



# West Gippsland Floodplain Management Strategy 2018 - 2027



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### **Acknowledgements**

The development of this *West Gippsland Floodplain Management Strategy* has involved the collective effort of a number of individuals and organisations.

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Support and technical input – WGCMA Board (Jane Hildebrant, Ian Gibson, Courtney Mraz), Martin Fuller (WGCMA), Adam Dunn (WGCMA), Catherine Couling (WGCMA), and representatives from VICSES, Bass Coast Shire Council, Baw Baw Shire Council, Latrobe City Council, South Gippsland Shire Council, Wellington Shire Council, East Gippsland Shire Council, East Gippsland Catchment Management Authority, DELWP, Bunurong Land Council, Gunaikurnai Land and Waters Aboriginal Corporation and Boon Wurrung Foundation.

### **Acknowledgement of Country**

We would like to acknowledge and pay our respects to the Traditional Land Owners and other indigenous people within the catchment area: the Gunaikurnai, The Bunurong and Boon Wurrung, and the Wurundjeri people. We also recognise the contribution of Aboriginal and Torres Strait Islander people and organisations in Land and Natural Resource Management.

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# ACRONYMS

<b>AAD</b>	Average Annual Damage
<b>AAPA</b>	Average Annual Population Affected
<b>AEP</b>	Annual Exceedance Probability
<b>ANCOLD</b>	Australian National Committee on Large Dams
<b>ARI</b>	Average Recurrence Interval
<b>ARR</b>	Australian Rainfall and Runoff
<b>BCA</b>	Building Code of Australia
<b>BLCAC</b>	Bunurong Land Council Aboriginal Corporation
<b>BoM</b>	Bureau of Meteorology
<b>CMA</b>	Catchment Management Authority
<b>DELWP</b>	Department of Environment, Land, Water and Planning
<b>DFE</b>	Design flood event
<b>ERRTS</b>	Event Reporting Radio Telemetry System
<b>EGCMA</b>	East Gippsland Catchment Management Authority
<b>FCL</b>	Flood Class Level
<b>GLaWAC</b>	Gunaikurnai Land and Waters Aboriginal Corporation
<b>ICM</b>	Integrated Catchment Management
<b>LGA</b>	Local Government Authority
<b>LPPF</b>	Local Planning Policy Framework
<b>LSIO</b>	Land Subject to Inundation Overlay
<b>MEMP</b>	Municipal Emergency Management Plan
<b>MEMPC</b>	Municipal Emergency Management Planning Committee
<b>MER</b>	Monitoring, Evaluation and Reporting
<b>MFEP</b>	Municipal Flood Emergency Plan
<b>MID</b>	Macalister Irrigation District
<b>MOU</b>	Memorandum of Understanding
<b>PSA</b>	Planning Scheme Amendment
<b>RFMS</b>	Regional Floodplain Management Strategy
<b>RAPs</b>	Registered Aboriginal Parties
<b>RCS</b>	Regional Catchment Strategy
<b>SOP</b>	Standard Operating Procedure
<b>SPPF</b>	State Planning Policy Framework

TFWS	Total Flood Warning System
VCS	Victorian Coastal Strategy
VFD	Victorian Flood Database
VFMS	Victorian Floodplain Management Strategy
VICSES	Victoria State Emergency Service
VPP	Victoria Planning Provisions
WGFMS	West Gippsland Floodplain Management Strategy
WGCMA	West Gippsland Catchment Management Authority
WMS	Water Management Scheme

# Glossary

## **Adaptation**

Adjustment in response to actual or expected climate change or its effects, which moderates harm or exploits beneficial opportunities.

## **Annual Exceedance Probability (AEP)**

The likelihood of the occurrence of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. For example, if a peak flood flow of 500 m<sup>3</sup>/s has an AEP of 5%, it means that there is a 5% (one-in-20) chance of a flow of 500 m<sup>3</sup>/s or larger occurring in any one year (see also average recurrence interval, flood risk, likelihood of occurrence, probability).

## **Average Annual Damage (AAD)**

Depending on its size (or severity), each flood will cause a different amount of flood damage to a flood-prone area. AAD is the average damage per year that would occur in a nominated development situation from flooding over a very long period of time. If the damage associated with various annual events is plotted against their probability of occurrence, the AAD is equal to the area under the consequence–probability curve. AAD provides a basis for comparing the economic effectiveness of different management measures (i.e. their ability to reduce the AAD).

## **Average Recurrence Interval (ARI)**

A statistical estimate of the average number of years between floods of a given size or larger than a selected event. For example, floods with a flow as great as or greater than the 20-year ARI (5% AEP) flood event will occur, on average, once every 20 years. ARI is another way of expressing the likelihood of occurrence of a flood event (see also Annual Exceedance Probability).

## **Australian Rainfall and Runoff (ARR)**

ARR is a national guideline for the estimation of design flood characteristics in Australia published by Engineers Australia. ARR aims to provide reliable (robust) estimates of flood risk to ensure that development does not occur in high risk areas and that infrastructure is appropriately designed.

## **Avulsion**

The rapid abandonment of a river channel and the formation of a new river channel. Avulsions occur as a result of channel slopes that are much lower than the slope that the river could travel if it took a new course. Avulsions typically occur during large floods that carry the power necessary to rapidly change the landscape.

## **Catchment**

The area of land draining to a particular site. It is related to a specific location and includes the catchment of the main waterway as well as any tributary streams.

## **Coastal erosion**

Short-term retreat of sandy shorelines as a result of storm effects and climatic variations.

### **Coastal flooding (inundation)**

Flooding of low-lying areas by ocean waters, caused by higher than normal sea level due to tidal or storm-driven coastal events, including storm surges in lower coastal waterways.

### **Coastal hazard assessments**

Coastal hazard assessments commonly define the extent of land expected to be threatened by coastal hazards (inundation, coastal erosion, coastal recession) over specific planning periods. They are typically used for development assessment purposes and to inform land-use planning considerations. In particular such assessments include consideration of future sea level rise scenarios, typically to the year 2100.

### **Consequence**

The outcome of an event or situation affecting objectives, expressed qualitatively or quantitatively. Consequences can be adverse (e.g. death or injury to people, damage to property and disruption of the community) or beneficial.

### **Curtilage**

The land occupied by a dwelling and its yard, outbuildings etc. actually enclosed or considered as enclosed.

### **Design Flood Event (DFE)**

To identify the areas that the planning and building systems should protect new development from the risk of flood, it is necessary to decide which level of flood risk should be used. This risk is known as the design flood event.

### **Development**

Development may be defined in jurisdictional legislation or regulation. It may include erecting a building or carrying out work, including the placement of fill; the use of land, or a building or work; or the subdivision of land.

*New development:* The intensification of use and/or development of a completely different nature to that associated with the former land use or zoning (e.g. the urban subdivision of an area previously used for rural purposes). New developments generally involve rezoning, and associated consents and approvals. Major extensions of existing urban services, such as roads, water supply, sewerage and electric power may also be required.

*Infill development:* The development of vacant blocks of land within an existing subdivision that are generally surrounded by developed properties and is permissible under the current zoning of the land.

*Redevelopment:* Rebuilding in an existing developed area. For example, as urban areas age, it may become necessary to demolish and reconstruct buildings on a relatively large scale. Redevelopment generally does not require either rezoning or major extensions to urban services.

*Greenfield development:* Building in a currently undeveloped area or development that is unrestrained by prior work.

### **Flash flooding**

Flooding that is sudden and unexpected, often caused by sudden local or nearby heavy rainfall. It is generally not possible to issue detailed flood warnings for flash flooding. However, generalised warnings may be possible. It is often defined as flooding that peaks within six hours of the causative rain.

### **Flood**

A natural phenomenon that occurs when water covers land that is normally dry. It may result from coastal or catchment flooding, or a combination of both (see also catchment flooding and coastal flooding).

### **Flood awareness**

An appreciation of the likely effects of flooding, and a knowledge of the relevant flood warning, response and evacuation procedures. In communities with a high degree of flood awareness, the response to flood warnings is prompt and effective. In communities with a low degree of flood awareness, flood warnings are liable to be ignored or misunderstood, and residents are often confused about what they should do, when to evacuate, what to take with them and where it should be taken.

### **Flood class levels**

The terms minor, moderate and major flooding are used in flood warnings to give a general indication of the types of problems expected with a flood.

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

*Moderate flooding:* In addition to the above, the area of inundation is more substantial. Main traffic routes may be affected. Some buildings may be affected above the floor level. Evacuation of flood-affected areas may be required. In rural areas removal of stock is required.

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

### **Flood damage**

The tangible (direct and indirect) and intangible costs (financial, opportunity costs, clean-up) of flooding. Tangible costs are quantified in monetary terms (e.g. damage to goods and possessions, loss of income or services in the flood aftermath). Intangible damages are difficult to quantify in monetary terms and include the increased levels of physical, emotional and psychological health problems suffered by flood-affected people that are attributed to a flooding episode.

### **Flood education**

Education that raises awareness of the flood problem to help individuals understand how to manage themselves and their property in response to flood warnings and in a flood event. It invokes a state of flood readiness.

### **Flood emergency management**

Emergency management is a range of measures to manage risks to communities and the environment. In the flood context, it may include measures to prevent, prepare for, respond to and recover from flooding.

### **Flood hazard**

Potential loss of life, injury and economic loss caused by future flood events. The degree of hazard varies with the severity of flooding and is affected by flood behaviour (extent, depth, velocity, isolation, rate of rise of floodwaters, duration), topography and emergency management.

### **Flood peaks**

The maximum flow occurring during a flood event past a given point in the river system (see also flow and hydrograph). The term may also refer to storm-induced flood peaks and peak ocean or peak estuarine conditions.

### **Flood-prone land**

Land susceptible to flooding by the largest probable flood event. Flood-prone land is synonymous with the floodplain. Floodplain management plans should encompass all flood-prone land rather than being restricted to areas affected by defined flood events.

### **Flood proofing of buildings**

A combination of measures incorporated in the design, construction and alteration of individual buildings or structures that are subject to flooding, to reduce structural damage and, in some cases, reduce contents damage.

### **Flood readiness**

An ability to react within the effective warning time (see also flood awareness and flood education).

### **Flood risk**

The potential risk of flooding to people, their social setting, and their built and natural environment. The degree of risk varies with circumstances across the full range of floods. Flood risk is divided into three types – existing, future and residual.

*Existing flood risk:* The risk a community is exposed to as a result of its location on the floodplain.

*Future flood risk:* The risk that new development within a community is exposed to as a result of developing on the floodplain.

*Residual flood risk:* The risk a community is exposed to after treatment measures have been implemented. For example:

- A town protected by a levee - the residual flood risk is the consequences of the levee being overtopped by floods larger than the design flood
- An area where flood risk is managed by land-use planning controls - the residual flood risk is the risk associated with the consequences of floods larger than the DFE on the community.

**Flood severity**

A qualitative indication of the 'size' of a flood and its hazard potential. Severity varies inversely with likelihood of occurrence (i.e. the greater the likelihood of occurrence, the more frequently an event will occur, but the less severe it will be). Reference is often made to major, moderate and minor flooding (see also flood class levels).

**Flood study**

A comprehensive technical assessment of flood behaviour. It defines the nature of flood hazard across the floodplain by providing information on the extent, depth and velocity of floodwaters, and on the distribution of flood flows. The flood study forms the basis for subsequent management studies and needs to take into account a full range of flood events up to and including the largest probable flood. Flood studies should provide new flood mapping for Planning Scheme inclusion, data and mapping for Municipal Emergency Management Plans (MEMPs), and a preliminary assessment into possible structural and non-structural flood mitigation measures.

**Flood warning**

A Total Flood Warning System (TFWS) encompasses all the elements necessary to maximise the effectiveness of the response to floods. These are data collection and prediction, interpretation, message construction, communication and response. Effective warning time refers to the time available to a flood-prone community between the communication of an official warning to prepare for imminent flooding and the loss of evacuation routes due to flooding. The effective warning time is typically used for people to move farm equipment, move stock, raise furniture, transport their possessions and self-evacuate.

**Floodplain**

An area of land that is subject to inundation by floods up to, and including, the largest probable flood event.

**Floodplain management**

The prevention activities of flood management together with related environmental activities (see also floodplain).

**Flow**

The rate of flow of water measured in volume per unit time, for example, megalitres per day (ML/day) or cubic metres per second (m<sup>3</sup>/sec). Flow is different from the speed or velocity of flow (a measure of how fast the water is moving in metres per second).

**Freeboard**

The height above the DFE or design flood used, in consideration of local and design factors, to provide reasonable certainty that the risk exposure selected in deciding on a particular DFE or design flood is actually provided. It is a factor of safety typically used in relation to the setting of floor levels, levee crest heights and so on. Freeboard compensates for a range of factors, including wave action, localised hydraulic behaviour and levee settlement, all of which increase water levels or reduce the level of protection provided by levees. Freeboard should not be relied upon to provide protection for flood events larger than the relevant design flood event. Freeboard is included in the flood planning controls applied to developments by Local Government Authorities (LGAs).

### **Frequency**

The measure of likelihood expressed as the number of occurrences of a specified event in a given time. For example, the frequency of occurrence of a 20% AEP or five-year ARI flood event is once every five years on average (see also Annual Exceedance Probability, Average Recurrence Interval, likelihood and probability).

### **Hazard**

A source of potential harm or a situation with a potential to cause loss.

### **Hydraulics**

The study of water flow in waterways; in particular, the evaluation of flow parameters such as water level, extent and velocity.

### **Hydrology**

The study of the rainfall and runoff process, including the evaluation of peak flows, flow volumes and the derivation of hydrographs for a range of floods.

### **Intolerable risk**

A risk that, following understanding of the likelihood and consequences of flooding, is so high that it requires consideration of implementation of treatments or actions to improve understanding of, avoid, transfer or reduce risk.

### **Likelihood**

A qualitative description of probability and frequency (see also frequency and probability).

### **Likelihood of occurrence**

The likelihood that a specified event will occur (see also Annual Exceedance Probability and Average Recurrence Interval).

### **Local overland flooding**

Inundation by local runoff on its way to a waterway, rather than overbank flow from a stream, river, estuary, lake or dam. This can be considered synonymous with stormwater flooding.

### **Mitigation**

Permanent or temporary measures (structural and non-structural) taken in advance of a flood and aimed at reducing its impacts.

### **Municipal Flood Emergency Plan**

A sub-plan of a flood-prone municipality's MEMP. It is a step-by-step sequence of previously agreed roles, responsibilities, functions, actions and management arrangements for the conduct of a single or series of connected emergency operations. The objective is to ensure a coordinated response by all agencies having responsibilities and functions in a given emergency.

### **Planning Scheme zones and overlays**

Planning Schemes set out the planning rules – the state and local policies, zones, overlays and provisions about specific land uses - that inform planning decisions. Land use zones specify what type of development is allowed in an area (e.g. urban [residential, commercial, industrial], rural, environmental protection). Overlays specify extra conditions for developments that are allowed in a zone. For example, flooding overlays specify that developments must not affect flood flow and storage capacity of a site, must adhere to freeboard requirements and must not compromise site safety and access.

### **Probability**

A statistical measure of the expected chance of flooding. It is the likelihood of a specific outcome, as measured by the ratio of specific outcomes to the total number of possible outcomes. Probability is expressed as a number between zero and unity; zero indicating an impossible outcome and unity an outcome that is certain. Probabilities are commonly expressed in terms of percentage. For example, the probability of 'throwing a six on a single roll of a dice is one in six, or 0.167 or 16.7% (see also Annual Exceedance Probability).

### **Rainfall intensity**

The rate at which rain falls, typically measured in millimetres per hour (mm/h). Rainfall intensity varies throughout a storm in accordance with the temporal pattern of the storm (see also temporal pattern).

### **Regional Coastal Boards**

Members of Victoria's three coastal boards have been appointed by the Minister for Environment and Climate Change due to their experience and expertise in areas such as local government, coastal planning and management, tourism and recreational use of the coast. The functions of the Western, Central and Gippsland Coastal Boards, set out under the Coastal Management Act 1995, include developing regional coastal plans and providing advice to the Minister on regional coastal development issues.

### **Risk analysis**

Risk is usually expressed in terms of a combination of the consequences of an event and the associated likelihood of its occurrence. Flood risk is based upon the consideration of the consequences of the full range of flood events on communities and their social settings, and the natural and built environment. Risk analysis in terms of flooding is a combination of defining what threat exists (see flood risk) and what steps are taken (see risk management) (see also likelihood and consequence).

### **Risk management**

The systematic application of management policies, procedures and practices to the tasks of identifying, analysing, assessing, treating and monitoring flood risk.

### **Riverine flooding**

Inundation of normally dry land when water overflows the natural or artificial banks of a stream, river, estuary, lake or dam. Riverine flooding generally excludes watercourses constructed with pipes or artificial channels considered as stormwater channels.

**Runoff**

The amount of rainfall that drains into the surface drainage network to become stream flow; also known as rainfall excess.

**Storm surge**

The increases in coastal water levels above the predicted tide level resulting from a range of location dependent factors such as wind and waves, together with any other factors that increase tidal water level.

**Stormwater flooding**

The inundation by local runoff caused by heavier than usual rainfall. It can be caused by local runoff exceeding the capacity of an urban stormwater drainage systems, flow overland on the way to waterways or by the backwater effects of mainstream flooding causing urban stormwater drainage systems to overflow (see also local overland flooding).

**Vulnerability**

The degree of susceptibility and resilience of a community, its social setting, and the natural and built environments to flood hazards. Vulnerability is assessed in terms of the ability of the community and environment to anticipate, cope with and recover from flood events. Flood awareness is an important indicator of vulnerability (see also flood awareness).

**Water Management Scheme (WMS)**

The formal process set out in the Water Act 1989 that can be applied to a flood mitigation infrastructure development and its ongoing management. It can be based on and carried out in parallel with a floodplain management study.

**West Gippsland**

The West Gippsland Catchment Management Authority region.

# Executive Summary

The West Gippsland Catchment Management Authority (WGCMA) has been working collaboratively with local communities, Traditional Owners, Local Government Authorities (LGAs), the Victorian State Emergency Service (VICSES) and other regional agencies to prepare this 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
- Establishes a list of priority actions to be implemented over the ten-year duration 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
- 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 agencies and communities 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.

A set of possible mitigation actions was outlined in a draft Strategy on which public feedback was sought in May and June 2017. Those actions were revised based on feedback received and prioritised into a Regional Work Program that will guide the implementation of the actions.

The work program will be reviewed each year and updated as required over the term of the Strategy.

