forecasting);
3. Dissemination (communication of flood warning information to the community);
4. Community flood awareness and education;
5. Interpretation (using flood intelligence to identify consequences);
6. Flood response (the availability of a Municipal Flood Management Plan); and
7. Social impacts (e.g. impacts on critical infrastructure and vulnerable communities).

A number of locations in West Gippsland were identified, through the TFWS assessment, where the flood risk exceeds the TFWS service. In most of these locations it was determined that the service level is low due to the lack of flood mapping, and that the development of detailed flood maps which are disseminated to the relevant communities is the most effective response to address the risk. For example, in the South Gippsland basin, where there are no BoM flood forecasts available, new gauges and prediction services are unlikely to be cost effective due to the large catchments and relatively small flood risk. Conversely, developing flood maps for a range of flood events would enable flood response agencies to provide better services during floods and improve flood information in local flood guides.

Issues and recommended actions relating to flood warning services in each municipality are detailed in Section 2.9.

TFWSs for riverine flooding require at least six hours to collect and process data, resulting in flood warnings to the community. Some areas experience flash flooding, which does not allow time to run these processes. As such, effective flash flood warning systems are currently not available.
Currently, Severe Weather Warnings issued by BoM have lead times ranging from an hour up to 24 hours, depending on the weather system. These warnings may offer a basis for the future development of flash flood warning systems. The Department of Environment, Land, Water and Planning (DELWP), BoM, the Emergency Management Commissioner and VICSES will work to evaluate the potential for localised flash flood warning services where there is a history of flash flooding.

The WGCMA, LGAs and VICSES have an opportunity to progressively identify areas with a history of flash flooding and include them in Regional Work Programs. Some locations that experience flash flooding are discussed in Section 2.9, however in each case the risk level is considered to be acceptable to the LGA in relation to other flood risks.

### 2.8.4 Municipal Flood Emergency Plans

VICSES is the lead agency for community education and awareness in support of flood preparedness. This includes facilitating the preparation of Municipal Flood Emergency Plans (MFEPs) with support from the relevant Local Government Authority. MFEPs are developed for municipalities to explain local flood risks for communities at risk and advise on how to prepare for and respond to flood events. They consider flood mitigation measures (both structural and non-structural), the needs of all relevant agencies and available flood intelligence.

As discussed in Section 2.8.2, MFEPs must consider the consequences of overtopping or failure of structural flood mitigation infrastructure. MFEPs are a highly valuable resource for information about the impacts of flooding, provided they are maintained and updated. The flood intelligence in the MFEPs is a crucial guide for communities and agencies during a flood incident, and can contribute to reducing property damage and personal injury.

MFEPs include an outline the impacts of floods particular to a location, the local waterway system, conditions likely to result in flooding, roads likely to be inundated at particular flood depths, flood inundation mapping, information about tidal, coastal and flash flooding as relevant, critical infrastructure that may be impacted, evacuation options if available, stream or rain gauge information if available, and information about flood warning.

VICSES also produces separate Flood Guides for priority areas to provide information to residents and business owners.


In West Gippsland, the following emergency plans and flood guides are currently available:

**Bass Coast Shire:**
- Municipal Flood Emergency Plan which includes a Flood Emergency Plan for Phillip Island (in Westernport catchment).

**Baw Baw Shire:**
- Municipal Flood Emergency Plan which includes Flood Emergency Plans for Warragul and Moe River Flats.
• Moe River Flats Local Flood Guide and Warragul Local Flood Guide.

Latrobe City:
• Municipal Flood Emergency Plan which includes a Flood Emergency Plan for Traralgon Creek.

South Gippsland Shire:
• Municipal Flood Emergency Plan which includes a Flood Emergency Plan for Tarwin Lower.
• Tarwin Valley Local Flood Guide.

Wellington Shire:
• Municipal Flood Emergency Plan which includes a Flood Emergency Plan for Stratford, Sale, Maffra Tinamba and Newry, Seaspray, Hollands Landing and Loch Sport.
• Local Flood Guides for Hollands Landing, Loch Sport and Sale.
• Gippsland Lakes Flood Warning System FAQ.

East Gippsland:
• Municipal Flood Emergency Plan which includes an attachment for the Gippsland Lakes.
• Local Flood Guides for Eagle Point, Lakes Entrance, Metung, Paynesville and Raymond Island (all located within the East Gippsland CMA region).
• Gippsland Lakes Flood Warning System FAQ.

Locations within West Gippsland where emergency plans and flood guides would benefit from being updated are discussed in Section 2.9. VICSES recommends that Municipal Emergency Management Plan Committees (MEMPCs) consider integrating flood and storm plans into a single plan when being updated. As per the existing arrangements, the development and updating of emergency plans and flood guides is supported by LGAs and WGCMA.

2.9 Summary of flood risk in West Gippsland

Recorded flooding in the region is summarised in Section 2.1.

Large-scale floods can impact Gippsland as a result of severe weather events, causing widespread property damage, risk to life, restricted movement and demand on a range of emergency response services.

There are a number of water storages located either within or upstream of the West Gippsland region including Thomson Reservoir, Moondarra Reservoir, Blue Rock Lake, Lake Narracan and Lake Glenmaggie. Storages are managed by their individual operator, including the development of emergency plans for the event of the failure or overtopping of the storage structures. Water storages present a downstream flood risk in the event of failure or overtopping. Modelling and mapping of the predicted impacts downstream of each storage is made available to emergency managers.

Flood risk in each municipality is summarised in Sections 2.9.1 to 2.9.6 below. Information in these sections has been derived from a number of sources, including the relevant Municipal Flood Emergency Plan, flood studies, community engagement and discussions with LGAs and VICSES.
2.9.1 Bass Coast Shire

Bass Coast Shire encompasses a total land area of about 860 square kilometres, including substantial coastal areas along both Western Port and Bass Strait. Its major towns are Wonthaggi, Cowes, Inverloch, San Remo and Grantville. The major industries of the Shire are tourism and agriculture, particularly cattle and sheep grazing.

The Shire is split between the Westernport catchment and West Gippsland catchment. This Strategy considers the Bass Coast Shire within the West Gippsland catchment only, as Melbourne Water is the catchment manager for the Westernport catchment.

**Figure 10 - Bass Coast Shire**

Inverloch is the only location within Bass Coast that was identified as having a significant flood risk as part of the regional risk assessment outlined in Section 2.4. However, flood risks and related mitigation options in several other locations are discussed below.

There are two reservoirs in the Shire, Candowie Reservoir at Almurta (in Westernport catchment) and Lance Creek Reservoir at Glen Alvie.
The main waterways are the Bass River (in Westernport catchment) and the Powlett River. Major townships only have minor creeks and drainage paths, therefore flooding in these towns usually occurs when flood flows exceed the design capacity of overland flow paths or underground drains.

The Powlett River has a catchment area of approximately 500 square kilometres originating in steep land in the Strzelecki Ranges in South Gippsland Shire, flowing into Bass Coast Shire and out to Bass Strait downstream of Dalyston. It has a significant floodplain which includes land mainly used for grazing. The estuary is influenced by tides, storm surge and periodic closure of the river mouth by natural sand movement. Inundation of farmland can occur during low flow periods when the river mouth is blocked, and excavation to reopen the entrance may be undertaken to mitigate this under appropriate conditions, including water quality, river flow, ocean and access conditions. The estuary entrance management is governed by the WGCMA’s Estuary Entrance Management Support System, which is outlined in the Powlett River Estuary Entrance Management Protocol (West Gippsland Catchment Management Authority, 2015).

Most riverine flooding in the area impacts on low-lying rural land and roads, with urban areas more likely to experience stormwater flooding. The Shire’s flat coastal areas are subject to frequent flooding, inundating or isolating rural properties.

Flash flooding can occur in urban areas within Bass Coast, generally during summer from high intensity rainfall events. These events occur with little warning and can cause severe localised damage. Wonthaggi and Inverloch are the most vulnerable towns to these events.

Coastal areas can experience flooding from the sea caused by high tides in conjunction with storm surge resulting from low-pressure systems and on-shore winds. These can cause backflow in waterways and stormwater drains and subsequent surcharge in and around the drainage network. Coastal areas including Inverloch and Pound Creek are likely to be vulnerable to sea level rise. Even under current climatic conditions, parts of the foreshore in Inverloch have experienced coastal inundation and subsequent damage to the foreshore and assets.

A number of roads on floodplains or crossing waterways are subject to flooding. Major roads in this category include Kongwak – Outtrim Road, Heslop Road in Wonthaggi, McCraws Road in Wattlebank and the Bass Highway at several locations including Inverloch, Wonthaggi, Dalyston, Kilcunda and Lance Creek. The Bass Highway is the regions’ main transport link, so its closure can cause severe disruption. It is proposed that VicRoads investigates the installation of warning systems on VicRoads roads within Bass Coast which are subject to significant inundation.

A number of roads within Inverloch can be closed by flash flooding or stormwater flooding. A full list of roads in the Shire which are likely to be inundated can be found in the Bass Coast Municipal Flood Emergency Plan (State Emergency Service and Bass Coast Shire Council, 2013).

A number of rural levees along the Powlett River offer protection from small flood events (nuisance flooding) only. Their overtopping ‘has little consequence for built assets or infrastructure’ (State Emergency Service and Bass Coast Shire Council, 2013).

Travel time between the start of heavy rain and peak flooding in the lower parts of the Powlett River is estimated to be 6 to 8 hours for large floods and 12 to 18 hours for smaller floods, with smaller waterways responding faster than this.
There is no Total Flood Warning System within the Bass Coast Shire in the West Gippsland catchment. There are three stream flow gauges in the region, two on the Powlett River and one on Screw Creek, however they are not connected to the BoM website and no prediction service is offered by the BoM. The BoM does however provide Flood Watch and Severe Weather Warning services in this area.

The Municipal Flood Emergency Plan for Bass Coast is well developed and reasonably current. Flood risk across the municipality could be reduced further if it was updated to include specific Flood Guides for Inverloch, Wonthaggi and the Lower Powlett River.