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 in order to reduce risk to life and to 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, such as levees, floodways and retarding basins, designed to reduce the impacts of flooding. Example actions include managing waterways, developing retarding basins and developing or managing levees.
3. **Flood warning** involves community education and awareness raising 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 the sharing of 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 LGAs, the VICSES, impacted communities and relevant agencies has taken place to both assess flood risks and identify possible actions to mitigate those risks.

A detailed monitoring, evaluation and reporting (MER) plan will be developed in 2018.



*Shakespeare Street Traralgon 2012  
(Source: WGCMA)*

# 1. Introduction and Strategic Context

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

- Identify those parts of the region with significant flood risk
- Identify possible actions to mitigate those risks
- Establish a set of priority actions to be implemented over the ten-year duration of the Strategy.

This Strategy continues on from previous work including the West Gippsland *Regional Floodplain Management Plan* (Sinclair Knight Mertz, 2000) and the *Victorian Floodplain Management Strategy* (Department of Environment, Land, Water and Planning, 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 LGA.

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

Part 4 sets out the mitigation actions identified in Part 3 in a Regional Work Program to prioritise actions for implementation.

Part 5 discusses the principles supporting the detailed Monitoring, Evaluation and Review (MER) Plan to be developed in 2018.

## 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* (Department of Environment, Land, Water and Planning, 2016) (VFMS) were around institutional arrangements rather than technical matters.

More information about the VFMS can be found at <http://www.delwp.vic.gov.au/water/floods-and-floodplains/new-victorian-floodplain-management-strategy>.

The floods of 2010-12 revealed institutional weaknesses in the management of flood warning systems and flood mitigation infrastructure. The *Review of the 2010-11 Flood Warnings & Response* (Comrie, 2011) and the *Inquiry into Flood Management Infrastructure* in Victoria (Environment and Natural Resources Committee, 2012) enabled the Victorian Government to set processes in train to ensure Victoria is better protected for the future. The 2016 VFMS 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 VFMS requires Catchment Management Authorities (CMAs) and Melbourne Water to develop and periodically review Regional Floodplain Management Strategies (RFMSs) in partnership with LGAs, 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
- Ensuring that local inputs are considered when developing solutions to local issues.

The *Victorian Emergency Management Reform White Paper* (Victorian Government, 2012) reinforces the 'all-hazards all-agencies' approach to emergency management. Strategic priorities include building community disaster resilience and streamlining governance arrangements.

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
- 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 VFMS 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
- Establish a monitoring and evaluation framework to determine the success of implementing the 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 have been further prioritised into a Regional Work Program for implementation in Table 3.

## 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.

	Minister for Environment, Climate Change and Water			Minister for Planning	Minister for Emergency Services	Minister for Local Government
STATE	Victorian Coastal Council	DELWP	DELWP	DELWP	VICSES	
	Coastal Strategy	Victorian Waterway Management Strategy	Victorian Floodplain Management Strategy	Policy and Victoria Planning Provisions (State Policy Planning Framework)	State Flood Emergency Plan	
REGIONAL	Coastal Boards	CMAs	CMAs & DELWP	Regional Growth Plans	Regional Flood Emergency Plans	
	Regional Coastal Plans	Regional Waterway Strategies	Regional Floodplain Management Strategies	Regional Growth Plans	Regional Flood Emergency Plans	
LOCAL	Local Councils	CMAs	CMAs and/or local councils	Local Councils	Local Councils	
	Coastal Management Plans	Works on Waterways permits	Local flood studies	Local Planning Policy Framework and local planning scheme controls	Municipal Emergency Management Plans	

**Figure 1 – Relationship between various State, Regional and Local activities**  
(Source: Victorian Floodplain Management Strategy Table 3)

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 its Vision Statement. It sets direction for how the region's land, water and biodiversity resources should be managed 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) (RFMP) 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. A comprehensive consultation process underpinned development of the plan.

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 RFMP had similar objectives to this current Strategy, mostly focused around addressing flood risks, improving flood information and increasing community awareness of flooding. The 2000 RFMP was reviewed prior to the commencement of this Strategy development.<sup>1</sup>

Most action items in the Implementation Plan have been completed. Of the 84 tasks, 66 have been completed, 10 have been partly completed, one was not undertaken and seven are no longer applicable. Implementation of these actions involved a number of partners including: LGAs undertaking Planning Scheme Amendments and applying 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.

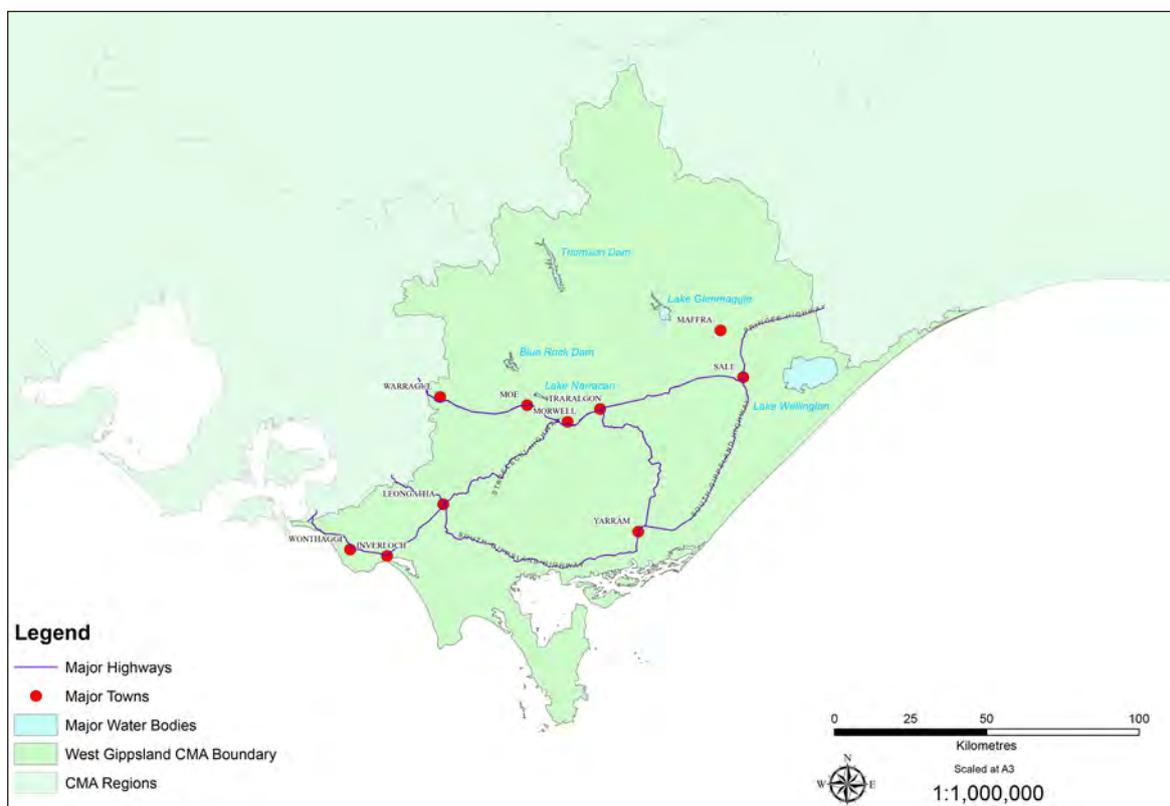
The major impediments to the completion of all the tasks were a lack of funding and the historic confusion around management responsibilities for flood mitigation infrastructure. In that context, the completion rates are positive, especially given the limited resources made available for floodplain management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

<sup>1</sup> Refer to Appendix A for details

## 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. Within Baw Baw Shire, the Mount Baw Baw Alpine Resort is located in the Mount Baw Baw Alpine Resort Unincorporated Local Government Authority.

The West and East Gippsland CMAs share responsibilities across the Gippsland Lakes. Each RFMS is being developed separately but, wherever possible, alignment is being sought across both regions. The most significant example of this alignment 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.



**Figure 2 – West Gippsland catchment map**

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
- Increase the WGCMA's 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.

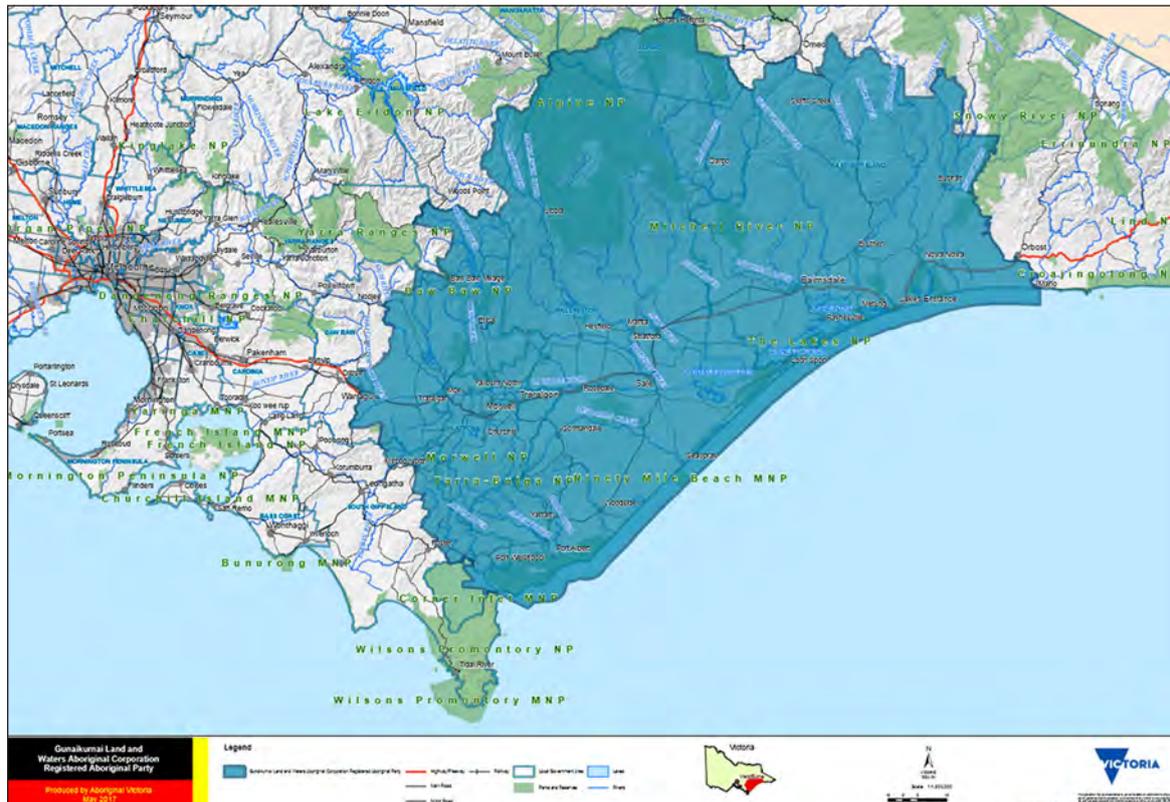
The Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC) and Bunurong Land Council Aboriginal Corporation (BLCAC) are Registered Aboriginal Parties (RAPs) in parts of the region as outlined below.

Flood behaviour is likely to have altered since European settlement. Consultation with the GLaWAC and the BLCAC 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 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 the work done together on this Strategy.



**Figure 3 – Area for which GLaWAC is registered as a RAP**

(Source: Aboriginal Victoria via <http://www.dpc.vic.gov.au/index.php/aboriginal-affairs/registered-aboriginal-parties/gunaikurnai-land-and-waters-aboriginal-corporation-glawac>)

The Gunaikurnai have lived, worked and hunted on Gippsland's waterways and floodplains for generations. They have cared for waterways as part of ongoing cultural maintenance, which has provided access to fresh water and surrounding land to ensure the availability of food and working materials. Waterways are highly significant to the Gunaikurnai people, making up many of their traditional stories, and delineating 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.

## The Dreaming

### Creation story of the Gunaikurnai people

The father of the Gunaikurnai people was Borun the pelican, he came down from the mountains in the North West of Victoria carrying his canoe on his head, he crossed over what is now known as the Thomson River at Sale, and walked on to Tara Warackel (Port Albert) in the west. While walking he heard a constant tapping sound but did not know what it was. When he reached the deep water of the inlets, Borun put down his canoe and, much to his surprise, there was a woman in it. She was Tuk the musk duck.

He was very happy to see her and she became his wife and the mother of the Gunaikurnai people – they are the parents of the five Gunaikurnai clans.

### Tiddalik the frog

Tiddalik the frog was a giant frog, the largest frog that had ever been, one day he woke up very thirsty, he drank and drank until there was no fresh water left in the region. The creatures and plants were all dying and it seemed that soon Tiddalik would be the only one still alive.

The animals did not know what to do, until a wise old wombat suggested that if they could make Tiddalik laugh then all of the water would flow out of his mouth.

So all of the animals gathered at the frogs resting place, for as long time they tried to make him laugh, but he would not. The kookaburra told his funniest stories, he himself had a good laugh, the kangaroo jumped over the emu, the lizard waddled around on two legs, but the frog did not laugh.

All the animals were reaching the point of despair when the eel, driven from his favourite creek by the drought, slithered up to the frog and began to dance. He started with slow, graceful movements, then moved faster and twisted and turned himself into weird and wonderful shapes, then suddenly Tiddalik the frog's eyes bulged, his body shook, and he began to laugh. As he laughed all of the water escaped from his mouth and caused a big flood which filled up all of the lakes and swamps and rivers.

## 1.7.2 Bunurong

In July 2017, the Victorian Aboriginal Heritage Council appointed the BLCAC as a Registered Aboriginal Party (RAP) over the area shown in Figure 4.

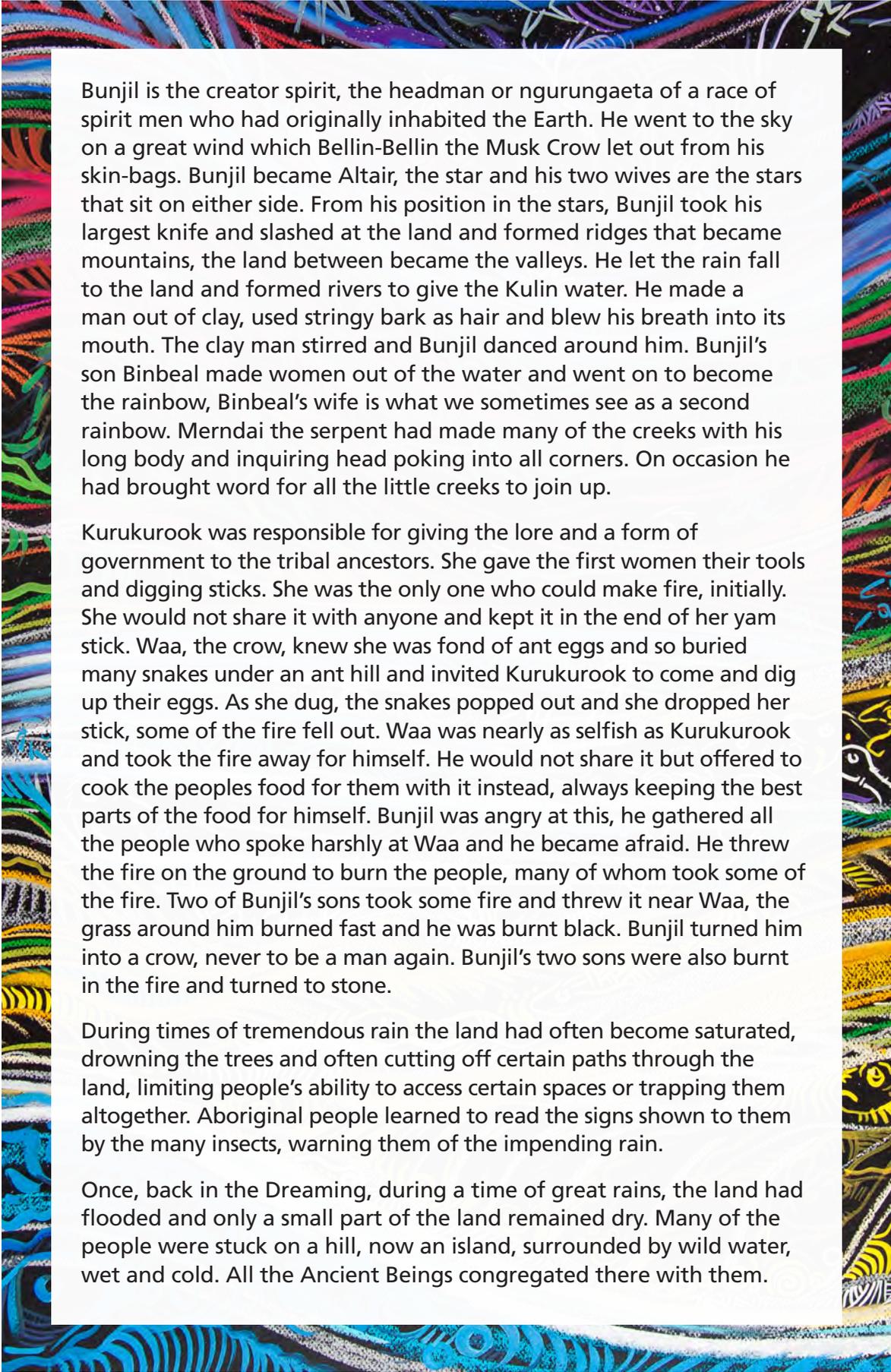


**Figure 4 – Area for which BLCAC is registered as a RAP**  
(Source: Victorian Aboriginal Heritage Council)

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 becomes part of its work with Traditional Owners.

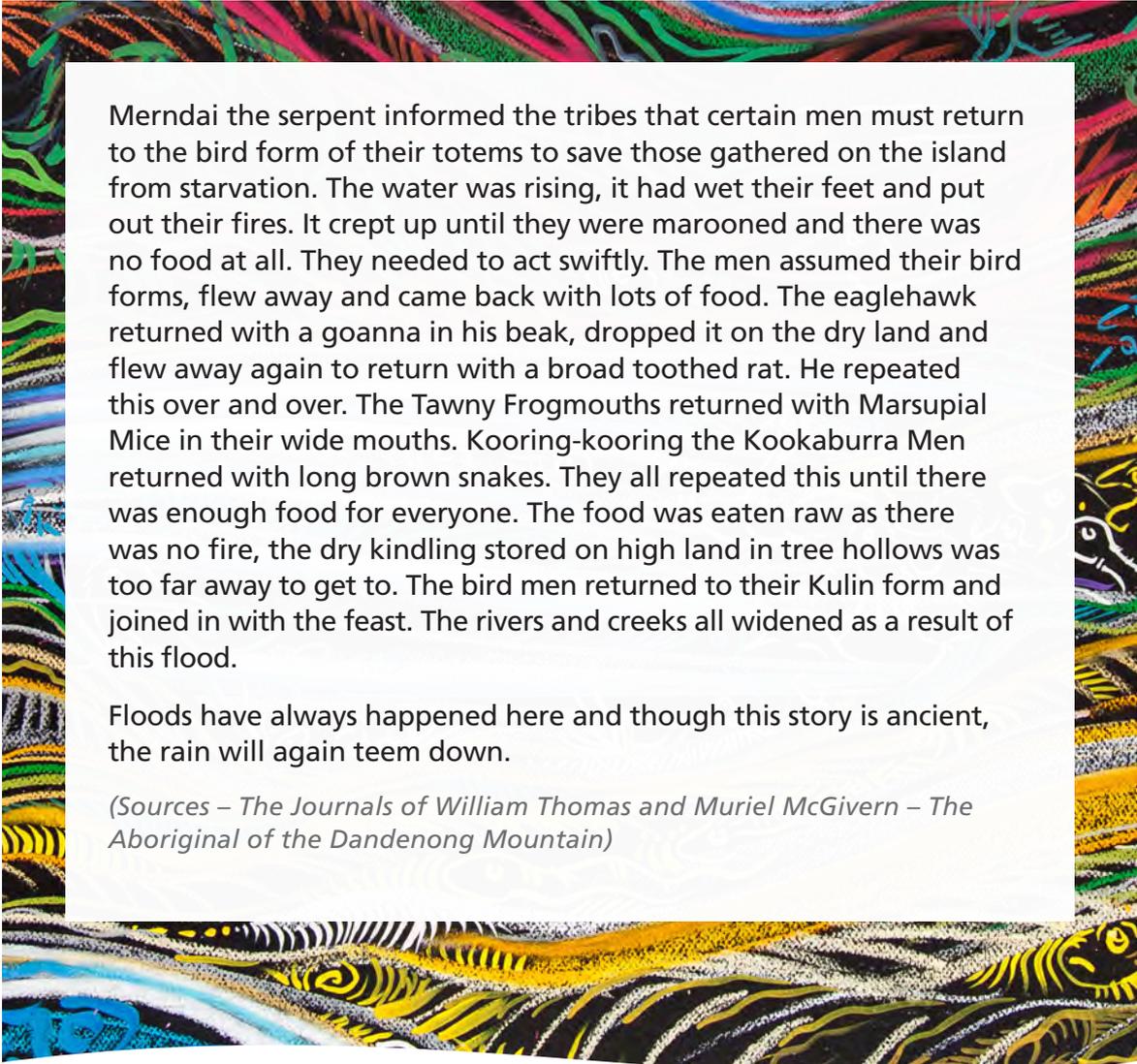


Bunjil is the creator spirit, the headman or ngurungaeta of a race of spirit men who had originally inhabited the Earth. He went to the sky on a great wind which Bellin-Bellin the Musk Crow let out from his skin-bags. Bunjil became Altair, the star and his two wives are the stars that sit on either side. From his position in the stars, Bunjil 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 Bunjil danced around him. Bunjil'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 people's food for them with it instead, always keeping the best parts of the food for himself. Bunjil 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 Bunjil's sons took some fire and threw it near Waa, the grass around him burned fast and he was burnt black. Bunjil turned him into a crow, never to be a man again. Bunjil'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. Koorring-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 teem down.

*(Sources – 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 the WGCMA's Regional Waterway Strategy.

The lands of the Boon Wurrung covers the areas from along the coast of Werribee River to Wilsons Promontory (Wamoon). It goes inland as far as the Dandenong Ranges and west to Warragul. It also includes Port Philip Bay, which was once a large flat plain known as Nairn, where the Boon Wurrung people hunted kangaroos and cultivated yam (murnong), and also Westernport Bay.

The Boon Wurrung people, absent of any writing traditions, passed on all their knowledge from one generation to the next by way of story, song and customs. These stories have been passed down for thousands of years surviving natural disasters, disease, war and displacement.

Our story of the Time of Chaos goes back to a time when the Yarra River (Birrarang) ran all the way through the great hunting plains of Nairn and past point Nepean and into Bass Strait.

One day, many many years ago, there came a time of chaos and crisis. The Boon Wurrung people were in conflict with the other Kulin Nations. They argued and fought. They were also neglecting their responsibility over the lands and not living in harmony with nature. The murnong was neglected. The animals were over killed and not always eaten. Fish were caught during their spawning season and the eel was not harvested.

As this chaos grew, the ocean became angry and began to rise, and all the creeks and rivers in Boon Wurrung country began to rise. First the plains by the birrarang, then further and further inland and out to the east past Western Port Bay until the people had nowhere to live.

The people became fearful and searched out Bundjil, their creator and spiritual leader. They asked Bundjil to stop the water from rising, but they found Bundjil was angry with his people, and he told them that they would have to change their ways if they wanted to save their land. The people thought about what they had been doing and made a promise to Bundjil to seek peace and harmony with both their neighbours and also with nature and the animals; not to hunt more than they could eat; not to catch fish during their spawning seasons, and to help cultivate the murnong so it could replenish.

Satisfied, Bundjil walked out to the rising sea and raised his great blade commanding the water to stop rising. Much of the water subsided back into the sea, but a giant bay over the hunting plains that the Boon Wurrung called Nairn remained.

The Boon Wurrung had learned from their mistakes and they made an oath to live by the lessons that Bundjil had taught them – to obey the laws of Bundjil, and not to harm or neglect the land and children of Bundjil.

The Boon Wurrung people also made amends with their neighbours through tanderrums – great gatherings of tribes from across the Kulin nations, and also through Ngargee, where dance and song was shared after competition and debate was used to settle disputes.

One of the most important laws that Bundjil had taught the Boon Wurrung people to follow was to always welcome guests and visitors, and to always require all visitors to make the same promise the Boon Wurrung people had once made to Bundjil thousands of years ago – to obey the laws of Bundjil, and not to harm the land or children of Bundjil.

Today the sea that once flooded the great land of the Boon Wurrung people sits under the two great bays; a warning to the people who live on this land to always keep the promise made by the Boon Wurrung.

### 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 in the north west of the region and is not subject to flooding, and therefore this group has not been consulted during the development of this Strategy.

## 2. Assessment of Regional Flooding

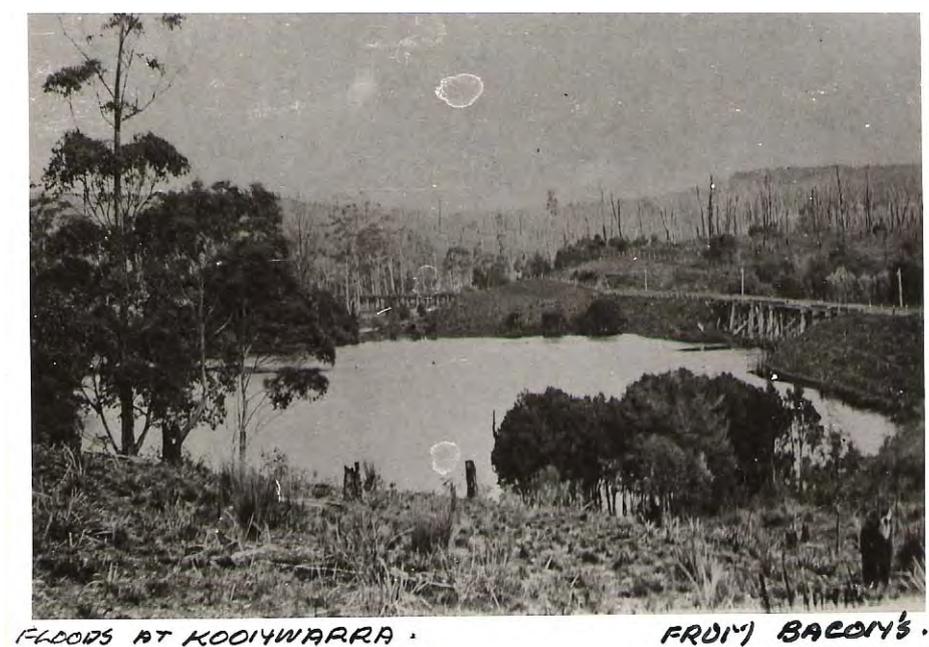
### 2.1 Recorded flooding in the region

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, for a range of floods the location, scale of effects and 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.

Floods have 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 that occurred across Victoria in 1934. Significant flooding took place 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 across the region were washed away. Many people drowned and hundreds of homes were flooded. The Wilsons 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 5 – Flooding on the Tarwin River near Koonwarra, 1934**  
(Source: Unknown)



**Figure 6 – Latrobe River flooding at the Traralgon-Maffra railway, 1934**  
(Source: Traralgon & District Historical Society [Catalogue number 10275])

The Latrobe River 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.

The Thomson River experienced significant floods in 1953, 1971, 1978, 1993, 2007, 2011 and 2012.

The Avon River has recorded flooding in 1936, 1950, 1971, 1990, 1998, 2007, 2011, 2012 and 2016. This floodplain encompasses large areas of farmland and flooding in this area often results in significant agricultural losses.

Sale, Traralgon, Seaspray and Rosedale all experienced flooding in 1978, with dwellings flooded in Sale and Rosedale, and Seaspray subject to two major floods within three weeks. In 2007 major flooding occurred on the Macalister and Avon Rivers. The presence and operation of Glenmaggie Dam on the Macalister River reduced the 2007 flood from an estimated 300-year Average Recurrence Interval (ARI) event upstream of the dam to 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 7 – Shakespeare Street, Traralgon, 2012 (Source: WGCMA)**

The nature and relatively lower level of development on floodplains in the South Gippsland and Bass Coast shires 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 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 8 – Lower Powlett River, 2013 (Source: WGCMA)**

## SECTION 2

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 to its north. A very large flood in 2012 resulted in many 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 that caused landslides and flooding in waterways including Tidal River and Darby River. The resulting flood was estimated to be larger than a 1% AEP flood. 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 National 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 is a major contributor.

Large-scale floods occurred across the West Gippsland region in 2007 and 2012. In both cases, several 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% Annual Exceedance Probability (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 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 degree of rainfall and flooding experienced 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 the dissemination of information about flooding to the wider community and, importantly, target local communities directly affected.

The West Gippsland coastline is vulnerable to coastal inundation during significantly high tides, particularly when in conjunction with storm surges. The severity of impacts varies depending on factors including geomorphology, estuary characteristics and population and infrastructure inundated. In addition, the impact of individual meteorological events on flooding can vary due to precedent conditions and the direction and severity of weather conditions. Assets including farmland, roads, boardwalks, life-saving towers, foreshores and jetties have been damaged as a result of coastal inundation.



**Figure 9 – Coastal damage at Seaspray, 2007** (Source: WGCMA)

In recent times, a storm surge in June 2014 resulted in damage from 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, constructed mostly by private landowners to protect large areas of land are in place around Corner, Shallow and Andersons Inlets. As opposed to those that protect banks from erosion caused by wave action, these sea walls are for flood mitigation purposes and protect the area of land behind them, mostly farmland, from seawater intrusion. Inundation currently occurs where these walls have been damaged or breached, a situation likely to be more common in 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 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 10 – 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* (Department of Environment, Land, Water and Planning, 2016), which outlines the Victorian Government's role in 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* (Department of Environment and Primary Industries, 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
- 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 that are vulnerable to inundation and erosion. Understanding how the community's values are affected by coastal hazards helps 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* (Department of Environment, Land, Water and Planning, 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* (Victorian Catchment Management Council, 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
- Improve state and regional floodplain management reporting using a consistent set of indicators.

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Both the *Victorian Floodplain Management Strategy* (Department of Environment, Land, Water and Planning, 2016) (VFMS) 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
  - Changes to groundwater
- Changes to natural flow regimes via regulating structures
- Floodplain management activities such as channel modification and construction of levees
- Climate change implications that 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 that 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. ICM 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 on 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, exacerbating flood impacts and erosion in the lower reaches. It also disconnects the waterway from its floodplain, which impacts on riparian vegetation and habitat.

By transferring floodwaters to other locations, levees have similar impacts to channel deepening. 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 flood risk. As with channel deepening and straightening, clearing of in-stream vegetation generally increases flood height and velocity downstream, and it 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
- Protection of floodplains for environmental values - slowing floodwaters and reducing downstream impact.

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, that 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 VFMS.

## 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
- II. Stakeholder consultation.

### I. Rapid appraisal of flood risk

The DELWP rapid appraisal of flood risk methodology is 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.

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This assessment was undertaken across the West Gippsland region in early 2016<sup>2</sup>. 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 247 '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 AAD divided by the flood extent for the 1% 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
- Existing and future coastal inundation
- Planning zones
- Rural, residential, commercial and industrial damage
- Agricultural damage
- Losses by land use type.

While the rapid appraisal of flood risks is useful, it is also important, in the medium and the long term, 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
- Existing mitigation.

<sup>2</sup> Refer to Appendix B for details

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 WGCMA website and Facebook page and relevant LGA websites. 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 and damage density were the 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.

As a result of both phases of the flood risk assessment, the management units with the highest flood risk in the region 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.

Management unit names may not be fully representative of the unit location and extent. 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. The significant flood risk does not necessarily apply to the entire management unit; rather it applies to those parts of the management unit which are subject to flooding, which are generally at lower elevation and near waterways or coastlines. Each unit in Table 1 is mapped in the relevant municipality discussion in Section 2.9.

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**Table 1 – Management units which include areas identified as having a significant flood risk**

Management Unit	LGA
<b>Urban</b>	
Traralgon	Latrobe
Loch Sport	Wellington
Seaspray	Wellington
Warragul	Baw Baw
Trafalgar	Baw Baw
Morwell	Latrobe
Moe	Latrobe
Rosedale	Wellington
Yarragon	Baw Baw
Toongabbie	Latrobe
Sale	Wellington
McLoughlins Beach	Wellington
Tarwin Lower	South Gippsland
Glengarry	Latrobe
Tinamba	Wellington
<b>Rural</b>	
Avon River – Wombat Flat Bridge to Clydebank	Wellington
Moe River and Shady Creek – Darnum to Latrobe River	Baw Baw
Tarra River – Macks Creek to Brewery Road	Wellington
Rainbow Creek	Wellington
Ninety Mile Beach – East of Merrimans Creek	Wellington
Macalister River – Glenmaggie Weir wall to Thomson River	Wellington
Thomson River – Macalister River to Park Street, Sale	Wellington
Latrobe River – Flynn to Rosedale	Wellington
Boggy Creek	Wellington
Latrobe River lower – Swing Bridge to Lake Wellington	Wellington
<b>Coastal</b>	
Inverloch	Bass Coast
Port Albert	Wellington
Port Welshpool	South Gippsland

## 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. Infrastructure was identified and considered in assessing of risk for an area, along with a focus on potential 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. LGAs 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 and 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 that address the impacts of climate change, population growth and new development.

As a result of stakeholder engagement, this Strategy identifies areas with a history of stormwater flooding. The Strategy does not recommend treatment options for stormwater flooding, which should occur through existing processes such as 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 vary greatly. One example, discussed further in Section 2.9, is the Yarragon-Trafalgar Flats Drainage Area in which the Moe River was straightened and channelised during the 1890s to reduce inundation of adjacent farmland.

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

The Victorian Government is currently developing a statewide strategy that 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, in particular where they intersect with floodplain management, such as along the Moe River in the Yarragon–Trafalgar Flats Drainage Area, have been identified and considered during the development of this Strategy. This document 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 statewide strategy for rural drainage.

### 2.8 Existing flood risk treatments

#### 2.8.1 Planning Scheme controls

Land use planning seeks to ensure that future use and development of land 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 the impact of long-term risks, and guide the application of various Planning Scheme controls.

Flood controls in Planning Schemes include policies addressing flood risks within a municipality, zones, overlays and schedules. These are detailed in *Planning Practice Note 12: Applying the Flood Provisions in Planning Schemes* (Department of Environment, Land, Water and Planning, 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
- Floodplain areas of environmental significance or of importance to river health'. (State Government Victoria).

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% 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 using 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 to the region. As outlined in Section 2.2, effective adaptation to climate risks is guided by *Victoria's Climate Change Adaptation Plan 2017-2020* (Department of Environment, Land, Water and Planning, 2016), which outlines the Victorian Government's role in coordinating state-wide action and in providing current information to assist communities in managing their risks. 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 Strategy will support the identification of priority areas and the inclusion of information about coastal risks into planning schemes.

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Policy 15e in the VFMS requires that planning scheme controls be applied to all priority coastal areas 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 (Department of Environment, Land, Water and Planning, 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 LGA 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, this information is incorporated into 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). In addition to the range of other documents mentioned above, these guidelines are used to assess proposals for use, development or subdivision in locations subject to flooding.

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
- Ensure developments maintain or improve waterway condition.

The objectives 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
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
- 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.

### Strategy in Action – Simplifying the Planning Process

In 2016, SGSC in partnership with WGCMA updated the flood controls in the South Gippsland Planning Scheme. This required extensive consultation with communities affected by flooding from rivers and creeks as well as flooding from coastal storm surge. Importantly, the flood extent mapping along the coast also included sea level rise considerations due to the future impacts of climate change.

Policy 15e of the Victorian Floodplain Management Strategy requires Councils to keep their planning schemes up to date with the most recent flood information. This ensures that landholders are aware of the risk to their property and ensures proper consideration of this risk should they wish to develop. Further to this, the VFMS and the *Victorian Coastal Strategy* (Department of Environment and Primary Industries, 2014) require planning schemes to include mapping which identifies those areas at future risk due to sea level rise.

To streamline planning processes and make it as simple as possible to develop in areas affected by sea level rise, the SGSC implemented an innovative approach by which a planning permit is not required for a new single or replacement dwelling in impacted coastal communities, subject to the floor level being above the future 1% AEP flood level.

Applications for intensification such as more than one dwelling on a lot or subdivision will require a planning permit, which triggers a referral to the WGCMA and assessment against *Flood Guidelines – Guidelines for development in flood prone areas* (West Gippsland Catchment Management Authority, 2013). The WGCMA Guidelines require development that increases the flood risk to be assessed against the following objectives:

- **Flood flow** – Works or structures must not affect floodwater flow capacity or the physical form of a waterway
- **Flood storage** – Works or structures must not reduce floodwater storage capacity
- **Site safety** – Development must not be allowed where the depth and flow of floodwaters is hazardous
- **Site access** – Development must not be allowed where the depth and flow of floodwaters along the access to or from the property is hazardous
- **Flood Damage** – Development must be designed to minimise the potential damage to property due to flooding
- **Waterway condition** – Development must ensure the maintenance or improvement of waterway condition including vegetation (instream and terrestrial), physical form (bed and banks), water quality and water quantity.
- **Water Quality** – Development must maintain or improve the quality of stormwater and catchment runoff in rural and urban areas

Development which seeks to increase the number of people or buildings in flood affected areas will only be supported if all the above objectives are met.