The flood controls in the Bass Coast Planning Scheme were updated in 2016 via Amendment C82. This amendment introduced sea level rise mapping within the Land Subject to Inundation Overlay (LSIO), and was the first planning scheme in Victoria to do so. There is currently updated flood mapping available for the Wonthaggi North East Development Area which can be incorporated into the Planning Scheme, however this is not considered to be a high priority and could be deferred until more flood related updates are available or done as part of rezoning and developing this area.

Possible flood mitigation actions identified in Bass Coast (within the West Gippsland catchment) are:

1. Ensure flood information in Municipal Flood Emergency Plans is regularly reviewed and updated.
2. Develop individual Flood Guides for high priority areas, specifically Inverloch, Wonthaggi and Lower Powlett River.
3. Investigate flooding along Wreck Creek including the impact of the status of the river mouth.
4. Schedule a future update of the Planning Scheme to include flood mapping for the Wonthaggi North East Development Area.
5. Improve the Total Flood Warning System by developing detailed flood maps for the Powlett River and share these with the community.
2.9.2 Baw Baw Shire

Baw Baw Shire has an area of approximately 4,000 square kilometres and its main towns are Warragul, Drouin, Yarragon, Longwarry and Trafalgar. It is a predominantly rural-based municipality which is experiencing significant residential growth, particularly in Drouin and Warragul.

The Shire is split between the Westernport catchment and West Gippsland catchment. This Strategy considers the Baw Baw Shire within the West Gippsland catchment only, as Melbourne Water is the catchment manager for the Westernport catchment.

Figure 11 - Baw Baw Shire

Several locations within Baw Baw were identified as having a significant flood risk as part of the regional risk assessment outlined in Section 2.4. These locations are the urban areas of Warragul, Trafalgar and Yarragon, and two rural areas along the Moe River from Shady Creek to Latrobe River and upstream of Shady Creek.

The West Gippsland catchment includes several major waterways that flow into the Gippsland Lakes to the east, including the Latrobe, Moe, Tanjil and Thomson Rivers and Narracan Creek. Other waterways include the upper reaches of Eaglehawk Creek, Tyers River and Rintouls Creek. Water storages include Moondarra Reservoir, Blue Rock Lake and Thomson Dam.
The most significant flood risk in the Shire is within the Latrobe River catchment, which is located between the Great Dividing Range and Strzelecki Range and originates from steep tributaries in areas of high rainfall.

Vegetation in urban waterways may contribute to localised flooding in some locations such as Hazel Creek in Warragul and Red Hill Creek in Neerim South.

Riverine flooding mostly occurs along the Moe River north of the Princes Highway and between Yarragon and Moe. Large parts of the upper catchments may experience rapid flooding due to localised rainfall events in steep catchments, however there is little information about the likely depth or extent of such flooding.

Flash flooding on local waterways and overland flows resulting from intense rainfall events occurs in Warragul, Trafalgar, Yarragon and Walhalla. The most significant effects have occurred in Warragul where urban stormwater flooding is likely to occur within 30 minutes of heavy rainfall and Hazel and Spring Creeks start to rise within 6 hours. Roads and parkland along these creeks can be inundated with high velocity flows and substantial depths.

A number of residential and commercial properties are subject to inundation in Walhalla (from Stringers Creek), Warragul (from overland flows, flash flooding and riverine flooding), and Yarragon and Trafalgar (from overland flows and flash flooding).

Three retarding basins have been constructed in Warragul to seek to reduce the impacts of flooding on developed areas adjacent to Hazel and Spring Creeks. These are located near Tarwin Street, in Brooker Park and near Landsborough Road. These retarding basins reduce the peak flow rates and resultant extent and depth of inundation, but they do not eliminate flooding. The Tarwin Street and Landsborough Road basins are classified as large dams by the Australian National Committee on Large Dams (ANCOLD) and therefore their structural integrity should be investigated and monitored by the infrastructure owners based on ANCOLD Guidelines.

Vegetation growth in Hazel Creek may reduce its flow capacity during floods. This should be investigated and managed accordingly to retain flow capacity in the creek. The Hazel Creek Waterway Management Plan was developed as a guide to ensure flood management is compatible with the environmental and social values of the waterway.

Flood risk in Trafalgar is likely to be reduced by the construction of the proposed Princes Highway retarding basin on the west side of the town, and ongoing management of the Contour Drain and Loch Creek. Flood risk in Yarragon is also likely to be reduced by construction of the proposed Hazeldean Road retarding basin.

A number of rural properties become inundated or isolated during floods along the Moe River in the Yarragon – Trafalgar Flats Drainage Area, in the rural areas around Warragul and Nilma, and along parts of the Aberfeldy and Tanjil Rivers.

A full list of roads, properties and assets likely to be inundated can be found in the Baw Baw Shire Flood Emergency Plan (State Emergency Service and Baw Baw Shire Council, 2013). The Princes Freeway can be impassable due to floodwaters in a number of sections between Yarragon and Trafalgar East. This road is the main transport route through the Shire and comprises part of the
National Highway system from Melbourne to Sydney. It is possible that culverts servicing the Freeway and the Gippsland Railway Line are not of adequate capacity for larger floods, and it is recommended that this be further investigated.

During the 1890s, the Moe River was straightened and channelized to reduce inundation of adjacent farmland. Material excavated from the channel was generally left at the top of the bank, creating a series of levee banks. This area, called the Yarragon - Trafalgar Flats Drainage Area, contains the most significant rural drainage issues in the region, which, as discussed in Section 2.7, will be dealt with in the state-wide strategy for rural drainage. However, flooding from the Moe River is considered within the scope of this Strategy. It is recommended that formal management of the Drainage Area and structural works along the Moe River on a section of North Canal Road (between Cummings Road and Telephone Road) be investigated.

Critical infrastructure can be disrupted during flood events, including the Princes Freeway and Gippsland Railway Line, transport related to the dairy and forestry industries, and electricity transmission lines and substations.

Flood warnings are available for the Moe, Latrobe and Tanjil Rivers which can assist people along these floodplains. These warnings are informed by data from river height gauges at Darnum, Willow Grove, Tanjil Junction and Tanjil South.

Warragul, Yarragon and Trafalgar experience flash flooding and there is insufficient time between rainfall and flooding to formulate a flood warning. These towns could benefit from a flash flood warning system when available.

The Municipal Flood Emergency Plan for Baw Baw is well developed, however it should be updated to include specific Flood Guides for Warragul, Yarragon and Trafalgar based on recent flood information. The existing Local Flood Guide for Warragul may also need to be updated based on this new information.

Flood controls in the Baw Baw Planning Scheme have not been updated for some time, and additional flood extent mapping has been developed which supersedes and is more detailed than the existing flood mapping. The relevant flood controls in the Planning Scheme should be updated as a priority to reflect the best available flood mapping.

Possible flood mitigation actions identified in Baw Baw Shire (within the West Gippsland catchment) are:

1. Ensure flood information in Municipal Flood Emergency Plans is regularly reviewed and updated.
2. Develop individual Flood Guides for high priority areas, specifically Warragul, Yarragon and Trafalgar.
3. Update the Planning Scheme to include updated flood mapping across the Shire.
4. Investigate structural works along the Moe River to protect North Canal Road and adjacent farm land (between Cummings Road and Telephone Road).
5. Liaise with VicRoads and VicTrack to investigate the capacity of culverts under the Princes Freeway and Gippsland Railway Line between Yarragon and Trafalgar East.
6. Investigate the structural integrity of the Landsborough Road retarding basin.
7. Ensure ongoing management of Hazel Creek to retain its current flow capacity.
8. Investigate options to increase the capacity of Hazel Creek at critical locations.
9. Construct the proposed Princes Highway retarding basin on the west side of Trafalgar.
10. Ensure ongoing management of the Contour Drain and Loch Creek at Trafalgar.
11. Construct the proposed Hazeldean Road retarding basin in Yarragon.
12. Improve the Total Flood Warning System by developing detailed flood maps for the Tanjil River downstream of Blue Rock, Latrobe River between Trafalgar-Willow Grove Rd and Westbury, Moe River upstream of the Darnum gauge, Shady Creek and Narracan Creek upstream of Moe, and share these with the community.
2.9.3 Latrobe City

The Latrobe City municipality covers an area of approximately 1,400 square kilometres and is entirely contained within the West Gippsland catchment. It includes varying topography ranging from steep hills of the Jeeralang and Strzelecki ranges to flat plains of the Latrobe Valley. The majority of the region is agriculture land, with large pockets of eucalypt and pine plantation, residential areas and industry, the most significant being coal mining and electricity production. The municipality contains four major urban areas - Moe, Morwell, Traralgon and Churchill.

Major rivers include the Latrobe, Tanjil, Tyers and Thompson Rivers.

Figure 12 - Latrobe City

Several locations within Latrobe were identified as having significant flood risk as part of the regional risk assessment outlined in Section 2.4. These locations are the urban areas of Traralgon, Moe, Morwell, Toongabbie and Glengarry.

Water storages include Lake Narracan and private storages within power generation facilities such as Hazelwood, as well as numerous private farm dams.
Riverine flooding is significant along the Latrobe River, Morwell River, Middle Creek, Waterhole Creek and Traralgon Creek. Smaller waterways including Eaglehawk and Rintoul Creeks also experience flooding and impact rural areas.

Traralgon Creek has a catchment area of 178 square kilometres, originating in the steep upper catchment of the Strzelecki Ranges with high rainfall, flowing through the Traralgon urban area just upstream of its confluence with the Latrobe River. The upper catchment is primarily forested, including plantations, whilst the lower catchment is generally farmland with the exception of the urban areas surrounding Traralgon.