## 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 in the north of Victoria such as Kerang and Nathalia. If mitigation infrastructure is not managed and maintained however, it is liable to fail during a flood. This can create significant downstream impacts such as the flooding of homes and businesses whose owners and occupants may otherwise have assumed were not exposed to flood risks.

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

New flood mitigation infrastructure identified through RFMSs 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 is supported following thorough evaluation that takes 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 of alternative solutions, and the community's willingness to pay. Beneficiaries will fund the maintenance and management of existing flood mitigation infrastructure under formal management arrangements.

A number of structural works that perform flood mitigation functions, mostly in the form of levees, are located within the West Gippsland region. 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 that offer protection from small flood events (nuisance flooding) only.
- A series of sea walls along the Corner, Shallow and Anderson Inlet coastline that provide some protection from coastal inundation of farmland. These walls have been damaged or breached in sections, resulting in inundation that 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 was constructed following flooding in 1978, and is operated by Wellington Shire Council in response to waterway flooding.
- 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.

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- The Peterkin Street levee in Traralgon that protects a residential area along Gwalia Street. The levee was constructed and is managed by the Latrobe City Council and includes sections of earthen levee through parkland and brick walls on private property boundaries.
- An earthen levee to the north-west of Tinamba that 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.

An inventory of levees in the West Gippsland region<sup>3</sup> was undertaken in order to document all known information about the levees, including service levels, main beneficiaries and management arrangements. This information will be useful for reference if proposals are made regarding new levees or modifications to existing levees, and can be updated as more information becomes available.

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'*.

Section 17 of the *Victorian Floodplain Management Strategy* (Department of Environment, Land, Water and Planning, 2016) 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 LGA 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 MFEPs should consider 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 under a permit issued by the CMA and maintain that levee in accordance with any conditions. Permit holders will not be authorised to change the levee's location, dimensions or extent, nor build a new levee or remove an existing one.

<sup>3</sup> See Appendix D for details

Decisions regarding flood mitigation infrastructure investment by the three tiers of government will be guided by the principles outlined in the Government's investment criteria in Section 17.2 of the VFMS. The principles most relevant to the region are those that relate to community benefits, including 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. 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 MFEPs as described in Section 2.8.5.

A Total Flood Warning System (TFWS) contains a number of elements vital to flood response, as shown in Figure 11.



**Figure 11 – Elements of a Total Flood Warning System**  
(Source – Victorian Floodplain Management Strategy Figure 13)

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The routine catchment monitoring and river height prediction activities necessary for a TFWS 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, 2017). The schedules in the report specify the level of service to be 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** – 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 are also available.
- ii. **Information location** – 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** – a location for which only the observed water level data is provided. Flood classifications are not available for these locations and forecasts of future water level are not produced.

Flood class levels (FCLs) are classifications using of the terms minor, moderate and major flooding in flood warnings to give a general indication of the expected flood impacts.

**Minor flooding:** Causes inconvenience.

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

**Moderate flooding:** In addition to the above, the area of inundation is more substantial.

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

**Major flooding:** In addition to the above, extensive rural areas and/or urban areas are inundated.

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

Overall, existing flood class levels correspond well to the impacts across the region, however, it is intended that they be reviewed following significant flood events.

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.

Details around the operation of the TFWS are outlined in the *Australian Emergency Manuals Series, Manual 21 Flood Warning* (Australian Government, 2009). At its simplest, an effective flood warning system can be defined as having six components:

1. Monitoring and prediction: detecting environmental conditions that lead to flooding and predicting river levels during the flood.
2. Interpretation: identifying in advance the impacts of the predicted flood levels on communities at risk.
3. Message construction: devising the content of the message that will warn people of impending flooding.
4. Communication: disseminating warning information in a timely fashion to people and organisations likely to be affected by the flood.
5. Protective behaviour: generating appropriate and timely actions and behaviours from the agencies involved and from the community under threat.
6. Review: examining the various aspects of the system with a view to improving its performance.

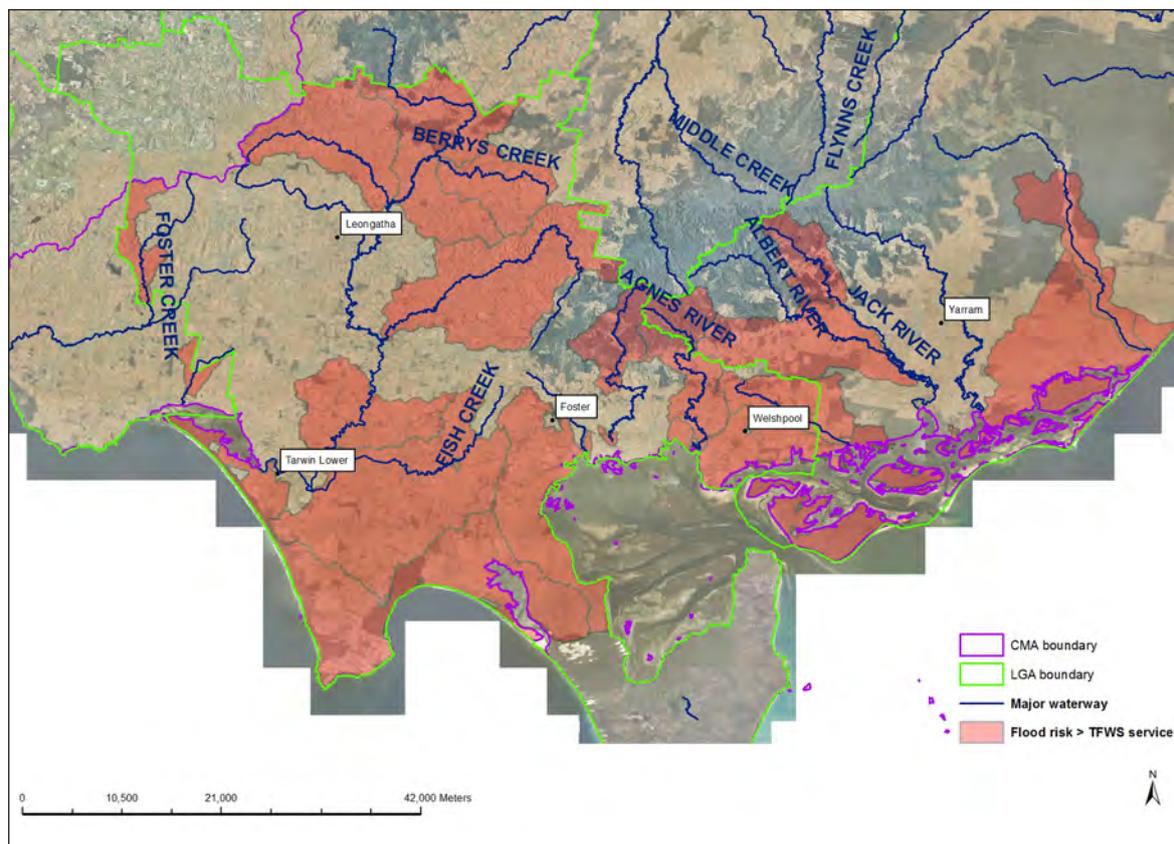
The VFMS requires TFWS levels to be tailored to flood risk and the needs of the community. This Strategy has assessed the existing TFWS service provided to flood prone communities against their needs. This involved comparing the results of the rapid appraisal of flood risk described in Section 2.4 against the existing TFWS service. Locations where the risk exceeds the current service were identified. Actions to improve the service have been proposed, based on a prioritisation process.

TFWS systems were assessed based on the following factors:

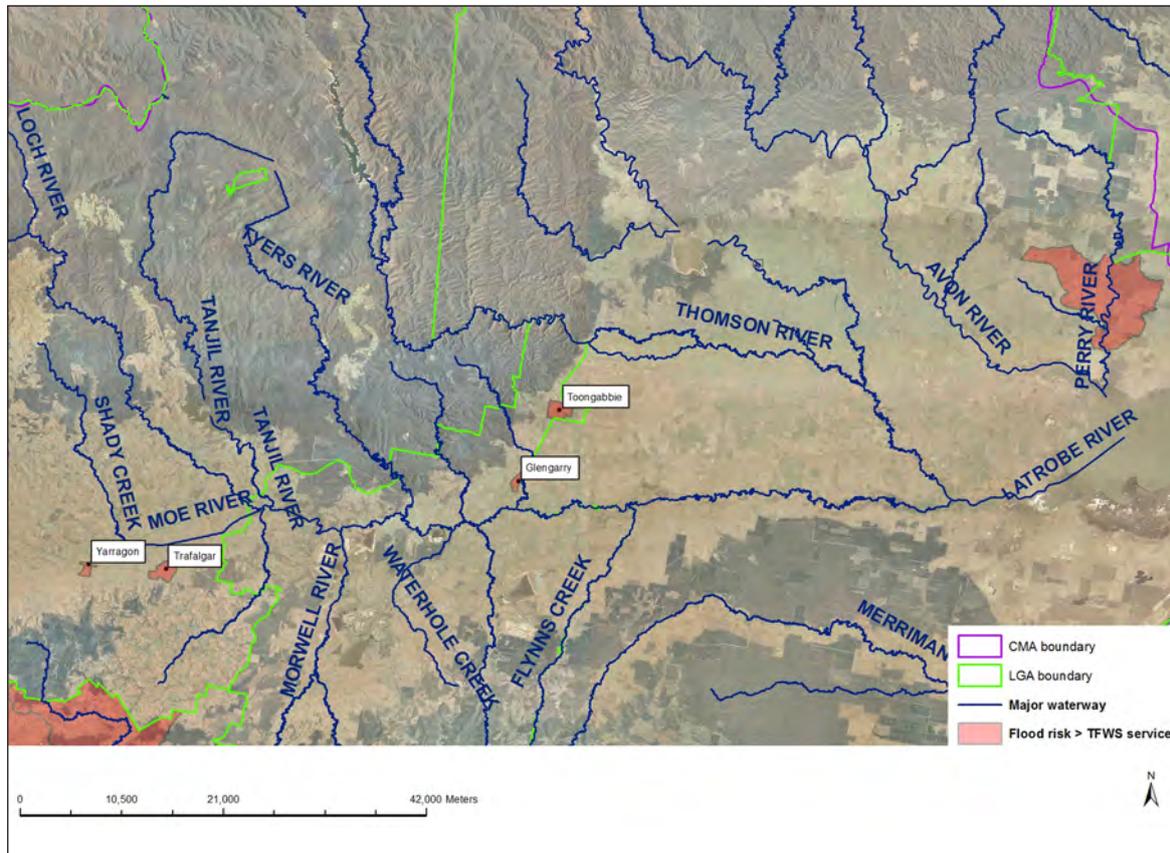
1. Data collection network (rain gauges and stream gauges);
2. Prediction (forecasting);
3. Dissemination (communication of flood warning information to the community);
4. Community flood awareness and education;
5. Interpretation (using flood intelligence to identify consequences);
6. Flood response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

## SECTION 2

Overall, areas with a significant flood risk in the West Gippsland region are well serviced by a TFWS. Land subject to flooding within a number of management units in West Gippsland has been identified, through the TFWS assessment, where the flood risk exceeds the TFWS service. These are mapped in Figure 12 and Figure 13. Please note that the flood risk only applies to the parts of each management unit that are subject to flooding, and not the entire management unit. In addition, as discussed in Section 2.4, the rapid appraisal of flood risk was not able to assess flood risk in management units where there was no flood mapping available, therefore some areas where flood risk may exceed the TFWS service may not have been identified through this process. They were however identified through engagement with agencies and communities.



**Figure 12 – Management units containing flood prone areas where flood risk > TFWS level (west)**



**Figure 13 – Management units containing flood prone areas where flood risk > TFWS level (east)**

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 to be 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, the installation of 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.

### 2.8.4 Flash flood warning services

Flash flooding is a rapid flooding caused by heavy rain, usually associated with a severe thunderstorm. They are extremely dangerous due to the lack of warning time and their unpredictability.

Flash floods do not allow time to run the processes required for TFWSs for riverine flooding and thus require expedited warning processes.

The BoM currently issues Severe Weather Warnings with varying lead times depending on the weather situation. The VFMS states that *'Given the short timeframes associated with flash flooding, more certainty is needed about each agency's roles, capacities, responsibilities and accountabilities, and the community's capacity to respond appropriately.'* (Department of Environment, Land, Water and Planning, 2016).

DELWP has committed to working with the BoM, the Emergency Management Commissioner and VICSES to *'evaluate the potential to provide localised neighbourhood-scale flash flood warning services where there is a history of flash flooding'* (Department of Environment, Land, Water and Planning, 2016).

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. In each case the risk level is considered to be acceptable to the LGA in relation to other flood risks and no actions are currently proposed within this Strategy. This will be reviewed as the Strategy is implemented and potential flash flood warning approaches evolve.

### 2.8.5 Municipal Flood Emergency Plans

VICSES is the lead agency for community education and awareness raising in support of flood preparedness. This includes facilitating the preparation of Municipal Flood Emergency Plans (MFEPs) with support from the relevant LGA. These plans are developed to explain local flood risks to those communities at risk, and to advise on how to prepare for and respond to flood events. MFEPs 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. Provided they are maintained and updated, MFEPs are a highly valuable resource regarding information about the impacts of flooding. 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 specified 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
- Information about flood warning.

VICSES also produces separate flood guides for priority areas to provide information to residents and business owners.

Emergency plans and flood guides are available on the VICSES website at <https://www.ses.vic.gov.au/get-ready/your-local-flood-information#municipality-list>.

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

#### Bass Coast Shire

- MFEP that includes a Flood Emergency Plan for Phillip Island (in Westernport catchment)

#### Baw Baw Shire

- MFEP that includes Flood Emergency Plans for Warragul and Moe River Flats
- Moe River Flats Local Flood Guide and Warragul Local Flood Guide

#### Latrobe City

- MFEP that which includes a Flood Emergency Plan for Traralgon Creek

#### South Gippsland Shire:

- MFEP<sup>5</sup> that includes a Flood Emergency Plan for Tarwin Lower
- Tarwin Valley Local Flood Guide

#### Wellington Shire

- MFEP that 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

- MFEP that 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

<sup>5</sup> An update of the MFEP to a Severe Weather Emergency Plan is due in 2018

It is proposed to ensure that the flood mapping, intelligence and local knowledge in MFEPs across the region is regularly reviewed and updated. Examples of useful information include school bus routes impacted by flooding, impacts of levee overtopping and Cultural Heritage concerns.

Specific 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 regularly. 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. In addition to situations where infrastructure and services are themselves flooded, access to emergency services may be restricted due to flooding that results in diminished access and mobilisation of the employees required to operate them. It is unlikely that feasible options to mitigate this flood risk are available and it is the responsibility of each service provider to include the potential for access to be restricted by flooding in their risk or business continuity plans.

Critical infrastructure can be disrupted during flood events, including infrastructure related to transport, forestry, sewerage, mining and power generation and transmission. Sewerage systems can be compromised by the ingress of stormwater as occurs in parts of Traralgon along Traralgon Creek.

Vulnerable sectors of the community, including individuals, hospitals, aged care facilities, schools, child care centres and caravan parks, may be impacted directly or indirectly by floods.

There are a number of significant 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 whose responsibilities include 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 MFEPs flood studies, community engagement and discussions with LGAs and VICSES.

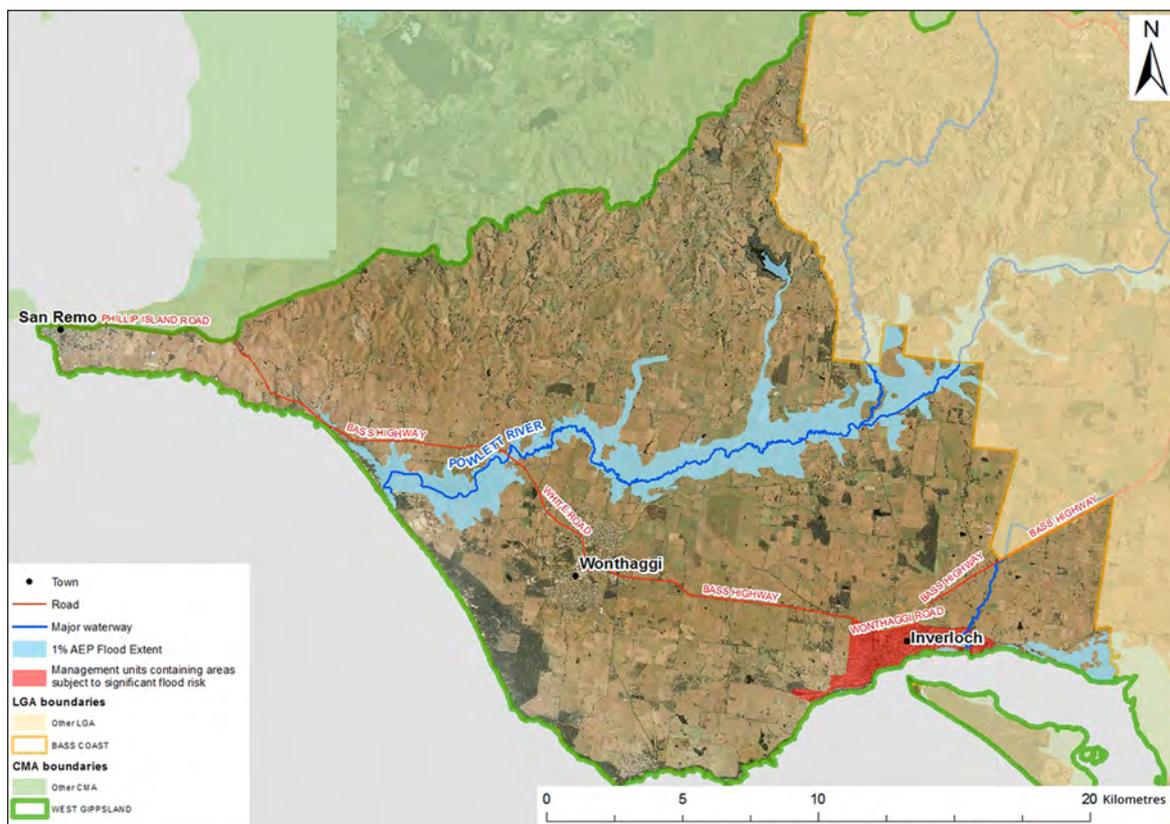
Riverine flooding within the Mount Baw Baw Alpine Resort LGA is minimal, however localised flooding occurs due to the local drainage system being overwhelmed during storms and periods of significant snow melt. Emergencies within this area are likely to impact on the encompassing Baw Baw Shire and adjacent municipalities if evacuation is required.