Significant flooding has been recorded in Traralgon as a result of flooding from Traralgon Creek, at times combined with the impact of stormwater flooding from rain falling within the town. A number of residential and commercial properties are subject to over-floor flooding, and road closures are significant and disruptive. There is a significant flash flooding risk in Traralgon, particularly at the eastern side of the town near the Princes Highway and Liddiard Road.

A flood study for Traralgon was completed in 2016 (Water Technology, 2016). This study modelled riverine flooding as a result of Traralgon Creek but did not include impacts of flooding from overland flow and urban stormwater. Community engagement undertaken during this study indicated that access to information about an approaching flood can be difficult despite the provision of a BoM flood warning. The study refined the flood information (including flood extent, depth and velocity) and investigated options to mitigate flooding. Mitigation of flooding within Traralgon is difficult and has been assessed in a number of previous studies. This resulted in the construction of the Peterkin Street levee which protects a residential area along Gwalia Street.

The only structural mitigation option deemed worthy of further investigation in the 2016 flood study is a retarding basin incorporated with the proposed Traralgon Bypass to the south of Traralgon. This option is complex and depends on alignment with the bypass construction, and consideration of a range of social, economic and environmental factors which require further investigation by a number of agencies.

Roads inundated during floods include the Princes Highway through eastern Morwell and Traralgon, and a large number of rural roads near and crossing waterways such as the Hyland Highway south of Traralgon, Glengarry West Road, Traralgon Maffra Road and Traralgon Creek Road.

Critical infrastructure can be disrupted during flood events, including infrastructure related to transport, forestry, mining and power generation and transmission. Vulnerable communities include individuals, hospitals, aged care facilities, schools, child care centres and caravan parks.

Flood warnings are available for Traralgon as part of the Traralgon Creek Flood Warning System, which aims to provide at least 6 hours warning of peak flooding at Traralgon. This short warning time is due to the topography of the catchment, which is a significant constraint on emergency response. Flood forecast stations are located at Traralgon and Thoms Bridge, with river data locations at Yallourn, Moe, Kilmany South, Traralgon South and Kooramalla.

The Municipal Flood Emergency Plan for Latrobe City should be updated to include specific Flood Guides for Morwell, Moe, Glengarry and Toongabbie. The Traralgon Flood Study (Water Technology, 2016) details a series of impacts at a range of flood heights, which would provide
useful information for community response. The existing Traralgon Flood Emergency Plan should be updated to include this information in the Flood Intelligence Card and to include the updated flood mapping.

Flood controls in the Latrobe Planning Scheme were last updated in 2012. Additional flood mapping has become available since then for areas including the Latrobe River, Eaglehawk Creek, Rintouls Creek and Traralgon. The relevant flood controls in the Planning Scheme should be updated to reflect the best available flood mapping.

Possible flood mitigation actions identified in Latrobe City are:

1. Ensure flood information in Municipal Flood Emergency Plans is regularly reviewed and updated.
2. Develop individual Flood Guides for high priority areas, specifically Morwell, Moe, Glengarry, Toongabbie and Traralgon.
3. Update the Planning Scheme to include updated flood mapping across the Shire.
4. Investigate the feasibility of the Traralgon Bypass Retarding Basin.
5. Proceed towards construction of the Narracan Creek levee in Moe.
6. Replace the Beattie Crescent footbridge in Morwell.
7. Investigate the protection of properties immediately west of Mid Valley Shopping Centre in Morwell.
8. Investigate options for flood mitigation infrastructure in Toongabbie.
9. Improve the Total Flood Warning System by developing detailed flood maps for the Tyers River downstream of Moondarra, Rintoul Creek, Morwell River and Middle Creek, Eaglehawk Creek, Flynn's Creek and Traralgon Creek upstream of Traralgon and share these with the community.
2.9.4 South Gippsland Shire

South Gippsland Shire covers an area of approximately 3,300 square kilometres, the majority of which is within the West Gippsland Catchment, with the Bass River catchment in the north flowing to Western Port, which is managed by Melbourne Water. Major towns are Leongatha, Korumburra, Mirboo North and Foster.

Wilsons Promontory forms much of the southern boundary of the Shire and is a significant feature and tourist attraction. Corner Inlet, adjacent to Wilson Promontory, is a protected site of significance under the Ramsar Convention on Wetlands, as it is a key habitat for migratory birds. The Strzelecki Ranges in the Shire’s north contain the headwaters of a number of the Shire’s waterways. Due to the prevalence of steep land, both in the ranges and the lower farmland upstream of the flat lowlands near the coast, erosion and landslip associated with heavy rainfall are a significant risk.

Major waterways in the Shire are the Powlett River’s upper reaches and the Tarwin River, with smaller waterways including Tidal River, Stockyard Creek, Franklin River and Agnes River.

**Figure 13 - South Gippsland Shire**

Two locations within South Gippsland - Tarwin Lower and Port Welshpool - were identified as having a significant flood risk as part of the regional risk assessment outlined in Section 2.4. In the
case of Port Welshpool, the flooding is caused by coastal and not riverine inundation. Flood risks and related mitigation options in several other locations are discussed below.

Water storages in the Shire include Ruby Creek near Leongatha, Coalition Creek near Korumburra and Deep Creek near Foster.

Riverine flooding in the Shire mostly impacts on rural land and roads in the low-lying land towards the coast, predominantly along the Tarwin River at Tarwin Lower, Fish Creek and Meeniyan and associated rural areas. This flooding can isolate towns including Venus Bay and Meeniyan. Properties have been inundated in Toora around Grip Road and Jetty Road.

The behaviour and impact of riverine flooding for large areas of the upper catchment has not been modelled and is likely to be a low priority as these areas are mostly contained within steep river valleys with little infrastructure or farmland being impacted.

High intensity rainfall events can cause flash flooding which results in flows of high depth and velocity and can trigger landslides in steep land and flash flooding in urban areas. Flash flooding in urban areas can overwhelm stormwater infrastructure. Parts of Foster, Fish Creek, Leongatha (around Turner Street), Waratah Bay (around the caravan park) and Toora have been inundated by flash flooding. Fish Creek experienced some property inundation and road closures due to flash flooding in 2011, as a result of combined riverine and stormwater flooding. A flood study is likely to be beneficial and provide a better understanding of the behaviour and impacts of flooding.

In July 2016, parts of Foster were inundated as a result of heavy rainfall leading to flooding in Stockyard Creek. It was speculated at the time that flooding was exacerbated by the presence of a large tree within the creek and other vegetation debris that had accumulated against a fenced, low level road bridge and large sewer main. Following the floods, South Gippsland Shire with the support of the WGCMA successfully sought funding through the $25 Million VFMS initiative to develop a project to understand the flood risk along Stockyard Creek. This project will determine the works required to manage the flood risk and clarify the ongoing management requirements.

Coastal areas including Port Welshpool, Port Franklin, Tarwin Lower and Waratah Bay have a flood risk due to storm surge, which can occur in conjunction with stormwater flooding in and around the drainage network. This impact will increase as sea levels rise and storm events become more frequent and intense in the future.

Rural areas around Meeniyan, Port Welshpool, Toora, Berry’s Creek, Tarwin Lower, Fish Creek, Port Franklin, Mardan South and Mirboo North have significant rural flood risk, which can inundate properties and roads, including the South Gippsland Highway west of Meeniyan, at the Agnes River west of Toora and at Nine Mile Creek near Hedley.

The single access road to Venus Bay is inundated due to flooding on the Tarwin River often exacerbated by coastal storm surge, totally preventing access into and out of the Venus Bay peninsula. Strategic land use planning in Venus Bay should recognise and respond to this significant constraint.

A full list of road closures is available in *South Gippsland Shire Flood Emergency Plan* (State Emergency Service and South Gippsland Shire Council, 2013). It is recommended that the
installation of warning systems for roads which are regularly inundated be investigated. Roads identified as a priority are Meeniyan Promontory Road at Fish Creek, Inverloch Venus Bay Road at Tarwin Lower and Stewart and Dunlops Roads near Middle Tarwin. It is proposed that VicRoads investigates the installation of warning systems on VicRoads roads within South Gippsland which are subject to significant inundation.

Critical infrastructure, other than roads, that is at risk of flooding includes caravan parks at Port Welshpool, Shallow Inlet and Waratah Bay, sporting facilities at Fish Creek and the volunteer CFA station at Tarwin Lower. Vulnerable communities include Venus Bay and Tarwin Lower, as residents can become isolated from facilities including emergency services.

Wilson Promontory is a key asset in the region, attracting large numbers of tourists and supporting the local economy. A severe storm in March 2011 resulted in flash flooding in a number of waterways including Tidal River and Darby River. The bridge on the Wilson Promontory Road at Darby River was destroyed, which prevented evacuation of people south of the bridge, in the main visitor area and elsewhere. The visitor area itself experienced rapidly rising floodwaters in Tidal River, which extensively damaged buildings in the area. Damage to roads, bridges and buildings was not repaired for many weeks after the event, which significantly affected the local economy.

The rainfall event and resulting flooding was considered to be extremely rare and therefore likely to occur very infrequently, however it raises the issue of the impact of very intense storm events on infrastructure within the area and the wider economy, particularly as storms are likely to become more intense and frequent due to climate change.

Levee systems in the Shire include along the Tarwin River near Tarwin Lower, along the north and south sides of Andersons Inlet and the sea walls in Corner Inlet. The Corner Inlet sea walls provide some protection from coastal inundation of farmland. Some small sections of these walls have been damaged or breached due to the absence of regular maintenance, animal activity and different landowner priorities, resulting in inundation which will increase into the future as sea level rises and the incidence and severity of storm surges increases.

South Gippsland Shire Council and Wellington Shire Council have commenced a study to investigate the potential impacts of climate change on the condition of sea walls in both Shires. Outcomes from this report may identify actions for inclusion in one of the future Regional Work Programs associated with this Strategy.

There are no BoM flood forecasts available within the South Gippsland Shire, therefore flood response relies on local rainfall and river observations and Flood Watch and Severe Weather Warning services. Stream flow gauges are available at several locations in the Tarwin River system including Meeniyan, on the Franklin River at Toora, on the Agnes River at Toora and on the Tidal River at Tidal River.