A number of regional actions that aim to improve flood warning and flood response have been identified throughout the process of developing this Strategy. These actions have been summarised in Table 2 and Table 3.

### 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 section of the Bass Coast Shire within the West Gippsland catchment only, as Melbourne Water is the catchment manager for the Westernport catchment.



**Figure 14 – Bass Coast Shire**

## SECTION 2

Inverloch is the only management unit within Bass Coast that was identified as including areas with 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 Bass Coast Shire, Lance Creek Reservoir at Glen Alvie and Candowie Reservoir at Almurta (in the Westernport catchment).

The main waterways are the Powlett River and the Bass River (in Westernport catchment). Major townships in the shire 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. It originates 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 that includes land mainly used for grazing. Its estuary is influenced by tides, storm surge and periodic closure of the river mouth by natural sand movement. Inundation of adjacent farmland can occur during low flow periods when the river mouth is blocked. Under appropriate conditions, taking into account water quality, river flow, ocean and access conditions, excavation to reopen the entrance may be undertaken to mitigate inundation. 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, inundation or the isolation of rural properties.

Flash flooding can occur in urban areas within the Bass Coast Shire 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 the combination of high tides and storm surges that result 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 those 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 area's main transport link, and its closure can cause severe disruption. It is proposed that VicRoads investigates the installation of warning systems on VicRoads roads that are subject to significant inundation within Bass Coast Shire.

Flash flooding or stormwater flooding can close a number of roads within Inverloch. A full list of roads in the Shire 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 TFWS within the Bass Coast Shire in the West Gippsland catchment. There are three stream gauges in the region, two on the Powlett River and one on Screw Creek, however they have no telemetry system to transmit data in real time. The BoM provides Flood Watch and Severe Weather Warning services in this area.

The MFEP 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.

### **Actions**

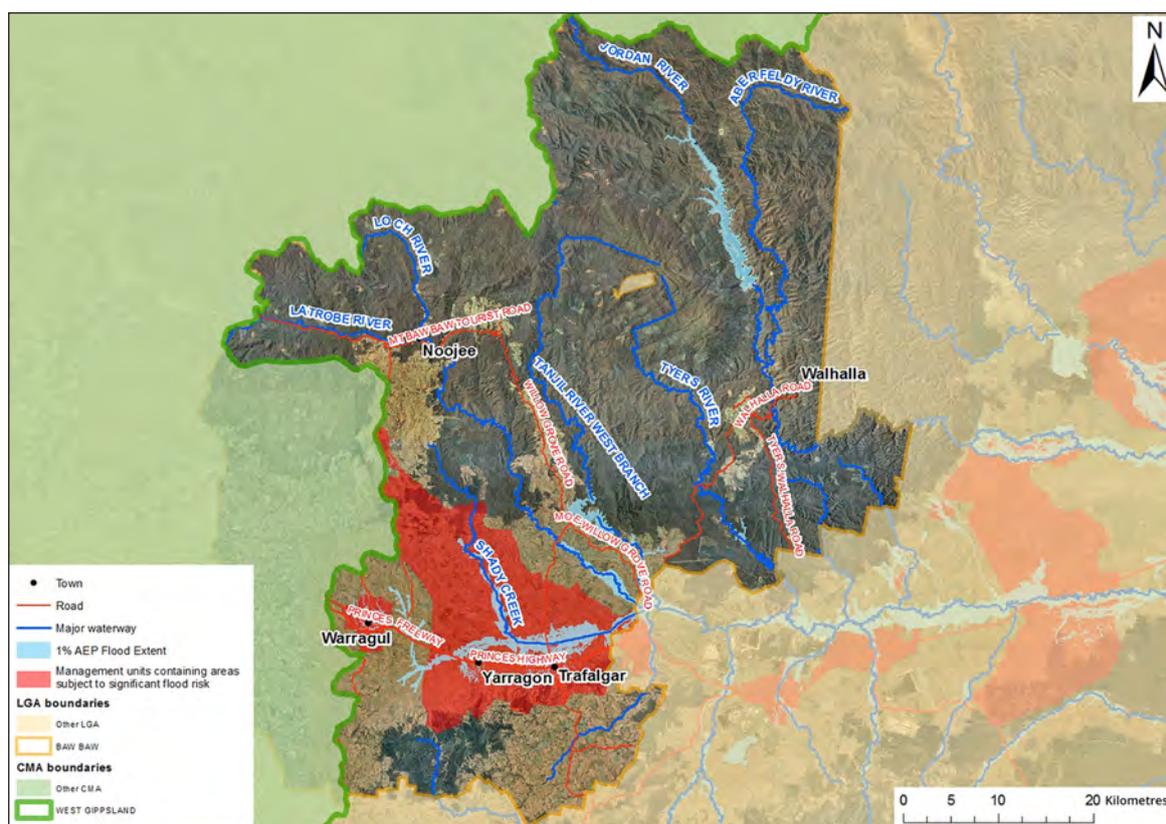
Flood mitigation actions to be implemented over the ten-year duration of the WGFMS within Bass Coast Shire, subject to funding and feasibility, include:

1. Develop individual flood guides for high priority areas, specifically Inverloch, Wonthaggi and lower Powlett River.
2. Investigate flooding along Wreck Creek including the impact of the status of the river mouth.
3. Schedule a future update of the Planning Scheme to include flood mapping for the Wonthaggi North East Development Area.
4. Investigate connecting the existing stream gauges in West Gippsland to telemetry and making data available to the community in real time.
5. Improve understanding of flood risk by developing detailed flood maps for the Powlett River and integrate them with flood education products and programs.

## 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 section of the Baw Baw Shire within the West Gippsland catchment only, as Melbourne Water is the catchment manager for the Westernport catchment.



**Figure 15 – Baw Baw Shire**

Several management units within the Baw Baw Shire were identified as including areas with 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 the 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 Baw Baw 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 catchment 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 Australian National Committee on Large Dams (ANCOLD) classifies the Tarwin Street and Landsborough Road basins as large dams 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* (Thompson Berrill Landscape Design Pty Ltd, 2010) 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 mitigated 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 mitigated 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.

## SECTION 2

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 Baw Baw 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 channelised 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, known as the Yarragon-Trafalgar Flats Drainage Area, contains the most significant rural drainage issues in the West Gippsland region, which, as discussed in Section 2.7, will be dealt with in the statewide 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 the 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. In addition, flood predictions are informed by rainfall information collected within the catchment.

Warragul, Yarragon and Trafalgar experience flash flooding and, in these instances, 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 MFEP for Baw Baw is well developed, however it should be updated to include specific flood guides for Warragul, Yarragon and Trafalgar that are 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. As a priority, the relevant flood controls in the planning scheme should be updated to reflect the best available flood mapping.

### Actions

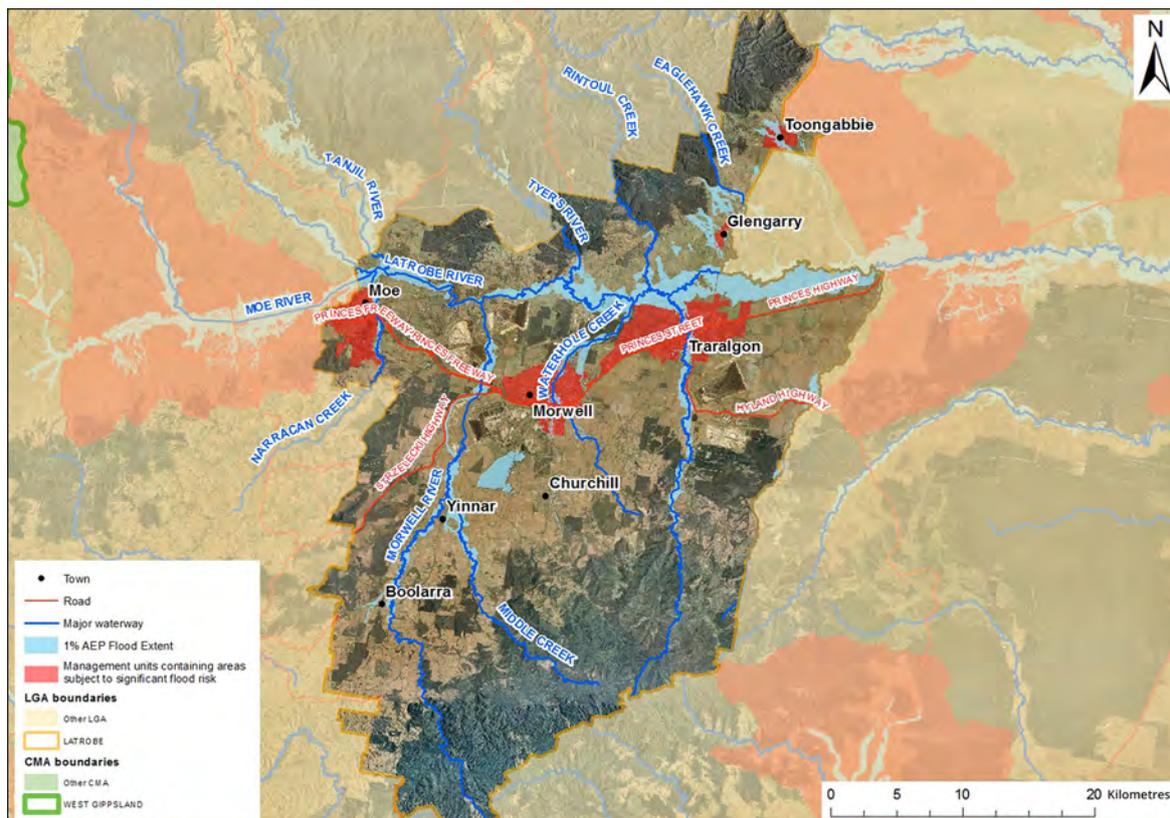
Flood mitigation actions to be implemented over the ten-year duration of the WGFMS within Baw Baw Shire, subject to funding and feasibility, include:

1. Develop individual flood guides for high priority areas, specifically Warragul, Yarragon and Trafalgar.
2. Update the planning scheme to include updated flood mapping across the LGA.
3. Investigate structural works along the Moe River to protect North Canal Road and adjacent farmland (between Cummings Road and Telephone Road).
4. Liaise with VicRoads and VicTrack to investigate the capacity of culverts under the Princes Freeway and Gippsland railway line between Yarragon and Trafalgar East.
5. Investigate the structural integrity of the Landsborough Road retarding basin.
6. Ensure ongoing management of Hazel Creek to retain its current flow capacity.
7. Investigate options to increase the capacity of Hazel Creek at critical locations.
8. Construct the proposed Princes Highway retarding basin on the west side of Trafalgar.
9. Ensure ongoing management of the contour drain and Loch Creek at Trafalgar.
10. Construct the proposed Hazeldean Road retarding basin in Yarragon.
11. Install Event Reporting Radio Telemetry System (ERRTS) at gauge Site 226209B on the Moe River at Darnum through a partnership between Baw Baw Shire Council and DELWP to enhance the real time transmission of data.
12. Improve understanding of flood risk by developing detailed flood maps for the Tanjil River downstream of: Blue Rock Dam; 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, integrate them with flood education products and programs.

### 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 the steep hills of the Jeeralang and Strzelecki Ranges to flat plains of the Latrobe Valley. The majority of the region is agricultural land, with large pockets of eucalypt and pine plantations, residential areas, and industry, with 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 16 – Latrobe City**

Several locations within the Latrobe City 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 including those within power generation facilities such as Hazelwood, and numerous private farm dams.

Riverine flooding is significant along the Latrobe and Morwell Rivers, as well as along smaller waterways such as Middle Creek, Waterhole Creek, Traralgon Creek, Eaglehawk Creek and Rintoul Creek.

Traralgon Creek has a catchment area of 178 square kilometres, originating in the high rainfall area of the steep upper catchment of the Strzelecki Ranges and flowing through the Traralgon urban area 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, which at times has also combined with 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. 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 the consideration of a range of social, economic and environmental factors, including the impact on mine batter stability, 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 such as the Hyland Highway south of Traralgon, Glengarry West Road, Traralgon Maffra Road and Traralgon Creek Road, that are near and/or cross waterways.

Critical infrastructure can be disrupted during flood events, including infrastructure related to transport, forestry, sewerage, mining and power generation and transmission. Vulnerable sectors of the community include individuals, hospitals, aged care facilities, schools, childcare 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 and is a significant constraint on emergency response.

The MFEP 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 that would provide useful information for community response. The existing Traralgon Flood Emergency Plan should be updated to include this information in its Flood Intelligence Card and to include the updated flood mapping.

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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 urban Traralgon. The relevant flood controls in the planning scheme should be updated to reflect the best available flood mapping.

### **Actions**

Flood mitigation actions to be implemented over the ten-year duration of the WGFMS within Latrobe City, subject to funding and feasibility, include:

1. Develop individual flood guides for high priority areas, specifically Morwell, Moe, Glengarry, Toongabbie and Traralgon.
2. Update the Planning Scheme to include updated flood mapping across the LGA.
3. Investigate the feasibility of the Traralgon Bypass Retarding Basin as part of VicRoads' planning process.
4. Replace the Beattie Crescent footbridge in Morwell.
5. Improve understanding of flood risks 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, integrate them with flood education products and programs.

## 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.

Wilson's 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 key habitat for migratory birds and is a protected site of significance under the Ramsar Convention on Wetlands. The Strzelecki Range in the shire's north contains the headwaters of a number of South Gippsland's waterways. Due to the prevalence of steep land, both in the ranges and farmland upstream of the flat coastal lowlands, erosion and landslip associated with heavy rainfall are a significant risk.

Major waterways in the shire are the Tarwin River and the upper reaches of the Powlett River and smaller waterways including Stockyard Creek and the Tidal, Franklin and Agnes Rivers.

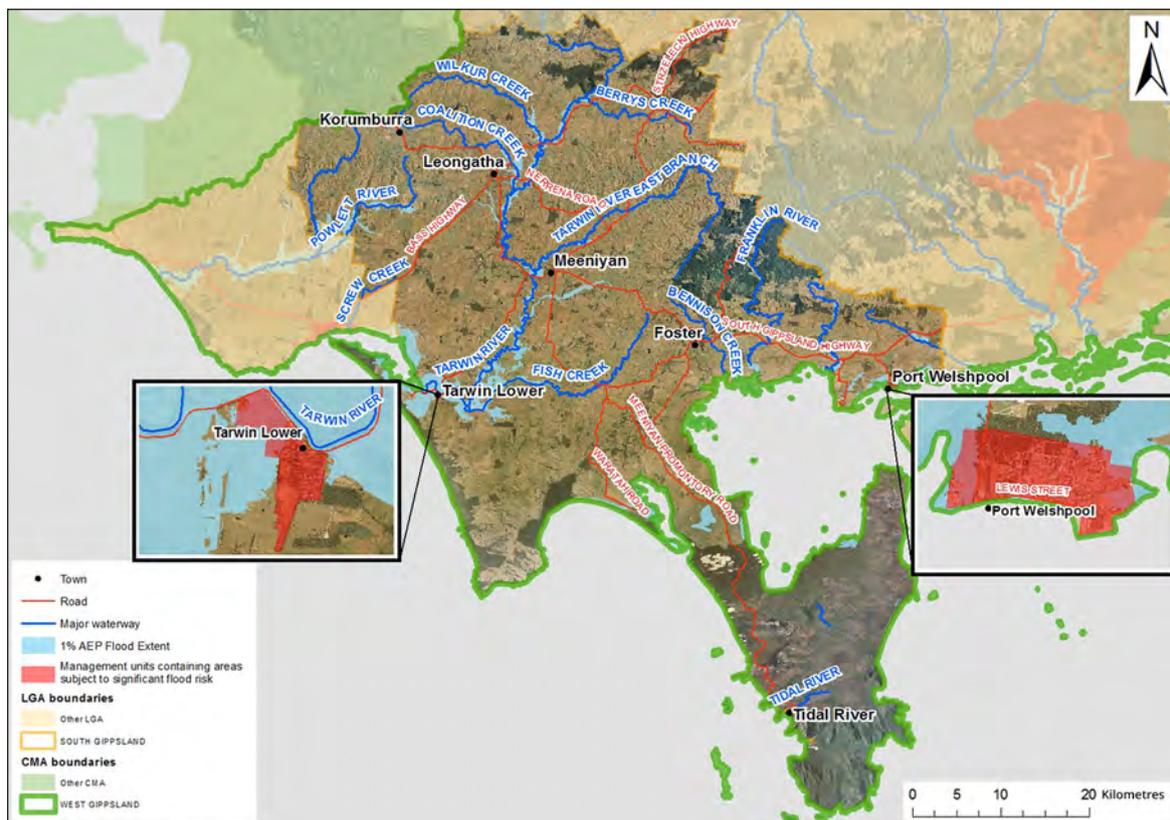


Figure 17 – South Gippsland Shire

## SECTION 2

As part of the regional risk assessment outlined in Section 2.4, two locations within the South Gippsland Shire, Tarwin Lower and Port Welshpool, were identified as having a significant flood risk. 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 South Gippsland 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 upon.

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. As a result of combined effects of riverine and stormwater flooding, Fish Creek experienced some property inundation and road closures due to flash flooding in 2011. A flood study is likely to be beneficial and provide a better understanding of the behaviour and impacts of flooding.

### Strategy in Action – Stockyard Creek, Foster

In July 2016, parts of Foster were inundated after heavy rainfall caused flooding in Stockyard Creek. It was speculated 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.

Stockyard Creek is an urban waterway and is a significant environmental and public open space asset running through the middle of Foster. Land ownership and therefore management responsibility varies along the creek with some of the area actively managed by South Gippsland Shire Council while other areas located in crown land are not actively managed.

The Victorian Floodplain Management Strategy (Policy 18b and 18c) allows for LGAs to carry out flood mitigation activities on waterways where:

- It can be shown that this will significantly reduce the impacts of flooding
- The benefits of the work outweigh the cost to river health
- Those that benefit from the vegetation removal are willing to fund the works.