Riverine floods generally rise quickly in South Gippsland Shire, with increasing waterway levels commencing around 6 to 12 hours after rainfall in smaller waterways and 18 to 24 hours in the lower floodplain areas of the Tarwin River (State Emergency Service and South Gippsland Shire Council, 2013).
The *South Gippsland Shire Flood Emergency Plan* (State Emergency Service and South Gippsland Shire Council, 2013) provides good quality information about flooding in the Shire in general and includes a Flood Emergency Plan for Tarwin Lower. It is important that the MFEP be kept up to date as additional flood intelligence and other information becomes available. It is recommended that the Municipal Flood Emergency Plan be updated to include specific Flood Guides for Fish Creek and Foster based on information from the potential flood studies.

Flood controls in the South Gippsland Planning Scheme were updated via Amendment C81 in 2016. Mapping of flood overlays was updated to include sea level rise to the year 2100.

Possible flood mitigation actions identified in South Gippsland (within the West Gippsland catchment) are:

1. Ensure flood information in Municipal Flood Emergency Plans is regularly reviewed and updated.
2. Develop individual Flood Guides for high priority areas, specifically Fish Creek and Foster.
3. Investigate undertaking a flood study for Fish Creek.
4. Proceed with a flood study for Stockyard Creek in Foster.
5. Investigate the installation of a warning system for flooding over Stewart and Dunlops Roads near Middle Tarwin.
6. Investigate connecting the existing stream gauges to a monitoring / forecasting system to improve flood warnings.
7. Proceed with South Gippsland Shire Council and Wellington Shire Council's investigation into the impacts of climate change on sea walls.
8. Improve the Total Flood Warning System by developing detailed flood maps for the Tarwin River, Fish Creek, Franklin River, Agnes River, Nine Mile Creek and Tidal River and share these with the community.
2.9.5 Wellington Shire

Wellington Shire covers approximately 11,000 square kilometres and over 140 kilometres of coastline along Bass Strait. It includes the towns of Heyfield, Rosedale, Maffra, Sale, Stratford and Yarram.

Major waterways are the Perry, Avon, Macalister, Thomson and Latrobe Rivers, all of which flow into Lake Wellington and out to the Gippsland Lakes. Smaller waterways which flow directly to the coast include Merriman's Creek, Bruthen Creek and the Albert, Jack and Tarra Rivers. The Macalister Irrigation District (MID) forms a large part of the Macalister River catchment and comprises significant areas of floodplain with a network of irrigation and drainage channels that have altered the natural flow paths.

**Figure 14 - Wellington Shire**
Of all the municipalities in West Gippsland, Wellington Shire has the highest number of locations identified as having significant flood risk as part of the regional risk assessment outlined in Section 2.4. These locations are:

- The urban areas of parts of Loch Sport, Seaspray, Rosedale, Sale, McLoughlin’s Beach, Tinamba and Port Albert;
- Rural areas along the Avon River from Valencia Creek to Clydebank;
- Rural areas along the Tarra River to Brewery Road;
- Rural areas along the Thomson River and Rainbow Creek from the Cowwarr Weir to the confluence with the Macalister River;
- Rural areas along the Macalister River from the Glenmaggie Weir to the Thomson River confluence;
- Rural areas along the Thomson River from the Macalister River confluence to the confluence with the Latrobe River south west of Sale;
- Rural areas along the lower Latrobe River from Flynn to downstream of Rosedale and from the Swing Bridge to Lake Wellington;
- Rural areas adjacent to the Ninety Mile Beach from Seaspray to Loch Sport; and
- The rural area of Boggy Creek.
Water storages in the Shire include Cowwarr Weir and Lake Glenmaggie.

Riverine flooding occurs frequently within the Shire, with large areas of rural land being regularly inundated. The upper catchments of rivers like the Avon and its tributaries Ben Cruachan, Valencia and Freestone Creeks are steep, leading to rapid flooding in the upstream reaches, which breaks the river banks further downstream on flatter land. This results in flooding in areas such as Valencia Creek, Boisadale, Stratford, Clydebank and Briagolong.

Briagolong experiences flooding through the town caused by overland flows from the nearby hills. An investigation into the flooding here may provide a better understanding of flood behaviour and suggest potential mitigation options to reduce the flooding impact.

The Macalister River is subject to rapid stream flow rises in its steep upper catchment, leading to flooding of low lying farmland. Flooding occurs in the towns of Newry and Tinamba and large areas of rural land downstream of Lake Glenmaggie. Flooding in the lower Macalister River is influenced by outflows from Lake Glenmaggie which are managed by strict protocols by Southern Rural Water. The floodplain includes drains, irrigation channels, anabranches and outbreaks, resulting in a complex interaction of flows. Overland flows from the north of Maffra cause flooding to residential areas as floodwaters move through the town. This flooding is complex and may be originating from two separate catchments. A flood study for Maffra is considered important to understand the nature of the flooding and investigate potential mitigation options.

The Thomson River has a steep, forested upper catchment and flows to the Thomson Reservoir which generally contains runoff above the storage. It flows eastwards into Wellington Shire upstream of Cowwarr Weir. The Thomson River formed a breakaway course, which formed Rainbow Creek during a flood in 1952. Both channels – Rainbow Creek and Thomson River – can flood rural land downstream of Cowwarr Weir before they re-join downstream of Heyfield.

During floods, the Thomson River overflows into Lavers Creek then breaks out to the north of Sale and enters Flooding Creek. A number of properties in Sale and Wurruk are likely to be inundated during a 1% AEP flood, resulting from an interaction of flooding in the Latrobe and Thomson Rivers, Flooding Creek and the Sale Canal, and exacerbated by high levels in Lake Wellington.

The Latrobe River joins the Thomson River near Longford and then flows into Lake Wellington, with large areas of farmland flooding around East Sale, The Heart and Dutson.

Some local landholders have raised concerns regarding the regrowth of native vegetation in the Macalister River, they are particularly concerned that riparian vegetation is potentially increasing the risk of flooding by forcing more water out of the river channel and onto the floodplain in the vicinity of Hagen’s Bridge. The WGCMA is currently investigating the impact of vegetation on flood behaviour. Based on the outcomes of this investigation, potential options to mitigate flooding without compromising waterway health will be explored with local landholders.

The WGCMA has worked for many years with a number of landholders along the Macalister River to remove willows and encourage native vegetation to re-establish along the river. The success of this work has only been possible with the support and cooperation of landholders and groups such as the Macalister Customer Consultative Committee, Landcare, the Macalister Irrigation District
Sustainability Group and Wellington Shire Council. This work has been instrumental in improving the health of the river and reducing impacts to the Gippsland Lakes.

As outlined in Section 2.3, the Victorian Floodplain Management Strategy allows for vegetation management to occur along waterways where it can be demonstrated that this will significantly reduce the impacts of flooding, the benefits outweigh the costs to river health and the beneficiaries are willing to fund the works.

The Latrobe River floods along its length to varying extents mainly impacting farmland. Parts of Rosedale, including private dwellings, are inundated from Blind Joe Creek and the waterways that flow off the hills to the south of town. A recent flood study for Rosedale (Water Technology, 2016) refined the 1% AEP flood extent and investigated mitigation options. None of the structural mitigation options investigated was shown to be cost effective based on current conditions. It was recommended that telemetered flood gauges be installed in Rosedale and Blind Joe Creek upper catchment to improve knowledge and potentially be used for flash flood warning. It was also recommended that the Planning Scheme be amended to update flood overlay extents.

Rural land along the lower reaches of Merriman’s Creek, Tarra River, Jack River and Albert River are subject to flooding, although flood mapping in these areas is currently limited. Extensive flooding occurs around the mouth of each of these waterways where they meet the coast, and this can be made worse by high tides and storm surges.

The coastline in Wellington Shire is subject to coastal inundation, which will increase into the future due to sea level rise caused by climate change. Port Albert is impacted solely by coastal storm surges and its residential area is likely to be impacted significantly by sea level rise. Other low lying areas along the Nooramunga Coast, including Manns Beach and Robertsons Beach, are likely to be vulnerable to coastal inundation.

Seaspray and McLoughlin’s Beach are impacted by riverine flooding which is exacerbated when coastal storm surges increase the water level at the mouth of the waterways. Loch Sport experiences a similar situation, impacted by flooding from the surrounding lakes. Flooding in these towns will occur more frequently and at higher levels as sea levels rise into the future.

In the Gippsland Lakes system, flooding can result from high inflows from the incoming river systems as well as high tides and storm conditions off the coast from Lakes Entrance. Floodwaters in the lakes can take a week or more to recede, with properties isolated for up to two weeks. Jetties, boat ramps and carparks often flood and mooring lines for the hundreds of boats moored around the lake system need to be extended and reduced during a flood event. Large floods in Gippsland Lakes inundate properties in Hollands Landing, Seacombe and Loch Sport. Road access to the eastern part of Loch Sport is impassable during flood events, which isolates a large number of residential properties.

Flash flooding mostly occurs in the steep upper catchments where it has little impact on property, and in urban areas such as Sale if runoff exceeds the capacity of the stormwater system.

Many rural roads in low-lying areas and around waterway crossings are subject to inundation from riverine flooding. These include Bengworden Road downstream of Stratford, Valencia Creek Road, Maffra Briagolong Road, Cowwarr Seaton Road, Tinamba Newry Road and Heyfield Traralgon.
Road. The Princes Highway on the Avon River floodplain south of Stratford and at Wurruk, and the South Gippsland Highway between Sale and Longford and at Stradbroke are subject to closure during floods. Recent improvements to Cox's Bridge have reduced flooding along the South Gippsland Highway between Sale and Longford, however the road is still subject to flooding in any event greater than a 5% AEP (20 year ARI) flood. It is proposed that VicRoads investigates the installation of warning systems on VicRoads roads within Wellington Shire which are subject to significant inundation.