To better understand the flood risk and to help determine appropriate management arrangements along Stockyard Creek, South Gippsland Shire Council with the support of the WGCMA successfully sought funding through the \$25-Million VFMS initiative. This project will investigate the works required to manage the flood risk and clarify the ongoing management requirements.



## SECTION 2

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 Meeniyah, Port Welshpool, Toora, Berry's Creek, Tarwin Lower, Fish Creek, Port Franklin, Mardan South and Mirboo North have significant rural flood risk. Floodwater can inundate properties and roads including the South Gippsland Highway west of Meeniyah, the Agnes River west of Toora and Nine Mile Creek near Hedley.

The single access road to Venus Bay is frequently inundated due to flooding on the Tarwin River, which is often exacerbated by coastal storm surge and totally prevents 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 regularly inundated should be investigated. Roads identified as a priority are the Meeniyah-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 subject to significant inundation within South Gippsland.

Other than roads, critical infrastructure 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's Promontory is a key asset within 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's Promontory Road at Darby River was destroyed, which prevented the evacuation of people located south of the bridge in the main visitor area and elsewhere. The visitor area itself experienced rapidly rising floodwaters in Tidal River that extensively damaged buildings in the area. Damage to roads, bridges and buildings was not repaired for many weeks after the event, significantly affecting 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 within the area on infrastructure and the wider economy, particularly as storms are likely to become more intense and frequent due to climate change.

Levee systems in the South Gippsland Shire include along the Tarwin River near Tarwin Lower, along the north and south sides of Anderson's Inlet and the sea walls around Corner Inlet. The Corner Inlet sea walls provide some protection for farmland from coastal inundation. 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 flood forecasting and warning services present for 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 present at several locations in the Tarwin River system including Meeniyah, on the Franklin River at Toora, on the Agnes River at Toora and on the Tidal River at Tidal River. However, these gauges are not connected to telemetry and information is not available in real time.

Riverine floods generally rise quickly in the 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 South Gippsland Shire's MFEP updated as additional flood intelligence and other information becomes available. It is recommended that the MFEP 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.

### **Actions**

Flood mitigation actions to be implemented over the ten-year duration of the WGFMS within South Gippsland Shire, subject to funding and feasibility, include:

1. Develop individual flood guides for high priority areas, specifically Fish Creek and Foster.
2. Investigate undertaking a flood study for Fish Creek.
3. Continue with the Stockyard Creek Foster flood study.
4. Investigate connecting the existing stream gauges to telemetry and making data available to the community in near real time.
5. Proceed with South Gippsland Shire Council and Wellington Shire Council's investigation into the impacts of climate change on sea walls.
6. Investigate the installation of a warning system for flooding over Stewart and Dunlops Roads near Middle Tarwin.
7. Improve understanding of flood risks by developing detailed flood maps for: Tarwin River; Fish Creek; Franklin River; Agnes River; Nine Mile Creek; Tidal River; and, integrate them with flood education products and programs.

### 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. Waterways flowing 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, which includes significant areas of floodplain comprising a network of irrigation and drainage channels that have altered natural flow paths.

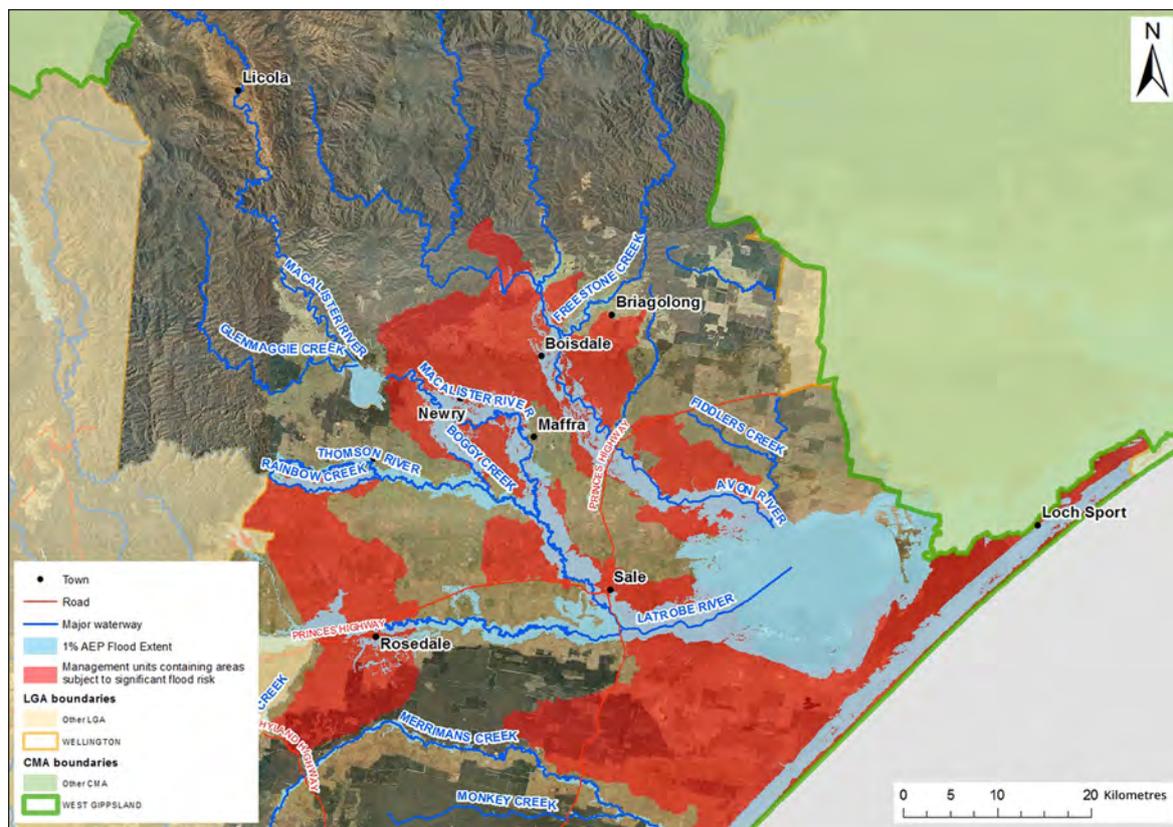
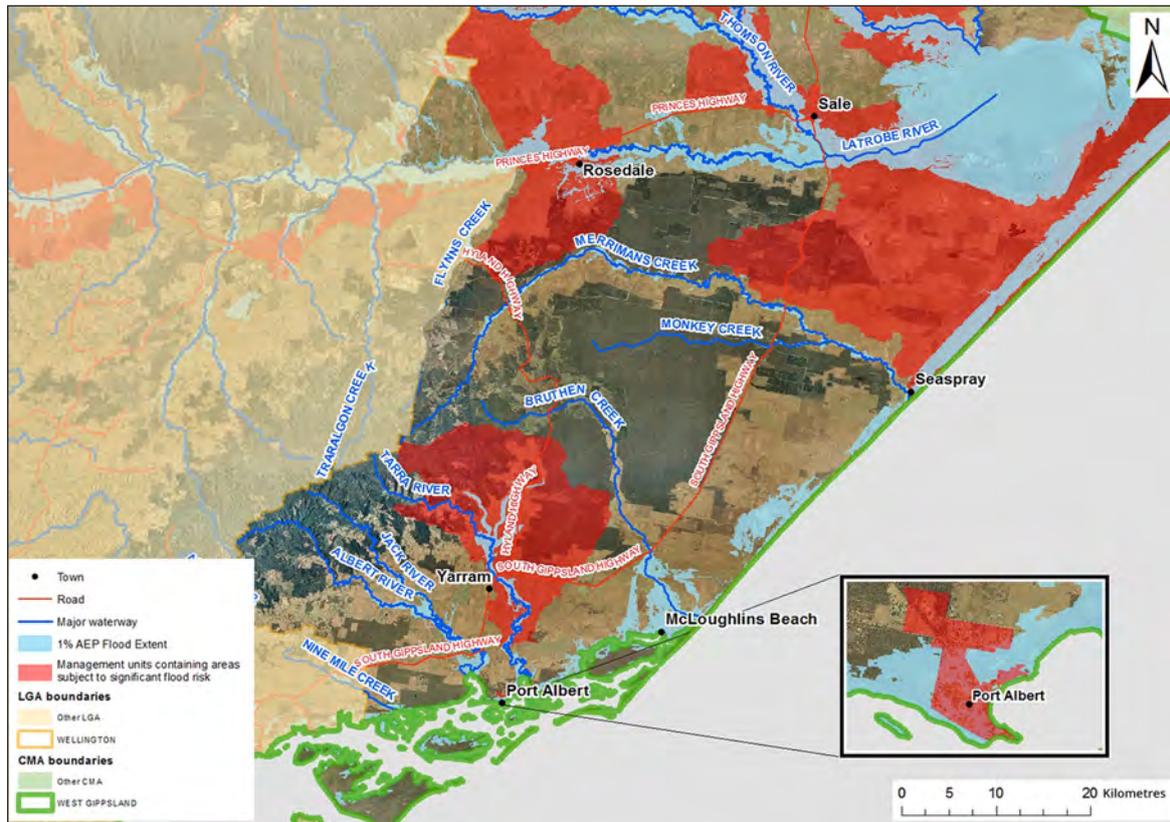


Figure 18 – Wellington Shire (North)



**Figure 19 – Wellington Shire (South)**

Of all the municipalities in West Gippsland, Wellington Shire has the highest number of management units identified as including areas with 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, McLoughlins Beach, Tinamba and Port Albert
- The rural areas along the:
  - Avon River from Valencia Creek to Clydebank
  - Tarra River downstream to Brewery Road
  - Thomson River and Rainbow Creek from the Cowwarr Weir to the confluence with the Macalister River
  - Macalister River from the Glenmaggie Weir to the Thomson River confluence
  - Thomson River from the Macalister River confluence to the confluence with the Latrobe River south west of Sale
  - 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
- The rural area of Boggy Creek.

Water storages in the Shire include Cowwarr Weir and Lake Glenmaggie.

## SECTION 2

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 that breaks river banks further downstream on flatter land. This results in flooding in areas such as Valencia Creek, Boisdale, Stratford, Clydebank and Briagolong.

The township of Briagolong experiences flooding caused by overland flows from the nearby hills. An investigation of this flooding 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 township. This flooding is complex and may be originating from two separate catchments. A flood study for Maffra is considered important in understanding the nature of the flooding and to 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. The river 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 below the 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. This results from an interaction of flooding in the Latrobe and Thomson Rivers, Flooding Creek and the Sale Canal, and is exacerbated by high water levels in Lake Wellington. Flooding can damage boating infrastructure and vessels moored in the Sale Canal.

The Latrobe River joins the Thomson River near Longford and then flows into Lake Wellington. Large areas of farmland adjacent to the rivers around East Sale, the Heart Morass and Dutson are subject to flooding.

### Strategy in Action – Hagen’s Bridge

Landholders on the Macalister River near Hagen’s Bridge raised concerns about the growth of native vegetation in the river and it potentially increasing the risk of flooding by forcing more water out of the river channel and onto the floodplain during high rainfall events.

The Victorian Floodplain Management Strategy (Policy 18b and 18c) allows for individuals or groups of landholders to manage vegetation along waterways where:

- It can be shown to significantly reduce the impacts of flooding
- The benefits of the work outweigh the costs to river health
- Those that benefit from the work are willing to fund it.

Native vegetation along the Macalister River helps improve water quality, provides habitat for native animals and fish, improves bed and bank stability and ultimately helps improve the health of the Gippsland Lakes downstream.

To better understand flood risk around Hagen’s Bridge, WGCMA staff worked with local landholders to understand their concerns. As part of this process two community meetings were held. The first meeting focused on understanding the local issues and determining what sort of information the WGCMA could provide to support local decision making. At the second meeting, local landholders were presented with outcomes from preliminary flood modelling undertaken by the WGCMA.

The investigations showed that the native vegetation regrowth along the banks of the Macalister River impacts on flooding, but the impact was not considered significant enough to warrant funding any works along the river. Accordingly, the WGCMA agreed to provide further flood mapping based on a range of flood flows and a range of vegetation growth scenarios. This more detailed information was shared with landholders so that they can better understand and therefore better plan for a range of potential floods.



## SECTION 2

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 VFMS allows for vegetation management to occur along waterways where it can be demonstrated that this will significantly reduce the impact of flooding, that 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 rainfall gauges be installed in Rosedale and Blind Joe Creek upper catchment to improve knowledge and potentially be used for flash flood warning. Through this Strategy, this action was determined not to be cost effective relative to other potential actions across the region. The Rosedale Flood Study also recommended that the planning scheme be amended to update flood overlay extents; this action has been included in this Strategy.

Rural land along the lower reaches of Merrimans Creek and the Tarra, Jack and Albert Rivers is 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 exacerbated 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 McLoughlins Beach are impacted by riverine flooding that 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 the 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 of the Wellington Shire where it has little impact on property, and in the urban areas such as Sale when 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, including: 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 Coxs 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. Flooding of the Albert River also inundates the South Gippsland Highway. It is proposed to undertake flood mapping in this area to provide more information about the frequency and extent of impact. In addition, VicRoads, Victoria Police and VICSES are developing a Standard Operating Procedure (SOP) for the management of gates and warning signs along the Highway. This SOP will assist in reducing the impact of this flooding on transport continuity.

It is proposed that VicRoads investigates the installation of warning systems on those VicRoads roads within Wellington Shire that 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 within the shire includes sea walls which provide 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 Wellington Shire 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.

There are numerous private farm levees in the Wellington Shire that are used to divert flows away from assets and improve irrigation functions. 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.

## SECTION 2

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.

Flood warning systems are available along the Thomson, Macalister and Avon Rivers, where there are a number of stream and rainfall gauges providing good quality flood warnings. The existing gauges on Merrimans Creek provide some indication of flooding for downstream communities including Seaspray, however, there is no current flood forecasting and warning service for Merrimans Creek. Flood warning services are not available for the other main waterways including the Albert and Jack Rivers and Bruthen Creek. It has been suggested that the existing flood class levels for the Macalister River downstream of Lake Glenmaggie be reviewed to ensure that the flood level can accurately predict impact.

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 McLoughlins 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 that needs to be incorporated into the Wellington Shire's 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 are not 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.

## Strategy in Action – The Seaspray Levee

In 1978, after severe flooding in Seaspray, the local Council built a regulating structure and floodway system to address flooding. It is operated by Council in response to waterway flooding when high flows are detected at upstream river data gauges at Seaspray (Prospect Road) and Stradbroke West. There is also an earthen levee and regulating structure providing direct protection to most of Seaspray.

The *Seaspray Flood Study* (Water Technology, 2016) determined that the levee does not provide the level of protection that it was originally designed to achieve, which is full protection of the township from a 1% AEP flood event, as the levee is overtopped and outflanked in several locations.

The Victorian Floodplain Management Strategy (Chapter 17) encourages communities to understand their flood risk. When certain investment criteria are met, Government funding may be available for flood mitigation infrastructure (Policy 17b) on a three-way share basis between local, state and federal levels of government. Ongoing costs to maintain any infrastructure constructed is the responsibility of local government and this must be agreed prior to any works proceeding.

The *Seaspray Flood Study* (Water Technology, 2016) recommended upgrading the levee to provide protection to the town from a 1% AEP flood. The study also recommended monitoring of the sand berm at the mouth of Merriman's Creek and the review of the formal management arrangement for the system. Minor levee works are required to raise it in several locations and extended it at another. The project has a positive cost-benefit ratio and Wellington Shire Council are looking to seek funding for the design and future construction of the recommended works.



### **Actions**

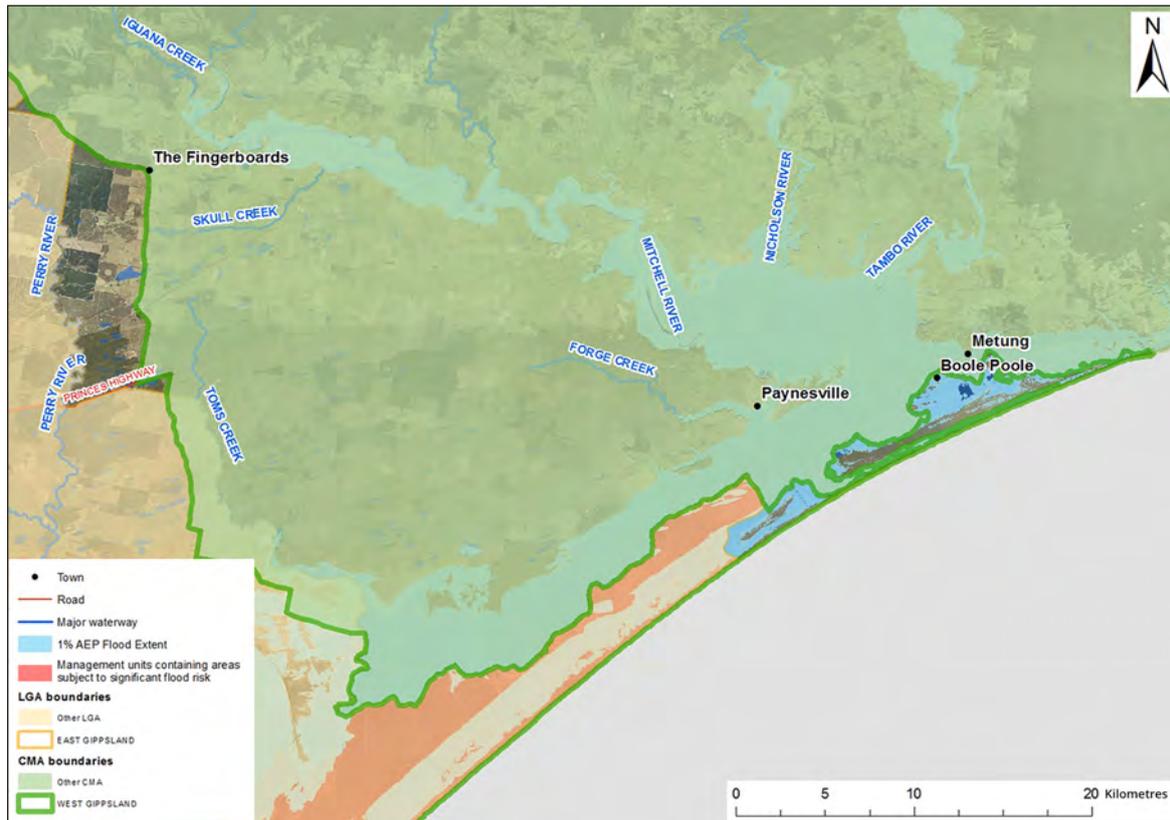
Flood mitigation actions to be implemented over the ten-year duration of the WGFMS within Wellington Shire, subject to funding and feasibility, include:

1. Develop individual flood guides for high priority areas, specifically Tinamba, Newry, Rosedale, Port Albert and Seaspray.
2. 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.
3. Investigate the feasibility of upgrading the road access to eastern Loch Sport and investigate localised drainage options to reduce flooding of Track 10.
4. 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.
5. Investigate the economic feasibility of providing flood mitigation infrastructure for townships along the Nooramunga Coast.
6. Undertake a flood study for the township of Briagolong.
7. Undertake a flood study for the township of Maffra.
8. Review flood class levels for the Macalister River downstream of Lake Glenmaggie.
9. Gippsland Ports in conjunction with Wellington Shire Council and DELWP develop a strategy to reduce risk to private and commercial vessels in Sale Canal during flood events.
10. Improve understanding of flood risks 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 integrate them with flood education products and programs.