Some roads in urban areas can be impacted by stormwater flooding, including in Sale and Rosedale.

A full list of road closures can be found in Wellington Shire Municipal Flood Emergency Plan (State Emergency Service and Wellington Shire Council, 2016).

CFA stations and police stations may be flooded in some of the high-risk towns including Rosedale, Loch Sport and Seaspray, as well as the Gippsland Water treatment plant for Sale. The eastern section of Loch Sport is entirely cut off in floods greater than a 5% AEP (also known as a 1-in-20 year flood). Caravan parks can be inundated and/or isolated at Seaspray, Woodside and Port Albert.

Structural flood mitigation in the Shire includes sea walls which provides some protection from coastal flooding for the township of Port Albert and farmland around Nine Mile Creek. A regulating structure and floodway system was constructed at Seaspray following flooding in 1978, and is operated by Council in response to waterway flooding as indicated by the upstream river data gauges at Seaspray (Prospect Road) and Stradbroke West. There is also an earthen levee protecting parts of Seaspray, however the Seaspray Flood Study (Water Technology, 2016) determined that the levee does not offer protection from a 1% AEP flood event.

An earthen levee to the north-west of Tinamba was constructed by a property owner on private land in 2014, and protects some of the township. There are also numerous private farm levees used to divert flows away from assets and improve irrigation functions.

An earthen levee bank in Kilmany South, also known as the Kilmany Bank, was constructed as part of a Soldier Settlement Scheme in the early twentieth century. It provides some protection for farmland along the flood overflow path on the Latrobe River morass. The system includes two floodgates and two pumps to remove drainage waters that build up on the upstream side of the bank.

Affected landowners have recently raised concerns about the potential for the proposed Wurruk Growth Area to increase stormwater behind the levee, thereby increasing their pumping requirement and associated costs. The WGCMA has engaged with these landowners and Wellington Shire to understand the issues. Further investigation is required prior to the land being rezoned or developed. The landowners are also considering a formal management arrangement for the levee, and the WGCMA will support this process if required.

Advanced flood warning systems are available along the Thomson, Macalister and Avon Rivers, where there are a large number of stream and rainfall gauges providing good quality flood warnings. Gauges on Merriman’s Creek provide some indication of flooding for downstream communities.
including Seaspray. Flood warning services are not available for the other main waterways including the Albert and Jack Rivers and Bruthen Creek.

Driven by available updated flood data, Wellington Shire’s Municipal Flood Emergency Plan (State Emergency Service and Wellington Shire Council, 2016) should be updated to include specific Flood Guides for Rosedale and Port Albert; similarly the existing Flood Guide for Seaspray should be updated. A Local Flood Guide for Seaspray has been commenced, and Local Flood Guides are recommended for Rosedale and Port Albert. An update of the Tinamba Community Flood Plan is recommended.

Flood controls in the Wellington Planning Scheme were updated via Amendment C33 in 2014, which added new flood controls for areas such as McLoughlin’s Beach and the Tarra, Albert and Jack River areas, and updated flood mapping for locations such as Rosedale and Seaspray. The approved amendment excluded Port Albert (for which new flood controls had been proposed) and flooding in Port Albert is currently regulated through the building permit process rather than through planning controls.

Subsequent flood studies for the Latrobe River, Seaspray, Rosedale and the Avon River have provided new or updated flood mapping, which needs to be incorporated into the Planning Scheme. The Seaspray Flood Study (Water Technology, 2016) determined that the existing levee and floodway do not protect the township from a 1% AEP flood, and recommended upgrading the levee. If the levee repair works aren’t undertaken or scheduled to be undertaken before the municipal wide planning scheme amendment, then the flood overlay in Seaspray should reflect this and show significant inundation within the town. Conversely if the levee repair works are undertaken, the overlay should be updated based on the levee providing protection to the town.

Possible flood mitigation actions identified in Wellington (within the West Gippsland catchment) are:

1. Ensure flood information in Municipal Flood Emergency Plans is regularly reviewed and updated.
2. Develop individual Flood Guides for high priority areas, specifically Tinamba, Newry, Rosedale, Port Albert and Seaspray.
3. Undertake a municipality-wide Planning Scheme Amendment to incorporate sea level rise mapping and updated flood mapping from the Latrobe, Rosedale, Seaspray and Avon flood studies and for locations including Bruthen Creek and Wurruk.
4. Investigate the feasibility of upgrading the road access to eastern Loch Sport and investigate localised drainage options to reduce flooding of Track 10.
5. Advance the design and construction of the upgrade to the existing Seaspray levee, monitoring of the sand berm at the mouth of Merriman’s Creek and develop a formal management arrangement for the system.
6. Investigate the economic feasibility of providing flood mitigation infrastructure for townships along the Nooramunga Coast.
7. Undertake a flood study for the township of Briagolong.
8. Undertake a flood study for the township of Maffra.
9. Review flood class levels for the Macalister River downstream of Lake Glenmaggie.
10. Improve the Total Flood Warning System by developing detailed flood maps for the Albert and Jack Rivers, Tarra River, Bruthen Creek, Merrimans Creek, Perry River and the Macalister River upstream of Glenmaggie and share these with the community.
2.9.6 East Gippsland Shire

Approximately 9,000 hectares of land in East Gippsland Shire is within the West Gippsland catchment, as shown in Figure 16. This includes two separate areas - a long peninsula of land along Ninety Mile Beach including Mosquito Point, Jubilee Head and Ocean Grange and part of the Perry River catchment upstream of the Princes Highway and south of Glenaladale.

Figure 16 - East Gippsland Shire

The Regional Risk Assessment outlined in Section 2.4 did not identify any of these units as having a significant flood risk relative to the West Gippsland catchment.

Flood mapping is not available for the upper Perry River area. Flooding is likely to occur in this area however its impact is expected to be low in relation to other areas in West Gippsland.

The locations of Mosquito Point, Ocean Grange and The Barrier currently function primarily as small holiday settlements with the balance of private land area in larger holdings. A large part of the Ninety Mile Beach area is subject to inundation, both under current climatic conditions and under a future sea level rise scenario. This is a unique area of East Gippsland and the Gippsland Lakes as access to properties in this area is by boat, and access from the available jetties to the dwellings may be subject to flooding. Given the zoning of these areas, development pressure is low and is regulated by the controls within the existing Land Subject to Inundation Overlay.
The Gippsland Lakes is a dynamic system that is impacted by contributing waterways in both East and West Gippsland catchments, therefore effective management of flooding issues in this area requires a coordinated approach across the two CMAs.

Flood controls in the East Gippsland Planning Scheme do not include all currently available flood mapping nor the impacts of sea level rise.

A possible flood mitigation action identified in East Gippsland Shire within the West Gippsland region is to undertake a Planning Scheme Amendment to apply flood controls across the Gippsland Lakes.
3. PART 3 – THE STRATEGY

3.1 Vision and objectives for floodplain management in the region

The vision, objectives and outcomes of the *Victorian Floodplain Management Strategy* (Victoria State Government, 2016) are outlined in Table 2 of that document. The VFMS outlines a number of policies, actions and accountabilities to achieve the objectives and outcomes.

Preventing flooding is extremely problematic and ineffective. Physical infrastructure options can protect floodplains to some extent but can never protect against all floods. They are often expensive, have negative effects on the environment and flood behaviour, and they create significant problems when they fail or are overtopped (Western, 2011).

It is well recognised that the most effective flood mitigation options include sound planning, including flood mapping, flood prediction, flood response, land use planning and education. Researchers argue that ‘there are many human uses consistent with periodic flooding, such as the growing of pasture and timber, but building infrastructure on floodplains is not one of them.’ (Humphries, McCasker, & Keller Kopf, 2016).

With this in mind, the vision and objectives for floodplain management in West Gippsland Floodplain are outlined in Figure 17.

Accountabilities and actions in the VFMS are attributed to a variety of lead agencies. Those agencies were consulted through the development of this Strategy. Some of the policies, actions and accountabilities which are significant to flooding in the region are outlined under the relevant Objective below.
West Gippsland communities are aware of flooding and are actively taking measures to manage their flood risks to minimise the consequences to life, property, community wellbeing, the economy and the environment.

1. **Build a flood resilient community**

Floods are potentially one of the most predictable natural disasters, with tools available to assess floods’ magnitude, frequency and impact. Some areas can be protected from flooding but it is not possible or practical to eliminate flooding. The impact of floods can be reduced by providing information to communities so they can consider their flood management options.

Floodplain managers collect and process information about floods. Effective sharing of this information with communities, government organisations and emergency management agencies can increase community understanding of and resilience to flooding. Improvements to the processes around the sharing of flood information have been investigated through the development of this Strategy and relevant actions proposed.

The VFMS outlines a number of policies to support this objective. These policies broadly seek to standardise outputs from flood studies and post-flood data collection, including mapping, so that information from flood studies is useful for a number of applications, ultimately resulting in a better-informed community. DELWP is developing a web-based flood intelligence platform known as ‘FloodZoom’ which will provide a range of flood information to assist in flood planning and response.

2. **Reduce existing flood risks**
The provision of real-time information about a flood’s behaviour and impacts to communities and emergency management agencies is crucial to reduce the impact of floods. Existing flood risks can also be managed through flood mitigation infrastructure and activities and risk management planning.

The VFMS outlines a number of actions, accountabilities and policies which support the reduction of existing flood risks. Those most significant to West Gippsland are outlined below.

**Flood Warnings**

As outlined in Section 2.8.3, flood warnings provide communities and emergency management agencies with information about when flooding may occur, its likely impacts and how to reduce damages.

Policy 16a - Where a flood study or a regional floodplain management strategy outside Melbourne Water’s region identifies the need for a TFWS and that service has community support, the capital costs of new rain or stream monitoring gauges will be shared between the Victorian and Australian Governments. The local community, through its LGA, will fund ongoing maintenance costs for the gauges.

Policy 16b - With leadership and guidance from DELWP, each of Victoria’s Total Flood Warning System services will require active cooperation and collaboration between DELWP, BoM, VICSES, water corporations, LGAs and CMAs.

The West Gippsland LGAs are generally positive about the benefit of stream monitoring gauges, but they are also concerned about the ongoing maintenance costs of new gauges. No new gauges have been proposed as part of this Strategy as it is considered more effective to improve and develop flood information and share this with the community. New gauges and prediction services are unlikely to be cost effective due to the large size of the catchments and the relatively small flood risk. This is discussed in more detail in Section 2.8.3.

**Flood mitigation infrastructure**

The benefits of flood mitigation infrastructure and an overview of infrastructure in West Gippsland is provided in Section 2.8.2. The VFMS seeks to remove uncertainty and inconsistency in the management of flood mitigation infrastructure to improve its performance during a flood.

**New flood mitigation infrastructure**

New flood mitigation infrastructure identified through Regional Floodplain Management Strategies must provide both community and environmental benefits. The ‘beneficiary pays’ principle will determine the management and funding arrangements. Large scale flood mitigation infrastructure is not considered best practice but there may be limited circumstances where it may be supported after a thorough evaluation taking into account social, cultural, economic and environmental costs and benefits.

Accountability 17a - LGAs (outside Melbourne Water’s region) are accountable for leading the processes to determine and implement new flood mitigation infrastructure through flood studies and Water Management Schemes and the ongoing maintenance and management of new infrastructure through flood studies and Water Management Schemes. CMAs are accountable for supporting
LGAs to lead the processes to determine and implement, through flood studies and Water Management Schemes (where appropriate), the assessment of new flood mitigation infrastructure.

Policy 17b - New, large-scale rural flood mitigation infrastructure will only attract government funding if it satisfies the investment criteria outlined in this Strategy.

Existing flood mitigation infrastructure
Regional Floodplain Management Strategies will identify areas where there is a need to investigate bringing existing flood mitigation infrastructure into formal management arrangements including Water Management Schemes. These investigations will need to consider the current governance arrangements, the costs and benefits of restoring (if required) and maintaining the infrastructure, the costs and benefits of alternative solutions and the community's willingness to pay.

Policy 17c - The costs of restoring or upgrading existing flood mitigation infrastructure to bring it into formal management arrangements will, if it meets the government investment criteria (Section 17.2), be shared equally between the Australian and Victorian Governments and the relevant LGAs. The maintenance and management of existing flood mitigation infrastructure under formal arrangements will be funded by beneficiaries (through relevant LGAs) and will be subject to third-party auditing arrangements to ensure it continues to be maintained.

Where there is flood mitigation infrastructure that is not being formally managed, the relevant Municipal Planning Scheme must not assume that the infrastructure will provide flood protection and the relevant Municipal Flood Emergency Plan must provide for the potential for sudden and complete failure of that infrastructure.

Policy 17d - Levees on Crown land that are not being formally managed will be allowed to weather away unless those benefiting from them decide to repair and maintain the levee (or part of the levee) under a levee maintenance permit.

Flood mitigation activities on waterways
Flood mitigation activities on waterways include construction of levees and floodways, changes to culverts, debris clearance, sediment removal and vegetation management. The WGCMA is responsible for waterway health and management in West Gippsland, and has a regulatory role in authorising flood mitigation activities on waterways. However, CMAs are not responsible for undertaking these works, which are to be funded by beneficiaries.

In urban areas, works that provide a clear public benefit may be undertaken by LGAs. In rural areas however, public benefit is less clear, and the WGCMA will support the regulatory process for individuals or groups who are willing to undertake the works. It is up to the key land owners who believe they are being impacted to identify and obtain the support of any potential beneficiaries and to get agreement from any private land owners where works may be required. The WGCMA will then support the beneficiaries to understand the level of risk, provide expertise on the type and extent of works to manage the level of risk and assist with identifying and managing any approvals processes required.

Policy 18b - Where flood studies demonstrate that flood risks can be materially reduced by large-scale flood mitigation activities on waterways, individuals or LGAs may be able to carry out those activities subject to authorisation granted by the CMAs or Melbourne Water.
Policy 18c - Unless they are formally exempt, individuals or groups of landholders, infrastructure managers, LGAs or other authorities proposing small-scale activities on waterways must obtain authorisation from the relevant CMA or Melbourne Water.

3. Avoid future flood risks

Community resilience can be improved by effective strategic and statutory land use planning and building controls, which account for the impacts of climate change. Stormwater and urban flooding can be managed by integrated water management such as rainwater harvesting.

The VFMS outlines a number of actions, accountabilities and policies around the avoidance or minimisation of future flood risks. Those most relevant in West Gippsland are outlined below.

The planning and building systems

As outlined in Section 2.8.1, land use planning seeks to ensure that development on floodplains is compatible with flood risk. The Review of the 2010-11 Flood Warnings & Response (Victoria State Government, 2011) noted that proactive mitigation measures such as land use planning and building standards are generally more cost effective for reducing risk than flow modification or response modification. However, land use planning flood provisions need to be informed by the best available flood data. Changes to topography, land use, improvements in flood record and other changes may trigger a need to update the information in planning schemes. This Strategy provides an opportunity for the accuracy and adequacy of the flood controls in the relevant planning schemes to be reviewed.

Section 2.8.1 details the relevant Victorian Planning Provision policies, the West Gippsland Catchment Management Authorities guidelines for assessing proposed development in floodplains and key issues relating to land use planning in West Gippsland. Each LGA Planning Scheme is discussed in more detail in Section 2.9.

A building permit is required for the construction or significant alteration of most buildings in Victoria. This process is independent of the land use planning process and is regulated under the Building Act 1993 and the Building Regulations 2006. The VFMS directs DELWP and the Victorian Building Authority to work together to improve the effectiveness of the flooding provisions of the Building Code of Australia.

Policy 13a – The 1% Annual Exceedance Probability flood will remain the design flood event for the land use planning and building systems in Victoria

Accountability 13a - LGAs are accountable for ensuring that their Planning Schemes correctly identify the areas at risk of a 1% Annual Exceedance Probability flood, and contain the appropriate objectives and strategies to guide decisions in exercising land use controls in regard to flooding.

The LGAs in West Gippsland support the need to amend planning schemes to incorporate updated flood information, and this already occurs to a large extent. The LGAs and WGCMA recognise the importance of planning schemes as a tool for categorising locations in terms of their appropriateness for development.
However, concern has been raised about the significant resourcing required to undertake planning scheme amendments as well as the interim arrangements required while amendments are being undertaken. In particular LGAs indicated that it was a challenge to have sufficiently experienced planners to manage the Planning Scheme Amendment process and that panel costs were also a barrier. Funding to assist LGAs update their planning schemes has been announced as part of the State Strategy.

**Stormwater and urban flooding**
As outlined in Section 2.6, urban stormwater flooding impacts a number of towns in the region, usually resulting from inadequate drainage infrastructure and planning practices. LGAs are accountable for managing urban stormwater in West Gippsland. This Strategy identifies areas with a history of stormwater flooding in Section 2.9 but it does not recommend treatment options for stormwater flooding.

**Policy 14a** - LGAs, in exercising their urban stormwater flood risk accountabilities, will consider integrated water management options in developing and evaluating measures to manage the urban stormwater flood risks.

**Accountability 14b** - LGAs are accountable for applying the planning requirements of Clause 56 of the Victoria Planning Provisions’ Practice Note 39 to ensure that new developments do not have significant third party impacts as a result of increased runoff from impervious surfaces.

**Managing coastal flooding**
Coastal inundation is mostly caused by storm surges combined with high tides, and can be exacerbated in estuaries by rainfall in coastal catchments and river mouth closures. The impacts of climate change are contributing to a ‘progressive permanent increase in sea level that will increase the extent and duration of storm-induced coastal inundation’ (Victoria State Government, 2012).

Locations in West Gippsland at risk from coastal flooding are discussed in Section 2.9.

**Accountability 15b** - LGAs are accountable for ensuring that their Planning Schemes correctly identify the areas at risk of coastal flooding, and contain the appropriate objectives and strategies to guide decisions in exercising land use controls relating to flooding.

**Policy 15e** - Planning scheme controls must be applied to all priority coastal areas, identified through Regional Floodplain Management Strategies, expected to be at risk of inundation by the 1% AEP flood level, taking into account a rise in mean sea level of at least 0.8 metres.

**Statutory planning decisions for planning permits triggered by the relevant planning scheme controls:**
—must be based on the risk of inundation taking into account a rise in mean sea level of at least 0.8 metres for subdivisions outside existing town boundaries and for all development accommodating emergency and community facilities
—may be based on the current 1% AEP flood level for all other development inside town boundaries and for development on existing lots outside town boundaries
—should include an additional 0.2 metres on top of the normal freeboard applied for decisions based on the current 1% AEP flood level.
As outlined in Section 2.9, Bass Coast and South Gippsland have updated their Planning Schemes to include the impacts of coastal inundation with projected sea level rise. It is recommended that Wellington Shire Council undertake a municipality-wide Planning Scheme Amendment to incorporate sea level rise mapping.

4. Manage residual flood risks

The residual flood risk is the risk remaining after structural or non-structural flood management measures have been applied. These risks cannot be eliminated but can be managed through flood insurance, provision of flood risk information, integrated flood emergency management and incident control.

The Victorian Government will work with the insurance industry to share flood data in an efficient and practical manner, including access to digital elevation data and flood mapping. The WGCMA will support this process by supplying all existing flood data and provide all new flood data when flood studies are completed, including those undertaken in partnership with Councils. The data will be provided through the FloodZoom platform.

It is important for communities to be able to make informed decisions about flood risk management and to ensure that essential infrastructure is located appropriately. The Victorian Flood Database (VFD) includes modelled flood extents for a range of flood events. The Victorian Government will seek to ensure that individuals can have full disclosure of the flood risks associated with their property, not just information relating to the 1% Annual Exceedance Probability flood.