### 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 20. This includes two separate areas:

- A long peninsula of land along Ninety Mile Beach including Mosquito Point, Jubilee Head and Ocean Grange.
- Part of the Perry River catchment upstream of the Princes Highway and south of Glenaladale.



**Figure 20 – East Gippsland Shire**

The Regional Risk Assessment outlined in Section 2.4 did not identify any of the management units in East Gippsland Shire as including areas with 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.

## SECTION 2

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 upon by contributing waterways in both the 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 consider the impacts of sea level rise.

### **Action**

A possible flood mitigation action to be implemented over the ten-year duration of the WGFMS within the East Gippsland Shire, subject to funding and feasibility, is to undertake a Planning Scheme Amendment to apply flood controls across the Gippsland Lakes.

# 3. The Strategy

## 3.1 Vision and objectives for floodplain management in the region

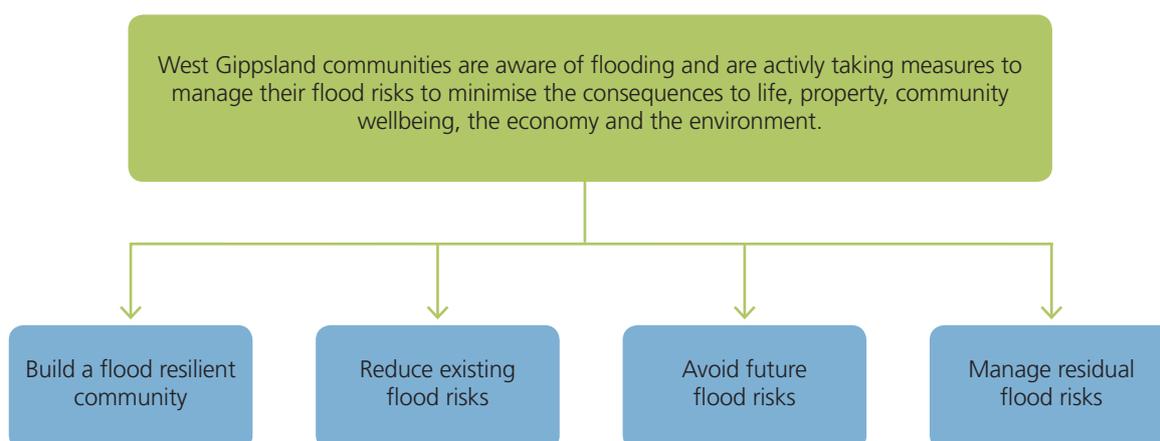
The vision, objectives and outcomes of the *Victorian Floodplain Management Strategy* (Department of Environment, Land, Water and Planning, 2016) (VFMS) are outlined in Table 2 of that document. The VFMS outlines a number of policies, actions and accountabilities to achieve the objectives and outcomes.

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 21.

Accountabilities and actions in the VFMS are attributed to a variety of lead agencies. Those agencies were consulted throughout the development of this Strategy. Some of the policies, actions and accountabilities significant to flooding in the region are outlined under the relevant Objective below.



**Figure 21 – West Gippsland Floodplain Management Strategy vision and objectives**

### **1. Build a flood resilient community**

Floods are potentially one of the most predictable natural disasters, with tools available to assess flood 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 to enable them to 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 the 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 and ultimately results in a better-informed community. DELWP is developing a web-based flood intelligence platform known as 'FloodZoom' that will provide a range of flood information to assist in flood planning and response.

## Strategy in Action – Community Flood Portal

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

One of the actions in the Strategy is to develop a community flood portal. The aim of the portal is to provide information about flooding, with a focus on areas without a flood warning system. Increasing community awareness around flooding will help to:

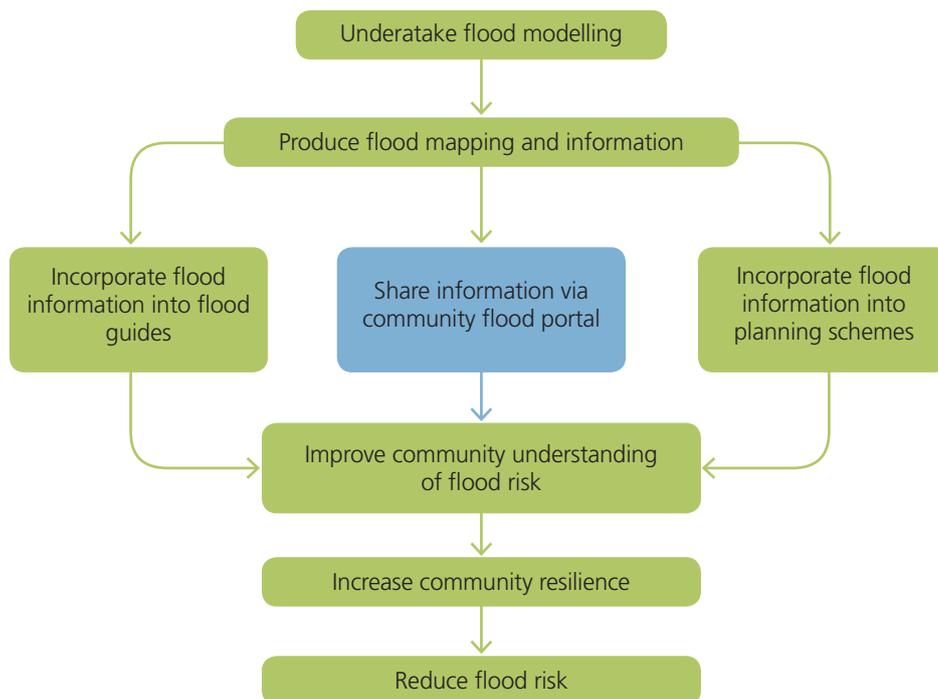
- Build a flood resilient community – through effective sharing of current information about flood behaviour
- Manage residual flood risks – through flood insurance, provision of flood risk information, integrated flood emergency management and incident control.

The Community Flood Portal will:

- Allow the community to access and analyse existing flood mapping;
- Provide templates for the community to produce individual flood response plans;
- Share new flood mapping in priority areas where it hasn't previously been available;
- Be a source of information for updating relevant area based Flood Guides;
- Be updated so that the community has ready access to the updated information and can determine their individual flood risk; and
- Allow the community to be better prepared to respond to a flood event and potentially reduce flood damages.

It is important that all parties are able to reference a single set of flood data which is current and accurate. WGCMA will work with DELWP to ensure that there is an authoritative set of flood data for West Gippsland that is shared with emergency services, land use planners, the insurance industry and community members.

The Community Flood Portal relates to flood information sources and the community as outlined in the following diagram.



## 2. Reduce existing flood risks

The provision of real-time information about a flood's behaviour and potential impacts to communities and emergency management agencies is crucial to reduce the effects 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 that 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 Total Flood Warning System (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 TFWS 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. 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.

Improvements can be made to the existing river level gauges by adding telemetry and making data available to the community in real time.

### **Flood mitigation infrastructure**

The benefit of flood mitigation infrastructure and an overview of infrastructure in West Gippsland are 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 that takes 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 (WMS) and the ongoing maintenance and management of new infrastructure through flood studies and WMSs. CMAs are accountable for supporting LGAs to lead the processes to determine and implement, through flood studies and WMSs (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 WFMSs. 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 MPS must not assume that the infrastructure will provide flood protection and the relevant MFEP 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; the works 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 obtain 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 approval 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. Integrated water management such as rainwater harvesting can manage stormwater and urban flooding.

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. Land use, changes to topography, 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 VPP policies, the WGCMA's 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% AEP 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% AEP 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. VFMS funding is available to assist LGAs update their planning schemes.

### **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.

## SECTION 3

*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 VPP's 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 by 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 RFMSs, that are 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.*

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 LGAs. The data will be provided through the FloodZoom platform being developed by DELWP.

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% AEP 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. The intense rainfall caused rapid flooding in Tidal River and destruction of the Darby River Bridge, requiring the 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, significantly impacting upon 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 raising, the support of Municipal Flood Emergency Committees and, in conjunction with LGAs, facilitating MFEPs. 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, including land use planning and community education and awareness raising, so that flood studies deliver information capable of being incorporated into the various plans and actions needed to manage floods.

*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 MFEPs 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* (Department of Environment, Land, Water and Planning, 2016). Submissions were sought during two exhibition periods (one in 2014 and another in 2015) and the Government used the ideas, knowledge and experience contributed through that process to develop the final strategy.

In developing this West Gippsland Floodplain Management Strategy (WGFMS), the project 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 reinforced throughout the stakeholder engagement for this Strategy.

Stakeholder engagement is an important part of the development process for the WGFMS. 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 major LGAs (Bass Coast, Baw Baw, Latrobe City, South Gippsland and Wellington), VICSES and the WGCMA, with observers from DELWP and 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 were scheduled between August 2016 and September 2017, with additional engagement occurring outside these meetings as required.

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

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

These workshops involved representatives from each LGA's emergency management, planning or infrastructure areas, as well as the relevant VICSES Regional Officer. Information from these workshops was documented and used to guide the assessment of flood risks and possible mitigation actions.

In addition, each of the five major LGAs 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 falling under the responsibility of the WGCMA, 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 East Gippsland Floodplain Management Strategy is addressing the major flood risks within the municipality however the WGCMA has been working with the EGCMA and East Gippsland Shire to ensure consistency across the regions, particularly across the Gippsland Lakes.

Regional agencies were invited to a stakeholder workshop to discuss the project to develop the WGFMS 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
- Country Fire Authority
- Emergency Management Victoria
- Department of Health and Human Services.

Information provided by agencies at this workshop identified flood risks particularly associated with 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
- Macalister Customer Consultative Committee
- Victorian Farmers' Federation
- Macalister Irrigation Council
- Moe River Drainage Committee
- The community associated with the Kilmany levee.

During the initial stage of the project, when information was being compiled about flood risks in the region, information about the Strategy development process was provided publicly on the WGCMA website and that of each relevant LGA. 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 LGA provided information about its key community groups, and many of these were contacted and invited to provide feedback at various stages throughout the development of the Strategy. Information was also sought from communities via local newspapers.

The draft Strategy was publicly exhibited from 15 May to 23 June 2017, 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 were developed to provide the key information and to request feedback from communities. Specific community groups were targeted, with further information provided to the community via various newspaper articles.

### 3.3 Determining regional priorities

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

- i. The Regional Risk Assessment identified a significant risk for the location
- ii. The existing risk treatments are considered inadequate
- iii. Additional risk treatment(s) may reduce flood risk
- iv. Additional risk treatment(s) are financially, socially and environmentally feasible
- 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 address 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 identified as a priority for the region throughout the development of this Strategy are outlined Table 2. The Regional Work Program which details priorities and timelines for those actions is outlined in Table 3.

The flood mitigation actions identified apply to the region as a whole, as well as those that are specific to LGAs. 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

Implementation of the actions in Table 2 has been prioritised into a Regional Work Program in Table 3. These actions are considered to be a priority and to be achievable over the duration of the Strategy (ten years). This is, however, subject to the actions being considered feasible as a result of further investigation and the availability of resources including funding. Prioritisation has been based on the nature of the projects, the flood risk, work programs of the relevant partner agencies and feedback from the community regarding the draft Strategy. Prioritisation is subject to change as implementation of the Strategy proceeds.

Following the release of this Strategy, its implementation will be guided by a detailed monitoring, evaluation and reporting (MER) plan that will be developed in 2018. 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.

An Implementation Committee which includes members from each agency with responsibilities or actions in the Regional Work Program will be established to oversee the implementation and review of the Regional Work Program throughout the life of the Strategy.

Engagement with relevant stakeholders, including impacted communities, will continue as individual actions in the Regional Work Program are implemented.

Annual reviews will be undertaken on a regular basis to guide the program over subsequent years. Actions will only be implemented if they are determined to be feasible, sufficiently resourced (including funding), and 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 that may not be of a large enough scale to be reflected in the list of high-risk locations and potential mitigation options, or they 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 MFEPs, the Victorian Rural Drainage Strategy or LGA infrastructure management.

### 3.6 Priority flood mitigation actions

**Table 2 – Priority flood mitigation actions for the term of the Strategy (2018-2027)**

	Location	LGA	Action	Lead Agency
R1	West Gippsland region	All	Scope the development of a community flood portal to disseminate information about flooding, with a focus on areas without a flood warning system	WGCMA
R2	Gunaikurnai Native Title area and Bunurong Land Council area of WGCMA region	As relevant	Support a WGCMA project to investigate the development of historical flood mapping	WGCMA
R3	West Gippsland region	All	Make current flood mapping available to Traditional Owner groups to assist them in identifying their Cultural Heritage sites at risk of flooding	WGCMA
R4	West Gippsland region	All	Ensure flood mapping, intelligence and local knowledge in MFEPs is regularly reviewed and updated, with MEMPCs to consider integrating flood and storm plans into a single plan	VICSES
R5	West Gippsland region	As relevant	Investigate the installation of warning systems for VicRoads roads that are subject to significant inundation as identified by LGAs and VICSES	VicRoads
BC 1	Bass Coast Shire	Bass Coast	Develop individual flood guides for high priority areas, specifically Inverloch, Wonthaggi and the lower Powlett River	VICSES
BC2	Wreck Creek, Inverloch	Bass Coast	Investigate flooding along Wreck Creek including the impact of the status of the river mouth	BCSC
BC3	Wonthaggi	Bass Coast	Schedule a future update of the Planning Scheme to include flood mapping for the Wonthaggi North East Development Area	BCSC
BC4	Powlett River and Screw Creek	Bass Coast	Investigate connecting the existing stream gauges in West Gippsland to telemetry and making data available to the community in real time	BCSC
BC5	Powlett River floodplain	Bass Coast	Improve the understanding of flood risk by developing detailed flood maps for the Powlett River and integrate them with flood education products and programs	WGCMA
BB1	Baw Baw Shire	Baw Baw	Develop individual flood guides for high priority areas, specifically Warragul, Yarragon and Trafalgar	VICSES
BB2	Baw Baw Shire	Baw Baw	Update the Planning Scheme to include updated flood mapping across the Shire	BBSC
BB3	Moe River	Baw Baw	Investigate structural works along the Moe River to protect North Canal Road and adjacent farm land (between Cummings Road and Telephone Road)	BBSC
BB4	Princes Freeway and Gippsland railway line between Yarragon and Trafalgar East	Baw Baw	Liaise with VicRoads and VicTrack to investigate the capacity of culverts under the Princes Freeway and Gippsland railway line between Yarragon and Trafalgar East	BBSC
BB5	Warragul	Baw Baw	Investigate the structural integrity of the Landsborough Road retarding basin in Warragul	BBSC

**Table 2 – Priority flood mitigation actions for the term of the Strategy (2018-2027) cont...**

	Location	LGA	Action	Lead Agency
BB6	Warragul	Baw Baw	Ensure ongoing management of Hazel Creek to retain its current flow capacity	BBSC
BB7	Warragul	Baw Baw	Investigate options to increase the capacity of Hazel Creek at critical locations	BBSC
BB8	Trafalgar	Baw Baw	Construct the proposed Princes Highway retarding basin on the west side of Trafalgar	BBSC
BB9	Trafalgar	Baw Baw	Ensure ongoing management of the contour drain and Loch Creek at Trafalgar	BBSC
BB10	Yarragon	Baw Baw	Construct the proposed Hazeldean Road retarding basin in Yarragon	BBSC
BB11	Moe River at Darnum	Baw Baw	Install Event Reporting Radio Telemetry System (ERRTS) at gauge Site 226209B on the Moe River at Darnum through a partnership between Baw Baw Shire Council and DELWP to enhance the real time transmission of data	BBSC / DELWP partnership
BB12	Various	Baw Baw	Improve the understanding of flood risk by developing detailed flood maps for the Tanjil River downstream of Blue Rock Dam, Latrobe River between Trafalgar-Willow Grove Rd and Westbury, Moe River upstream of the Darnum gauge, Shady Creek and Narracan Creek, and integrate them with flood education products and programs	WGCMA
L1	Latrobe City	Latrobe	Develop individual flood guides for high priority areas, specifically Morwell, Moe, Glengarry, Toongabbie and Traralgon	VICSES
L2	Latrobe City	Latrobe	Update the Planning Scheme to include updated flood mapping across the Shire	LCC
L3	Traralgon	Latrobe	Investigate the feasibility of the Traralgon Bypass Retarding Basin as part of VicRoads' planning process	Coordinated by WGCMA
L4	Morwell	Latrobe	Replace the Beattie Crescent footbridge in Morwell	LCC
L5	Various	Latrobe	Improve the understanding of flood risk by developing detailed flood maps for the Tyers River downstream of Moondarra, Rintoul Creek, Morwell River, Middle Creek, Eaglehawk Creek, Flynn's Creek and Traralgon Creek upstream of Traralgon, and integrate them with flood education products and programs	WGCMA
SG1	South Gippsland Shire	South Gippsland	Develop individual flood guides for high priority areas, specifically Fish Creek and Foster	VICSES
SG2	Fish Creek	South Gippsland	Investigate undertaking a flood study for Fish Creek	SGSC
SG3	Stockyard Creek, Foster	South Gippsland	Continue with the Stockyard Creek Foster flood study	SGSC
SG4	South Gippsland Shire	South Gippsland	Investigate connecting the existing stream gauges to telemetry and making data available to the community in near real time	SGSC
SG5	Coastal South Gippsland & Wellington Shire	South Gippsland	Proceed with South Gippsland Shire Council and Wellington Shire Council's investigation into the impacts of climate change on sea walls	SGSC

## SECTION 3

**Table 2 – Priority flood mitigation actions for the term of the Strategy (2018-2027) cont...**

	Location	LGA	Action	Lead Agency
SG6	Middle Tarwin	South Gippsland	Investigate the installation of a warning system for flooding over Stewart and Dunlops Roads near Middle Tarwin	SGSC
SG7	Various	South Gippsland	Improve the understanding of flood risk by developing detailed flood maps for the Tarwin River, Fish Creek, Franklin River, Agnes River, Nine Mile Creek and Tidal River, and integrate them with flood education products and programs	WGCMA
W1	Wellington Shire	Wellington	Develop individual flood guides for high priority areas, specifically Tinamba, Newry, Rosedale, Port Albert and Seaspray	VICSES
W2	Wellington Shire	Wellington	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	WSC
W3	Loch Sport	Wellington	Investigate the feasibility of upgrading the road access to eastern Loch Sport	WSC
W4	Seaspray	Wellington	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	WSC
W5	Nooramunga Coast	Wellington	Investigate the economic feasibility of providing flood mitigation infrastructure for townships along the Nooramunga Coast	WSC
W6	Briagolong	Wellington	Undertake a flood study for the township of Briagolong	WSC
W7	Maffra	Wellington	Undertake a flood study for the township of Maffra	WSC
W8	Downstream of Lake Glenmaggie	Wellington	Review flood class levels for the Macalister River downstream of Lake Glenmaggie	WGCMA
W9	Sale Canal	Wellington	Develop a strategy to reduce risk to private and commercial vessels in Sale Canal during flood events	Gippsland Ports
W10	Various	Wellington	Improve the understanding of flood risk 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 integrate them with flood education products and programs	WGCMA
EG1	Gippsland Lakes	East Gippsland	Undertake a Planning Scheme Amendment to apply flood controls across the Gippsland Lakes	EGSC

### Key

- R regional
- BC Bass Coast Shire
- BB Baw Baw Shire
- L Latrobe City
- SG South Gippsland Shire
- W Wellington Shire

# 4. Implementation Plan

As there will not be sufficient resources to immediately implement all actions proposed in Section 3.6, a process has been undertaken to prioritise actions for implementation.

Any proposed action must meet the following criteria to be considered for implementation:

1. It supports the vision and aligns with the objectives of the Strategy (outlined in Section 3.1);
2. It is likely to be technically feasible;
3. It is aligned with government policy and priorities; and
4. It is aligned with community needs and expectations.

Further consultation occurred with all parties responsible for priority actions identified in Part 3. Each party considered its processes for determining priority actions independent of this Strategy, including a consideration of feedback from the public exhibition of the draft Strategy, and prioritised the list of actions in the Regional Work Program in Table 3. The implementation of any of the actions identified is subject to resources, funding and feasibility.

Consideration of benefits to critical infrastructure and services, including their access, should be considered as part of the feasibility assessment for each action.

Funding for priority works identified in the Regional Work Program will be subject to a three-way cost-sharing arrangement between the Federal Government, State Government and Local Government (or other responsible agency). Eligible projects must meet the State Government's investment criteria in that they must be subject to due process and due diligence, they must be cost effective, be supported by economic analysis and have community benefits.

Table 3 – Regional Work Program

	Location	Municipality	Action	Floodplain Management Objective (S) From Section 3.1	Responsibility		Year				Comments	
					Lead	Partner(S)	2018	2019	2020	2021 +		
R1	Regional	All	Scope the development of a community flood portal to disseminate information about flooding, with a focus on areas without a flood warning system	1, 4	WGCMA	VICSES LGAs						
R2	Regional	As relevant	Support a WGCMA project to investigate the development of historical flood mapping	1	WGCMA							
R3	Regional	All	Make current flood mapping available to Traditional Owner groups to assist them in identifying their Cultural Heritage sites at risk of flooding	1, 4	WGCMA							
R4	Regional	All	Ensure flood mapping, intelligence and local knowledge in MFEPS is regularly reviewed and updated, with MEMPCs to consider integrating flood and storm plans into a single plan	1, 2, 4	VICSES		Latrobe Baw Baw	Wellington	Bass Coast	All as updates required	SES has capacity with current resources to deliver one MFEPS per year for the region, including merging Storm and Flood into the one plan, community consultation and update of intelligence cards	

Table 3 – Regional Work Program cont...

	Location	Municipality	Action	Floodplain Management Objective (S) From Section 3.1	Responsibility		Year				Comments
					Lead	Partner(S)	2018	2019	2020	2021 +	
R5	Regional	As relevant	Investigate the installation of warning systems for VicRoads roads that are subject to significant inundation as identified by LGAs and VICSES	2	VicRoads	WGCMA					WGCMA to progress discussions with VicRoads
BC1	Bass Coast Shire	Bass Coast	Develop individual flood guides for high priority areas, specifically Inverloch, Wonthaggi and Lower Powlett River	1, 4	VICSES						SES has capacity with current resources to deliver two flood guides per year for the region
BC2	Wreck Creek, Inverloch	Bass Coast	Investigate flooding along Wreck Creek including the impact of the status of the river mouth	2	BCSC						The issue was identified during the development of the Strategy and processes have been identified and put in place to address the risk. Monitoring and review of the processes will occur over the next 12 months

Table 3 – Regional Work Program cont...

	Location	Municipality	Action	Floodplain Management Objective (S) From Section 3.1	Responsibility		Year				Comments	
					Lead	Partner(S)	2018	2019	2020	2021 +		
BC3	Wonthaggi	Bass Coast	Schedule a future update of the Planning Scheme to include flood mapping for the Wonthaggi North East Development Area	3	BCSC	WGCMMA						The Wonthaggi North East PSP will remove the LSIO to the land within the precinct as this will be dealt with through the infrastructure delivery in the area. However there may be a need to undertake a further planning scheme amendment to identify land north of Heslop Road affected by flooding subject to WGCMMA undertaking a flood study of the Powlett River
BC4	Powlett River and Screw Creek	Bass Coast	Investigate connecting the existing stream gauges in West Gippsland to telemetry and making data available to the community in near real time	2	BCSC	DELWP						To be further prioritized in future Council related strategy. Ideally should be undertaken in conjunction with Action SG4 to maximise efficiencies

Table 3 – Regional Work Program cont...

	Location	Municipality	Action	Floodplain Management Objective (S) From Section 3.1	Responsibility		Year				Comments	
					Lead	Partner(S)	2018	2019	2020	2021 +		
BC5	Powlett River floodplain	Bass Coast	Improve the understanding of flood risk by developing detailed flood maps for the Powlett River and integrate them with flood education products and programs	1, 4	WGCMMA							
BB1	Baw Baw Shire	Baw Baw	Develop individual flood guides for high priority areas, specifically Warragul, Yarragon and Trafalgar	1, 4	VICSES		Warragul Trafalgar		Yarragon			SES has capacity with current resources to deliver two flood guides per year for the region
BB2	Baw Baw Shire	Baw Baw	Update the Planning Scheme to include updated flood mapping across the Shire	3	BBSC							Works to be completed in stages by June 2021
BB3	Moe River	Baw Baw	Investigate structural works along the Moe River to protect North Canal Road and adjacent farm land (between Cummings Road and Telephone Road)	2	BBSC							Works subject to external funding and refining of scope of works in consultation with local residents, CMA and DELWP

Table 3 – Regional Work Program cont...

	Location	Municipality	Action	Floodplain Management Objective (S) From Section 3.1	Responsibility		Year				Comments
					Lead	Partner(S)	2018	2019	2020	2021 +	
BB4	Princes Freeway and Gippsland Railway Line between Yarragon and Trafalgar East	Baw Baw	Liaise with VicRoads and VicTrack to investigate the capacity of culverts under the Princes Freeway and Gippsland railway line between Yarragon and Trafalgar East	2	BBSC	VicRoads VicTrack					In progress. Cost subject to scope of works to be considered by VicTrack/VicRoads
BB5	Warragul	Baw Baw	Investigate the structural integrity of the Landsborough Road retarding basin in Warragul	2	BBSC						Works expected to be completed by 2021 subject to external funding and council future budget consideration
BB6	Warragul	Baw Baw	Ensure ongoing management of Hazel Creek to retain its current flow capacity	2	BBSC						Ongoing action
BB7	Warragul	Baw Baw	Investigate options to increase the capacity of Hazel Creek at critical locations	2	BBSC						Completion expected June 2020
BB8	Trafalgar	Baw Baw	Construct the proposed Princes Highway retarding basin on the west side of Trafalgar	2	BBSC						Completion expected June 2020

Table 3 – Regional Work Program cont...

	Location	Municipality	Action	Floodplain Management Objective (S) From Section 3.1	Responsibility		Year				Comments
					Lead	Partner(S)	2018	2019	2020	2021 +	
BB9	Trafalgar	Baw Baw	Ensure ongoing management of the Contour Drain and Loch Creek at Trafalgar	2	BBSC						Ongoing action
BB10	Yarragon	Baw Baw	Construct the proposed Hazeldean Road retarding basin in Yarragon	2	BBSC						Completion expected June 2020
BB11	Moe River at Darnum	Baw Baw	Install Event Reporting Radio Telemetry System (ERTS) at gauge Site 226209B on the Moe River at Darnum through a partnership between Baw Baw Shire Council and DELWP to enhance the real time transmission of data	2	BBSC DELWP	GRWMP					No capital cost involved. Completion expected end of 2018

Table 3 – Regional Work Program cont...

	Location	Municipality	Action	Floodplain Management Objective (S) From Section 3.1	Responsibility		Year				Comments
					Lead	Partner(S)	2018	2019	2020	2021 +	
BB12	Various	Baw Baw	Improve the understanding of flood risk by developing detailed flood maps for the Tanjil River downstream of Blue Rock Dam, Latrobe River between Trafalgar-Willow Grove Rd and Westbury, Moe River upstream of the Darnum gauge, Shady Creek and Narracan Creek and integrate them with flood education products and programs	1, 4	WGCGMA		Moe River Shady Creek	Narracan Creek		Tanjil River Latrobe River	
L1	Latrobe City	Latrobe	Develop individual flood guides for high priority areas, specifically Morwell, Moe, Glengarry, Toongabbie and Traralgon	1, 4	VICSES		Traralgon		Morwell Moe	Glengarry Toongabbie	SES has capacity with current resources to deliver two flood guides per year for the region
L2	Latrobe City	Latrobe	Update the Planning Scheme to include updated flood mapping across the Shire	3	LCC	WGCGMA					

Table 3 – Regional Work Program cont...

	Location	Municipality	Action	Floodplain Management Objective (S) From Section 3.1	Responsibility		Year				Comments	
					Lead	Partner(S)	2018	2019	2020	2021 +		
L3	Traralgon	Latrobe	Investigate the feasibility of the Traralgon Bypass Retarding Basin as part of VicRoads' planning process	2	Coordinated by WGCMA	VicRoads LCC WGCMA						
L4	Morwell	Latrobe	Replace the Beattie Crescent footbridge in Morwell	2	LCC							Action currently under review. Priority to be updated as the review progresses
L5	Various	Latrobe	Improve the understanding of flood risk by developing detailed flood maps for the Tyers River downstream of Moondarra, Rintoul Creek, Morwell River and Middle Creek, Eaglehawk Creek, Flyns Creek and Traralgon Creek upstream of Traralgon, and integrate them with flood education products and programs	1, 4	WGCMA		Tyers River Rintoul Creek Eaglehawk Creek	Traralgon Creek		Morwell River and Middle Creek Flyns Creek		

Table 3 – Regional Work Program cont...

	Location	Municipality	Action	Floodplain Management Objective (S) From Section 3.1	Responsibility		Year				Comments
					Lead	Partner(S)	2018	2019	2020	2021 +	
SG1	South Gippsland Shire	South Gippsland	Develop individual flood guides for high priority areas, specifically Fish Creek and Foster	1, 4	VICSES						SES has capacity with current resources to deliver two flood guides per year for the region
SG2	Fish Creek	South Gippsland	Investigate undertaking a flood study for Fish Creek	1	SGSC	WGCMMA					May consider bringing forward if grant funding for the project can be secured
SG3	Stockyard Creek, Foster	South Gippsland	Continue with the Stockyard Creek Foster flood study	1, 2, 3	SGSC	WGCMMA					Commenced 2017 due for completion in June 2018
SG4	South Gippsland Shire	South Gippsland	Investigate connecting the existing stream gauges to telemetry and making data available to the community in near real time	2	SGSC	DELWP					Identified as beneficial however not a high Council priority. Concern with potential ongoing maintenance and upkeep. Ideally should be undertaken in conjunction with Action BC4 to maximise efficiencies
SG5	Coastal South Gippsland & Wellington Shire	South Gippsland	Proceed with South Gippsland Shire Council and Wellington Shire Council's investigation into the impacts of climate change on sea walls	2	SGSC						Work currently ongoing with expected completion in 2019. Unclear at this time what the implementation outcomes will be.

Table 3 – Regional Work Program cont...

	Location	Municipality	Action	Floodplain Management Objective (S) From Section 3.1	Responsibility		Year				Comments
					Lead	Partner(S)	2018	2019	2020	2021 +	
SG6	Middle Tarwin	South Gippsland	Investigate the installation of a warning system for flooding over Stewart and Dunlops Roads near Middle Tarwin	2	SGSC						Identified as beneficial however not a high Council priority. Concern with potential ongoing maintenance and upkeep
SG7	Various	South Gippsland	Improve the understanding of flood risk by developing detailed flood maps for the Tarwin River, Fish Creek, Franklin River, Agnes River, Nine Mile Creek and Tidal River, and integrate them with flood education products and programs	1, 4	WGCMMA	Tarwin River East and West branches Fish Creek	Tarwin River below Meeniyah		Franklin River Agnes River Nine Mile Creek Tidal River		
W1	Wellington Shire	Wellington	Develop individual flood guides for high priority areas, specifically Tinamba, Newry, Rosedale, Port Albert and Seaspray	1, 4	VICSES	Seaspray Rosedale			Tinamba Newry Port Albert		SES has capacity with current resources to deliver two flood guides per year for the region

Table 3 – Regional Work Program cont...

	Location	Municipality	Action	Floodplain Management Objective (S) From Section 3.1	Responsibility		Year				Comments
					Lead	Partner(S)	2018	2019	2020	2021 +	
W2	Wellington Shire	Wellington	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	3	WSC	WGCMA					
W3	Loch Sport	Wellington	Investigate the feasibility of upgrading the road access to eastern Loch Sport	2	WSC						
W4	Seaspray	Wellington	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	2	WSC	WGCMA					

Table 3 – Regional Work Program cont...

	Location	Municipality	Action	Floodplain Management Objective (S) From Section 3.1	Responsibility		Year				Comments	
					Lead	Partner(S)	2018	2019	2020	2021 +		
W5	Nooramunga Coast	Wellington	Investigate the economic feasibility of providing flood mitigation infrastructure for townships along the Nooramunga Coast	2	WSC							
W6	Briargolong	Wellington	Undertake a flood study for the township of Briargolong	1	WSC	WGCMMA						Commenced 2017
W7	Maffra	Wellington	Undertake a flood study for the township of Maffra	1	WSC	WGCMMA						
W8	Downstream of Lake Glenmaggie	Wellington	Review flood class levels for the Macalister River downstream of Lake Glenmaggie	2	WGCMMA VICSES	WSC BoM						
W9	Sale Canal	Wellington	Develop a strategy to reduce risk to private and commercial vessels in Sale Canal during flood events	2	Gippsland Ports	WSC DELWP						Undertake in parallel with Action GL5 in East Gippsland Floodplain Management Strategy to develop similar strategy for Gippsland Lakes

Table 3 – Regional Work Program cont...

	Location	Municipality	Action	Floodplain Management Objective (S) From Section 3.1	Responsibility		Year				Comments
					Lead	Partner(S)	2018	2019	2020	2021 +	
W10	Various	Wellington	Improve the understanding of flood risk 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 integrate them with flood education products and programs	1, 4	WGCMMA		Albert and Jack Rivers Bruthen Creek Merrimans Creek	Tarra River	Perry River Macalister River		
EG1	Gippsland Lakes	East Gippsland	Undertake a Planning Scheme Amendment to apply flood controls across the Gippsland Lakes	3	EGSC	WGCMMA					

**Action Key**

- R regional
- BC Bass Coast Shire
- BB Baw Baw Shire
- L Latrobe City
- SG South Gippsland Shire
- W Wellington Shire

**Floodplain Management Objective Key**

1. Build a flood resilient community
2. Reduce existing flood risks
3. Avoid future flood risks
4. Manage residual flood risks

# 5. Monitoring, Evaluation And Reporting

Effectively managing floodplains requires all responsible agencies to have access to reliable information on which to base management decisions. Through the combination of clear accountabilities, strong community engagement and technical rigour in assessing and treating flood risks, floodplain management activities will continue to be guided by their feasibility, the needs of the community and the availability of resources.

This Strategy outlines the vision and objectives for floodplain management in West Gippsland that will guide communities and agencies over the coming 10 years. It will take time to achieve the outcomes identified in this Strategy. Responsible agencies will need time and resources to build the capacity necessary for them to fully meet the accountabilities. However, they must be able to demonstrate that they are on a credible path to developing that capacity.

This Strategy draws on the policy guidelines in the VFMS (Department of Environment, Land, Water and Planning, 2016). It forms a future business case for investment by all tiers of government in floodplain management activities in West Gippsland.

The management of floodplains in the region is conducted within an adaptive management framework. Adaptive management *'promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood'* (National Research Council, 2014).

Adaptive management at the regional level requires both regular review and learnings from previous experience. This allows responsible agencies to alter management approaches based on knowledge gained during implementation.

Community participation is sought and encouraged, with the provision of new information occurring across all parts of the program. The knowledge and information gained is crucial for ensuring effective adaptive management and for informing associated monitoring, evaluation and reporting processes.

Evaluation of the success of the Strategy will target the following areas:

1. Effectiveness – have the desired activities or outputs been delivered?
2. Impact – have the desired outcomes been delivered?
3. Appropriateness – were the mechanisms the right ones to achieve the desired outcomes?
4. Efficiency – does the output represent value for investment?
5. Legacy – will the impacts continue over time, including after the Strategy ceases?

To support this, a detailed monitoring, evaluation and reporting (MER) plan will be developed in 2018.

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*Cover images:*

*Front: Stockyard Hill Causeway Loch Sport 2007 (Source: WGCMA)*

*Inside front: Traralgon 2012 (Source: WGCMA)*

*Above: Traralgon-Tyers Road 2012 (Source: WGCMA)*

*Back: Albert River South Gippsland Highway 2013 (Source: WGCMA)*

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