The 1% AEP flood is the design flood event for the land use planning and building systems in Victoria. Even with the most rigorous land use planning and building systems in place, the residual risk of extreme flood events with a very low probability remains.

As discussed in Section 2.9.4, a severe storm in March 2011 resulted in flash flooding in Wilsons Promontory National Park. This storm produced significantly more rainfall than the 1% AEP storm, which is typically used for development decisions in Victoria. The intense rainfall caused rapid flooding in Tidal River and destruction of the Darby River Bridge, requiring mass evacuation by helicopter of a number of visitors and residents. Buildings in Tidal River were extensively damaged. Damage to roads, bridges and buildings was not repaired for many weeks after the event, which significantly impacted on the local economy. It is difficult to plan for events like this, however accurate information about more frequent floods, effective emergency response and integration of relevant agencies assists in managing their impacts.

Emergency management in Victoria has three components – prevention, response and recovery. VICSES is the lead agency for flood response and as such is responsible for community education and awareness, the support of Municipal Flood Emergency Committees, and it is responsible for facilitating Municipal Flood Emergency Plans (MFEPs) in conjunction with LGAs. Flood Emergency Plans should include information about flood mitigation measures including the consequences of the failure or overtopping of flood levees.

It is critical that all agencies integrate their activities so that flood studies deliver information capable of being incorporated into the various plans and actions needed to manage floods, including land use planning as well as community education and awareness.
Accountability 22b - Melbourne Water, CMAs and LGAs are accountable for making sure that the outputs of their floodplain management activities can be integrated with other emergency management functions.

Action 22a - LGAs will work with VICSES to ensure that Municipal Flood Emergency Plans include the best available information about the condition of flood mitigation infrastructure, including levees. Flood emergency plans will make reference to the overtopping or failure of flood levees and their possible consequences.

3.2 Stakeholder engagement

The Victorian Government undertook public engagement during the development of the *Victorian Floodplain Management Strategy* (Victoria State Government, 2016) (VFMS). Submissions were sought during two exhibition periods (one in 2014 and another in 2015) and the Government used the ideas, knowledge and experience contributed in that process to develop the final Strategy.

In developing this regional strategy, the Steering Committee built on that prior consultation to ensure continuity in community engagement. Because the community of interest was aware of the VFMS process, they understood the connection between this strategy and the VFMS. These connections were highlighted throughout the stakeholder engagement for this Strategy.

Stakeholder engagement is an important part of the development process for the West Gippsland Floodplain Management Strategy. Effective stakeholder engagement strengthens existing relationships across agencies and communities, creates new relationships, and builds a culture of shared responsibility. These relationships are invaluable for strategy development and implementation as well as for future flood emergency response.

The Steering Committee was established at the commencement of the project, and includes representatives from each of the five (5) major Local Government Authorities (Bass Coast, Baw Baw, Latrobe, South Gippsland and Wellington), VICSES and the WGCMA, with observers from DELWP and East Gippsland Catchment Management Authority (EGCMA). The benefit of the relationship with EGCMA is to ensure consistency across the broader Gippsland region and particularly with cross border issues such as the Gippsland Lakes. A number of regular Steering Committee meetings are scheduled between August 2016 and September 2017, with additional engagement occurring outside these meetings as required.

The five major LGAs were engaged at officer level collectively via the Steering Committee representative(s) and individually via workshops. The following two series of workshops with each of those Councils were undertaken:

1. Identify and discuss flood risks within the municipality (September 2016); and
2. Investigate options to mitigate the identified flood risks (December 2016).

These workshops involved representatives from each Council’s Emergency Management, Planning or Infrastructure areas, as well as the relevant VICSES Regional Officer.
In addition, each of the five major Councils was briefed regarding the Strategy at either Executive or Councillor level in early 2017. At these briefings, the draft strategy and proposed mitigation options for each municipality were discussed and reviewed.

Due to the small area of land within East Gippsland Shire in the region, and the relatively low flood risks in those areas, the East Gippsland Shire was not involved in the Steering Committee or the workshops mentioned above. The major flood risks within that Shire are being addressed by the East Gippsland Floodplain Management Strategy, however the WGCMA has been working with the EGCMA and EGSC to ensure consistency across the regions, particularly across the Gippsland Lakes.

Regional agencies were invited to a stakeholder workshop to discuss the project and provide information about flood risks in the region. This workshop took place in September 2016 and included representatives from a number of agencies including Ambulance Victoria, Energy Australia, CFA, Emergency Management Victoria and Department of Health and Human Services. Information provided at this workshop from the agencies identified flood risks particularly to critical infrastructure throughout the region.

Specific agencies and groups have been engaged individually as relevant, throughout the process of developing this Strategy. These include VicRoads, the Macalister Customer Consultative Committee, the Victorian Farmers’ Federation, the Macalister Irrigation Council, the Moe River Drainage Committee and the community associated with the Kilmany levee.

During the initial stage of the Strategy development, when information was being compiled about flood risks in the region, information about the Strategy development was provided on the WGCMA website and that of each relevant Council. This information included background on the Victorian Strategy and the purpose of this regional Strategy, as well as channels for the provision of feedback, including an online mapping tool, which was created for this project. Each Council provided information about its key community groups, and many of these were contacted to provide feedback at various stages throughout the Strategy development. Information was also sought from communities via local newspapers.

This draft Strategy is being publicly exhibited, with access available from the WGCMA website and those of the five major LGAs in the region (Bass Coast, Baw Baw, Latrobe, South Gippsland and Wellington). Summary documents have been developed to provide the key information and request feedback from communities. Specific community groups have been targeted, with further information provided to the community via various newspaper articles.

### 3.3 Determining regional priorities

The information from Part 2 in this Strategy was used to determine priority actions for mitigating floods in the region over the period of the Strategy (ten years). Priority actions are those in which:

- The Regional Risk Assessment identified a significant risk for the location;
- The existing risk treatments are considered inadequate;
- Additional risk treatment(s) may reduce flood risk;
- Additional risk treatment(s) are financially, socially and environmentally feasible; and
v. Each responsible party considers the action achievable, subject to funding and resources, over the term of this Strategy.

Additional priority actions have been identified independent of the regional risk assessment process. These additional priority actions treat flood risk in areas where the flood risk has not been mapped or is poorly understood. Hence those areas were not identified as having a significant risk.

For example, flooding occurred in Foster in July 2016 affecting private property. Flood mapping has not been done for Stockyard Creek and this was identified as a knowledge gap in the risk identification workshops. Funding for a flood study was subsequently sought from DELWP and the study commenced in 2017.

Flooding at Wilsons Promontory National Park in 2011 had a significant impact on the local economy due to a loss of tourism income for a period of time. The risk assessment process undertaken through this Strategy was not able to account for this economic impact, which has not been quantified. However, the issue has been identified throughout the consultation process as one requiring further investigation.

Flood mitigation actions which have initially been identified as a priority for the region throughout the development of this Strategy, intended to be achieved over the term of the Strategy, are outlined in Table 2. This list will be refined following public exhibition of this draft Strategy, and is therefore subject to change.

The flood mitigation actions identified apply to the region as a whole, as well as those that are specific to a Local Government Area. Regardless of the area to which they apply, all partner agencies will work collaboratively across the region to benefit the region as a whole.

3.4 Strategy implementation

As discussed in Section 1.3, the list of potential flood mitigation activities listed in Table 2 includes those initially identified for action over the period of this Strategy (10 years). This list will be refined based on feedback from the public exhibition of this draft.

Implementation of the actions in Table 2 in the final Strategy will be prioritised into an initial Regional Work Program for 2018-2020. Actions in the Regional Work Program are considered to be a priority and to be achievable over the initial time period, subject to their being considered feasible as a result of further investigation, and the availability of resources including funding. Decisions on which actions to include are based on the nature of the projects, the flood risk being assessed, work programs of the relevant partner agencies and feedback from the community during the initial public consultation of the draft Strategy.

Following release of the final Strategy, its implementation will be guided by an implementation plan. This plan will emphasise that all relevant agencies will continue to work collaboratively across the region to implement the actions identified, and that the WGCMA will continue to facilitate and support this implementation.

Each Regional Work Program will be reviewed, with the outcomes of these reviews used to guide each subsequent Work Program. In addition, annual reviews will be undertaken within the term of
each Work Program to guide the program over subsequent years. Actions which are transferred to each Work Program will depend on their feasibility, which in many cases can only be determined by further detailed investigation after the Strategy has been finalised. Actions will only be implemented if sufficient resources including funding are available and they are supported by all partner agencies. Future funding opportunities cannot be predicted, therefore the implementation of actions identified in this Strategy is subject to change. It is crucial to identify potential actions in order to be able to respond to future funding opportunities as they become available.

3.5 Other flooding issues

Feedback has been received from the community regarding local flooding issues which may not be of a large enough scale to be reflected in the list of high risk locations and potential mitigation options, or may not be within the scope of this Strategy (for example, rural drainage issues). These issues have been recorded and will be dealt with in the appropriate forum, such as Municipal Flood Emergency Plans, the Victorian Rural Drainage Strategy or Council infrastructure management.
### Table 2 – Draft priority flood mitigation actions for the term of the Strategy (2017-2026)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>LGA</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong> West Gippsland region</td>
<td>All</td>
<td>Scope the development of a community flood portal to disseminate information about flooding, with a focus on areas without a flood warning system</td>
</tr>
<tr>
<td><strong>2</strong> Gunaikurnai Native Title area and Bunurong Land Council area of WGCMA</td>
<td>As relevant</td>
<td>Support a WGCMA project to investigate the development of historical flood mapping</td>
</tr>
<tr>
<td><strong>3</strong> West Gippsland region</td>
<td>All</td>
<td>Make current flood mapping available to Traditional Owner groups to assist them in identifying their cultural heritage sites at risk of flooding</td>
</tr>
<tr>
<td><strong>4</strong> West Gippsland region</td>
<td>All</td>
<td>Ensure flood information in Municipal Flood Emergency Plans is regularly reviewed and updated, with MEMPCs to consider integrating flood and storm plans into a single plan</td>
</tr>
<tr>
<td><strong>5</strong> West Gippsland region</td>
<td>As relevant</td>
<td>Investigate the installation of warning systems for VicRoads roads that are subject to significant inundation as identified by LGAs</td>
</tr>
<tr>
<td><strong>6</strong> Bass Coast Shire</td>
<td>Bass Coast</td>
<td>Develop individual Flood Guides for high priority areas, specifically Inverloch, Wonthaggi and Lower Powlett River</td>
</tr>
<tr>
<td><strong>7</strong> Wreck Creek, Inverloch</td>
<td>Bass Coast</td>
<td>Investigate flooding along Wreck Creek including the impact of the status of the river mouth</td>
</tr>
<tr>
<td><strong>8</strong> Wonthaggi</td>
<td>Bass Coast</td>
<td>Schedule a future update of the Planning Scheme to include flood mapping for the Wonthaggi North East Development Area</td>
</tr>
<tr>
<td><strong>9</strong> Powlett River floodplain</td>
<td>Bass Coast</td>
<td>Improve the Total Flood Warning System by developing detailed flood maps for the Powlett River and share these with the community</td>
</tr>
<tr>
<td><strong>10</strong> Baw Baw Shire</td>
<td>Baw Baw</td>
<td>Develop individual Flood Guides for high priority areas, specifically Warragul, Yarragon and Trafalgar</td>
</tr>
<tr>
<td><strong>11</strong> Baw Baw Shire</td>
<td>Baw Baw</td>
<td>Update the Planning Scheme to include updated flood mapping across the Shire</td>
</tr>
<tr>
<td><strong>12</strong> Moe River</td>
<td>Baw Baw</td>
<td>Investigate structural works along the Moe River to protect North Canal Road and adjacent farm land (between Cummings Road and Telephone Road)</td>
</tr>
<tr>
<td><strong>13</strong> Princes Freeway and Gippsland Railway Line</td>
<td>Baw Baw</td>
<td>Liaise with VicRoads and VicTrack to investigate the capacity of culverts under the Princes Freeway and Gippsland Railway Line between Yarragon and Trafalgar East</td>
</tr>
</tbody>
</table>

*LEAD AGENCY:*

- WGCMA
- VICSES
- BCSC
- BBSC
<table>
<thead>
<tr>
<th>No.</th>
<th>Location</th>
<th>Authority</th>
<th>Action Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Warragul</td>
<td>Baw Baw</td>
<td>Investigate the structural integrity of the Landsborough Road retarding basin in Warragul</td>
</tr>
<tr>
<td>15</td>
<td>Warragul</td>
<td>Baw Baw</td>
<td>Ensure ongoing management of Hazel Creek to retain its current flow capacity</td>
</tr>
<tr>
<td>16</td>
<td>Warragul</td>
<td>Baw Baw</td>
<td>Investigate options to increase the capacity of Hazel Creek at critical locations</td>
</tr>
<tr>
<td>17</td>
<td>Trafalgar</td>
<td>Baw Baw</td>
<td>Construct the proposed Princes Highway retarding basin on the west side of Trafalgar</td>
</tr>
<tr>
<td>18</td>
<td>Trafalgar</td>
<td>Baw Baw</td>
<td>Ensure ongoing management of the Contour Drain and Loch Creek at Trafalgar</td>
</tr>
<tr>
<td>19</td>
<td>Yarragon</td>
<td>Baw Baw</td>
<td>Construct the proposed Hazeldean Road retarding basin in Yarragon</td>
</tr>
<tr>
<td>20</td>
<td>Various</td>
<td>Baw Baw</td>
<td>Improve the Total Flood Warning System by developing detailed flood maps for the Tanjil River downstream of Blue Rock, Latrobe River between Trafalgar-Willow Grove Rd and Westbury, Moe River upstream of the Darnum gauge, Shady Creek and Narracan Creek</td>
</tr>
<tr>
<td>21</td>
<td>Latrobe City</td>
<td>Latrobe</td>
<td>Develop individual Flood Guides for high priority areas, specifically Morwell, Moe, Glengarry, Toongabbie and Traralgon</td>
</tr>
<tr>
<td>22</td>
<td>Latrobe City</td>
<td>Latrobe</td>
<td>Update the Planning Scheme to include updated flood mapping across the Shire</td>
</tr>
<tr>
<td>23</td>
<td>Traralgon</td>
<td>Latrobe</td>
<td>Investigate the feasibility of the Traralgon Bypass Retarding Basin</td>
</tr>
<tr>
<td>24</td>
<td>Moe</td>
<td>Latrobe</td>
<td>Proceed towards construction of the Narracan Creek levee in Moe</td>
</tr>
<tr>
<td>25</td>
<td>Morwell</td>
<td>Latrobe</td>
<td>Replace the Beattie Crescent footbridge in Morwell</td>
</tr>
<tr>
<td>26</td>
<td>Morwell</td>
<td>Latrobe</td>
<td>Investigate the protection of properties immediately west of Mid Valley Shopping Centre in Morwell</td>
</tr>
<tr>
<td>27</td>
<td>Toongabbie</td>
<td>Latrobe</td>
<td>Investigate options for flood mitigation infrastructure in Toongabbie</td>
</tr>
<tr>
<td>28</td>
<td>Various</td>
<td>Latrobe</td>
<td>Improve the Total Flood Warning System by developing detailed flood maps for the Tyers River downstream of Moondarra, Rintoul Creek, Morwell River and Middle Creek, Eaglehawk Creek, Flynns Creek and Traralgon Creek upstream of Traralgon and share these with the community</td>
</tr>
<tr>
<td>29</td>
<td>South Gippsland Shire</td>
<td>South Gippsland</td>
<td>Develop individual Flood Guides for high priority areas, specifically Fish Creek and Foster</td>
</tr>
<tr>
<td>30</td>
<td>Fish Creek</td>
<td>South Gippsland</td>
<td>Investigate undertaking a flood study for Fish Creek</td>
</tr>
<tr>
<td>31</td>
<td>Stockyard Creek, Foster</td>
<td>South Gippsland</td>
<td>Continue with the Stockyard Creek Foster flood study</td>
</tr>
<tr>
<td>32</td>
<td>South Gippsland Shire</td>
<td>South Gippsland</td>
<td>Investigate connecting the existing stream gauges to a monitoring / forecasting system to improve flood warnings</td>
</tr>
<tr>
<td>33</td>
<td>Coastal South Gippsland &amp; Wellington Shire</td>
<td>South Gippsland</td>
<td>Proceed with South Gippsland Shire Council and Wellington Shire Council’s investigation into the impacts of climate change on sea walls</td>
</tr>
<tr>
<td>No.</td>
<td>Location</td>
<td>Region</td>
<td>Task Description</td>
</tr>
<tr>
<td>-----</td>
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</tr>
<tr>
<td>34</td>
<td>Middle Tarwin</td>
<td>South Gippsland</td>
<td>Investigate the installation of a warning system for flooding over Stewart and Dunlops Roads near Middle Tarwin</td>
</tr>
<tr>
<td>35</td>
<td>Various</td>
<td>South Gippsland</td>
<td>Improve the Total Flood Warning System by developing detailed flood maps for the Tarwin River, Fish Creek, Franklin River, Agnes River, Nine Mile Creek and Tidal River and share these with the community</td>
</tr>
<tr>
<td>36</td>
<td>Wellington Shire</td>
<td>Wellington</td>
<td>Develop individual Flood Guides for high priority areas, specifically Tinamba, Newry, Rosedale, Port Albert and Seaspray</td>
</tr>
<tr>
<td>37</td>
<td>Wellington Shire</td>
<td>Wellington</td>
<td>Undertake a municipality-wide Planning Scheme Amendment to incorporate sea level rise mapping and updated flood mapping from the Latrobe, Rosedale, Seaspray and Avon flood studies and for locations including Bruthen Creek and Wurruk</td>
</tr>
<tr>
<td>38</td>
<td>Loch Sport</td>
<td>Wellington</td>
<td>Investigate the feasibility of upgrading the road access to eastern Loch Sport and investigate localised drainage options to reduce flooding of Track 10</td>
</tr>
<tr>
<td>39</td>
<td>Seaspray</td>
<td>Wellington</td>
<td>Advance the design and construction of the upgrade to the existing Seaspray levee, monitoring of the sand berm at the mouth of Merriman’s Creek and develop a formal management arrangement for the system</td>
</tr>
<tr>
<td>40</td>
<td>Nooramunga Coast</td>
<td>Wellington</td>
<td>Investigate the economic feasibility of providing flood mitigation infrastructure for townships along the Nooramunga Coast</td>
</tr>
<tr>
<td>41</td>
<td>Briagolong</td>
<td>Wellington</td>
<td>Undertake a flood study for the township of Briagolong</td>
</tr>
<tr>
<td>42</td>
<td>Maffra</td>
<td>Wellington</td>
<td>Undertake a flood study for the township of Maffra</td>
</tr>
<tr>
<td>43</td>
<td>Downstream of Lake Glenmaggie</td>
<td>Wellington</td>
<td>Review flood class levels for the Macalister River downstream of Lake Glenmaggie</td>
</tr>
<tr>
<td>44</td>
<td>Various</td>
<td>Wellington</td>
<td>Improve the Total Flood Warning System by developing detailed flood maps for the Albert and Jack Rivers, Tarra River, Bruthen Creek, Merrimans Creek, Perry River and the Macalister River upstream of Glenmaggie and share these with the community</td>
</tr>
<tr>
<td>45</td>
<td>Gippsland</td>
<td>East Gippsland</td>
<td>Undertake a Planning Scheme Amendment to apply flood controls across the Gippsland Lakes</td>
</tr>
</tbody>
</table>
REFERENCES

Western, A. (2011, March 24). Retrieved from The Conversation: