East Gippsland Floodplain Management Strategy

Acknowledgement of Country

We acknowledge the Traditional Owners of the land and waters to which this Plan refers and their long and continuing relationship with Country. We pay our respects to their Elders, past and present.

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Table of contents

Acronyms

AAD	Average Annual Damage
AEM	Australian Emergency Manual
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
BoM	Bureau of Meteorology
CMA	Catchment Management Authority
CoAG	Council of Australian Governments
DELWP	Department of Environment, Land, Water and Planning
ECLs	East Coast Lows
EGFC	East Gippsland Floodplain Committee
EGFMS	East Gippsland Floodplain Management Strategy
EGCMA	East Gippsland Catchment Management Authority
EGSC	East Gippsland Shire Council
EMA	Emergency Management Australia
EMV	Emergency Management Victoria
FEP	Flood Emergency Plan
KEQ	Key Evaluation Question
LFG	Local Flood Guide
LIMP	Local Incident Management Plan
LSIO	Land Subject to Inundation Overlay
MFEP	Municipal Flood Emergency Plan
MEMP	Municipal Emergency Management Plan
MERI	Monitoring Evaluation Review and Improvement
MU	Management Units
TFWS	Total Flood Warning System
VFMS	Victorian Floodplain Management Strategy
VICSES	Victoria State Emergency Service
WSC	Wellington Shire Council

Glossary

Adapted from the Victorian Floodplain Management Strategy (DELWP 2016)

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^3/s has an AEP of 5%, it means that there is a 5% (one-in-20) chance of a flow of 500 m^3/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).

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.

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.

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 (see http://www.bom.gov.au/vic/flood/floodclass_south.shtml)

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 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 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 potentially, 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 refers to the risk a community is exposed to as a result of its location on the floodplain. Future flood risk refers to the risk that new development within a community is exposed to as a result of developing on the floodplain. Residual flood risk refers to the risk a community is exposed to after treatment measures have been implemented.

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 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.

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^3/sec). Flow is different from the speed or velocity of flow, which is a measure of how fast the water is moving, for example, metres per second (m/s).

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% Annual Exceedance Probability or five-year average recurrence interval flood event is once every five years on average (see also Annual Exceedance Probability, Average Recurrence Interval, likelihood and probability).

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 graphs 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 the risk.

Likelihood

A qualitative description of probability and frequency.

Mitigation

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

Municipal Flood Emergency Plan

A sub-plan of a flood-prone municipality's Municipal Emergency Management Plan. 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 emergencies

Planning Scheme

The *Planning and Environment Act 1987* provides for a single instrument of planning control for each municipality, the Planning Scheme, which sets out the way land may be used or

development. The Planning Scheme is a legal document, prepared and approved under the Act. It contains state and local planning policies, zones, overlays and other provisions that affect how land can be used and developed.

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 one, zero indicating an impossible outcome and one 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).

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 term of flooding is a combination of defining what threat exists and what steps are taken.

Victoria Planning Provisions

The Planning and Environment Act 1987 provides for the Victoria Planning Provisions, which is a template document of standard state provisions for all Planning Schemes to be derived from. It is not a planning scheme and does not apply to land.

1 Strategic context

1.1 Purpose of the EGFMS

The purpose of this regional strategy is to provide a single, regional planning document for floodplain management in the East Gippsland Catchment Management Region. The strategy was developed collaboratively with regional stakeholders to provide a regional program of priority actions for future investment.

The vision for the EGFMS is:

"*Communities, businesses and government agencies are aware of flooding in East Gippsland and are actively taking measures to manage their flood risks to minimise the consequences to life, property, community wellbeing, the economy and the environment*."

To achieve this vision, there are four objectives for the EGFMS:

1. To build a flood resilient community
2. To reduce existing flood risks
3. To avoid future flood risks
4. To manage residual flood risks

This strategy is supported by a series of technical documents that comprise:

- A detailed flood history
- A series of Rapid Flood Studies for several locations in East Gippsland
- A detailed Risk Assessment
- A Total Flood Warning Tool Assessment
- A comprehensive Development and Improvement Plan

1.2 Floodplains of the East Gippsland region

The East Gippsland Catchment Management Region covers an area of around 2.2 million hectares, comprising around 10% of Victoria. It contains four main river Basins (Mitchell, Tambo, Snowy and Far East Gippsland) and includes part of the Gippsland Lakes and the marine areas to a distance of 5.5 kilometres offshore (Figure 1). It includes most of the East Gippsland Shire, the northern part of the Wellington Shire and the southern-most part of the Alpine Shire.

Over 80% of the East Gippsland region is publically owned and vested in state forests, national and coastal parks and marine national parks. The region has retained much of its natural values and includes a wide variety of landscapes from the mountains of the Great Dividing Range to the Gippsland Lakes and the Southern Ocean.

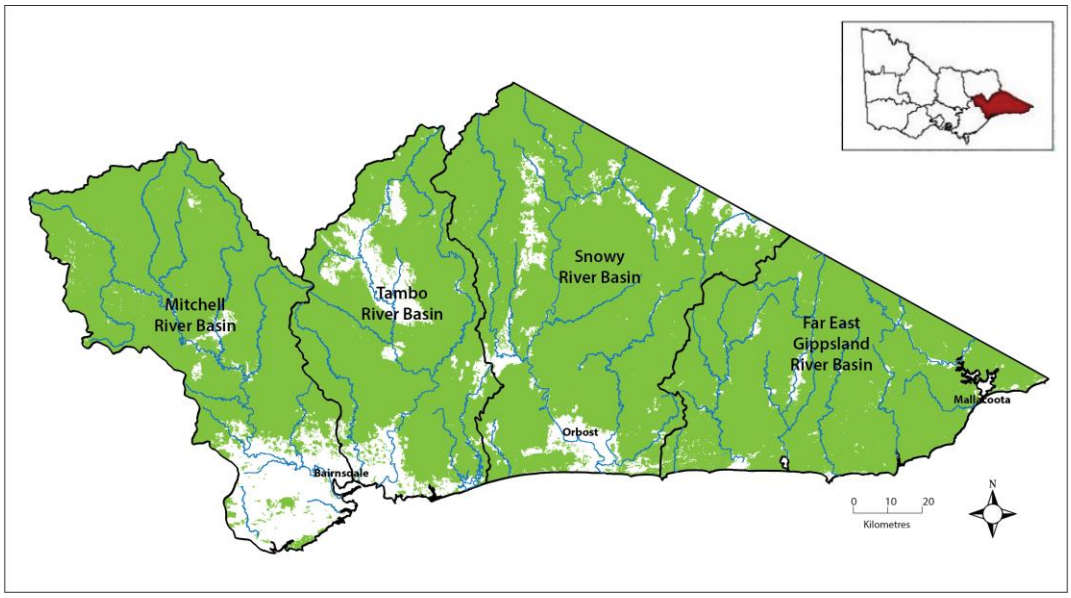

Figure 1: Map of the East Gippsland region (green represents uncleared native vegetation).

1.2.1 *Value of floodplains*

Floodplains are the areas adjacent to rivers that become inundated when the water flowing down the river exceeds channel capacity and overtops, spreading across the landscape. They are the link between aquatic and terrestrial environments and support many social, economic and environmental values, including:

- Flood water storage, reduction in flood flow velocity and flood water retention in low lying areas such as wetlands and billabongs
- Rich fertile soils which are important both for natural systems and agricultural production
- Biodiversity and habitat values, studies have shown that floodplains support 100 - 1000 times more species than rivers
- Improved water quality by filtering and retention of sediments and nutrients
- Open spaces and recreation opportunities, including tourism
- Desirable places to live beside rivers and lakes
- Aboriginal cultural values (Text Box 1 below)

The floodplains in East Gippsland provide all of these values. Private land covers 17% of the region, with grazing occupying the largest area and there are significant productive areas of irrigated horticulture and dairying on the floodplains of the Snowy and Mitchell rivers. In addition, many urban areas such as Lakes Entrance, Paynesville, Metung and Raymond Island are located on the floodplains of the Gippsland Lakes and its rivers.

Text Box 1: Aboriginal values of the floodplains of East Gippsland

The Gunaikurnai people have been custodians of the waterways in the Gippsland region, including the wetlands and rivers of the Ramsar site, for thousands of years. Waterways and their floodplains were, and remain important to Aboriginal people, providing food, materials for implements such as bark for canoes and meeting places.

"*In the past, our people cared for the waterways and kept them clean to ensure they were always a source of food and materials and could be used for cultural activities. The regular floods experienced in this region were an important way for the rivers and estuaries to be flushed out and kept clean. For our people the lesson about floods coming from Tiddalik the frog, who was too greedy with the water firstly causing drought and then flood with his bad behaviour." Mandy Leggett*

Photo (right): Scar-tree on the floodplain of the Mitchell River in Bairnsdale.

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 a 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. (Reproduced with permission of the Gunaikurnai Land and Water Aboriginal Corporation).

1.2.2 A history of floods in East Gippsland

Flood records for some major rivers in East Gippsland extend back to the late 1800s and indicate that flooding is a relatively regular occurrence in the region. It is not unusual for East Gippsland catchments to experience multiple floods within a single year. In contrast with much of the rest of the State of Victoria, there is no "flood season" in East Gippsland: large floods can and do occur within any month of the year.

Floods in East Gippsland are most often brought about by the development of East Coast Lows (ECLs). ECLs are intense low pressure systems that occur off the eastern coast of Australia, including the East Gippsland region of Victoria. They can form during a variety of weather conditions and at any time of the year, including the decay of tropical cyclones, or in the wake of a cold front moving into the Tasman Sea. ECLs are slow moving and bring widespread and intensive rainfall, high winds and very rough seas. They can be responsible for both floods in the catchments, as well as coastal inundation and flooding along the towns of the Gippsland Lakes.

Less frequently, floods in East Gippsland can be the result of frontal systems that deliver heavy rainfall along and to the south of the Great Dividing Range. Flooding from these latter events tends to be less severe (i.e. smaller floods) than from ECLs.

The differences in these main rain-producing weather systems, in combination with the geography and topography of the catchment, results in highly variable temporal and spatial patterns of flooding in the region. Floods may be wide scale, such as in June 1998 or more localised. This means that comparable rainfall depths and intensities at different times of the year and / or at different locations can result in a wide variety of flood responses.

A summary of the large floods experienced across the region is provided in Table 1 and in more detail in the accompanying technical document "Flood History of East Gippsland".

1.2.3 Floods in East Gippsland in the future

The flood history provides us with some indication of the likely future frequency and extent of flooding in the region, but we must also consider the potential effects of climate change on inland and coastal floods. The climate change modelling from CSIRO (Grose et al. 2015, Timbal et al. 2016[1]) indicates that there is likely to be lower average annual rainfall, increased temperatures and an increase in the frequency and duration of droughts in East Gippsland. While this may seem as though it may result in a decrease in the frequency and extent of floods, there is also a prediction for an increase in the frequency and intensity of rainfall events, which is likely to result in increased flooding in the region.

In addition, continued increase in sea levels and more frequent sea level extremes, including storm surge, is projected. This is likely to result in an increase in the frequency and severity of floods in East Gippsland towns on the Gippsland Lakes such as Lakes Entrance, Paynesville and Raymond Island (Bishop et al. 2014[2]) as well as towns on estuaries further east.

1.2.4 Floodplain management

This is the first formal floodplain management strategy for the East Gippsland region. Two previous regional floodplain management strategies were drafted (2001 and 2009), but never completed or formally endorsed. There has, however, been much work on flood and floodplain management in the region over the past two decades. This includes improving the knowledge base to inform flood and floodplain management (Text Box 2) as well as on ground actions. In particular, East Gippsland has adopted an integrated approach to

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[1] Grose, M., Abbs, D., Bhend, J., Chiew, F., Church, J., Ekstrom, M., Kirono, D., Lenton, A., Lucas, C., McInnes, K., Moise, A., MonselesanD., Mpelasoka, F., Webb, L., and Whetton, P. (2015). Southern Slopes Cluster Report, Climate Change in Australia Projections for Australia's Natural Resource Management Regions: Cluster Reports. *Edited by*M. Ekstrom, P. Whetton, C. Gerbing, M. Grose, L. Webb, and J. Risby. CSIRO and Bureau of Meteorology, Australia.

Timbal, B., Ekstrom, M., Fiddes, S., Grose, M., Kirono, D., Lim, E., Lucas, C., and Wilson, L. (2016). Climate Change Science and Victoria. Bureau of Meteorology, Melbourne, Victoria

[2] Bishop, W., Womersley, T., Mawer, J., and Ladson, A. (2014). Gippsland Lakes/90 Mile Beach Local Coastal Hazard Assessment Project: Report 2 Inundation Hazard. Water Technology.

floodplain management that includes building resilience to floods as well as improvements to waterway health (Text Box 3).

Table 1: Summary of large floods across East Gippsland.

Catchment	Largest recorded flood	Other major floods
Far East Gippsland Basin		
Genoa River	June 1978	
Cann River	February 1971	June 1974, June 1978, 1983 (March, May & October), September 1985, June 1998, June 2011
Bemm River	June 1998	June 1978, June 2011, June 2012
Snowy Basin		
Suggan Buggan River	March 2011	August 1974, April 1990
Buchan River	June 1978	February 1971, November 1988, June 1998, June 2012, July 2016
Brodribb River	June 1998	July 1925, June 1960, April 1978, December 1985, November 1988, June 2012, June 2014, July 2016
Snowy River	February 1971	February 1952, August 1974, June 1978, March 1983, November 1985, July 1991, June 1998, July 2011, March 2012, June 2012
Tambo Basin		
Timbarra River	June 2012	July 1984, October 1985, November 1988, June 1998, June 2007, July 2011,
Tambo River	June 1998	December 1893, June 1978, October 1985, November 1988, October 1993, June 2007, June 2012, July 2016
Nicholson River	June 2012	June 1978, April 1990, June 1998, June 2007, July 2016
Mitchell Basin		
Wonnangatta River	April 1990	September 1998, Jun3 2007, June 2012
Wentworth River	June 1998	July 1974, April 1990, June 2007, June 2012, July 2016
Dargo River	April 1990	July 1974, October 1993, 1998 (June & September), June 2007, June 2012
Mitchell River	December 1893	1936, December 1952, January 1971, June 1978, April 1990, June 1998, June 2007, June 2012, July 2016
Gippsland Lakes		
Lakes communities	1893	1952, 1978, 1998, 2007
Lakes Entrance	1952	1978, 1998, 2007

Text Box 2: Flood level modelling in the Gippsland Lakes

The Gippsland Lakes are a complex chain of coastal lagoons that receive freshwater inflows from seven major river systems and are connected to the Southern Ocean via the channel at Lakes Entrance. A number of towns and communities are located along the shorelines of the Lakes including Paynesville, Metung, Lakes Entrance and the community on Raymond Island.

Flooding in these towns and surrounding areas is a complex interaction of river inflows, tidal movement, sea level and local wind effects. In 2004, a study was completed to update the 1 % Annual Exceedence Probability (AEP), more commonly known as the 1 in 100 year event. Prior to this study, the only information was an estimate calculated in 1952.

The 2004 study, commissioned by East Gippsland CMA, and conducted by a team of experts led by Associate Professor Rodger Grayson from Melbourne University, developed a robust hydrological method that provided a sound and defensible basis for planning. The final results from the project were new estimates for the 1 in 100, 1 in 50 and 1 in 20 year flood levels for the Gippsland Lakes, that become legislated under the Water Act.

Photo: Rex Candy (Lakes Entrance, June 2007).

Text Box 3: Integrating waterway and floodplain management: Far East Gippsland

The Far East Basin includes the rivers and floodplains of the Cann, Thurra, Wingan, Betka and Genoa rivers. The river valleys rise in the forested uplands and flow to discharge through inlets and estuaries. Although the majority of the basin is public land (88%) the fertile floodplains support both dairying and beef cattle, as well as social values including bushwalking, camping and game hunting. Since 2004, significant effort has been made to improve floodplain and waterway health in the Far East Basin addressing erosion and river avulsion during flood events. Large areas of weed and willow control, revegetation, stock exclusion fencing and large wood structures have been installed.

While these efforts have improved river health in the region, they also have benefits to floodplains and flood management. Intact riparian vegetation slows floodwaters, decreasing their destructive power, and capturing loads of sediments. In addition, healthy native vegetation is more resilient to floods and requires less restoration following a flood event.

The before and after photos from the Cann River below, illustrate some of the achievements to date. The goal is for the Cann River Floodplain to be self-sustaining in the future requiring minimal intervention. Vegetated river banks will increase recreational and biodiversity values and the river will be resilient to moderate floods minimising impacts to agricultural production.

1.3 Relationship to other plans and strategies

The East Gippsland Floodplain Management Strategy (EGFMS) sits within a framework for the integrated management of catchments, including floods and floodplains at the State, regional and local level (Figure 2). At the national level Emergency Management Australia (EMA) is a division within the Attorney-General's Department and the Australian Government lead for disaster and emergency management. There are national programs and guides to support disaster management and promote resilience in Australian communities.

1.3.1 National

The Council of Australian Governments (COAG) adopted the National Strategy for Disaster Resilience in 2011. The strategy recognises that a national cooperative and coordinated approach is necessary to improve Australia's capacity to withstand and recover from emergencies such as fires and floods. It 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. If all these sectors work together with a united focus and a shared sense of responsibility to improve disaster resilience, they will be far more effective than the individual efforts.

In consideration of the national strategy, a series of five manuals providing guidance on best practice principles for flood and floodplain management have been produced: *Managing the floodplain* (Australian Emergency Manual [AEM] 19), *Flood preparedness* (AEM 20), *Flood warning* (AEM 21), *Flood response (AEM 22) and Emergency management planning for floods affected by dams* (AEM 23).

	Minister for Environment, Climate Change and Water			Minister for Planning	Minister for Emergency Services	
STATE	Victorian Coastal Council	DELWP	DELWP	DELWP	VICSES	Minister for Local Government
	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 2: State, regional and local responsibilities related to flood and floodplain management in Victoria (DELWP 2016).

1.3.2 Victorian Floodplain Management Strategy

In 2016, the Victorian Government released the Victorian Floodplain Management Strategy (VFMS, http://www.delwp.vic.gov.au/water/floods-and-floodplains/new-victorian-floodplain-management-strategy). The 2016 VFMS sets out actions and policies that will help to implement the Victorian Government's response to floods. It also clarifies institutional arrangements to ensure continual improvement in all aspects of floodplain management.

The VFMS responds to the National Strategy for Disaster Resilience 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 VFMS also follows the national approach set out in the *Australian Emergency Management Handbook* from a flood study to on-ground action, and will be achieved by local agencies through Regional Floodplain Management Strategies.

The EGFMS is the starting point for implementing the policies, actions and accountabilities of the VFMS to manage flood risks in the East Gippsland region. The main role of this regional strategy is to help all agencies with flood emergency management functions align their priorities in the form of rolling 3-year regional implementation plans.

The VFMS (and EGFMS) relate to floodplain management, which does not include rural drainage. Rural drainage is the collection and removal of water generated from local rainfall runoff from rural land prone to natural waterlogging. Victoria is developing a Rural Drainage Strategy to manage the hydraulic capacity of drainage lines and soils. The issues of rural drainage is not within the scope of the VFMS or the EGFMS.

1.3.3 Regional plans and strategies

The EGFMS seeks to be complementary to and consistent with the management of land and water in the East Gippsland region as guided by several key plans and strategies within the region.

The *East Gippsland Regional Catchment Management Strategy (2013 - 2019)* is the overarching strategy for the management of land, water and biodiversity in East Gippsland. In

line with the requirements of the *Catchment and Land Protection Act 1994* (CaLP Act), the principal objectives of the strategy are to:

- establish a framework for the integrated and coordinated management of catchments; and,
- establish processes that can be used to assess the condition of the region's land and water resources, and the effectiveness of land protection measures.

The *East Gippsland Waterway Strategy (2014 - 2022)* sits under the Regional Catchment Management Strategy and provides the framework for the management of rivers, streams, estuaries and wetlands in the region. The vision of the Waterway Strategy is:

The East Gippsland's rivers, estuaries and wetlands are valued and well-managed, so that communities can enjoy the current and future benefits that healthy waterways provide.

The Waterway Strategy recognises the impacts of floods on waterway condition and the values these provide to communities, the economy and the environment. It provides some actions for the management of riparian and floodplain areas aimed at improving the stability and health of waterways that will need to be complemented by the actions of the EGFMS.

The Gippsland Regional Coastal Plan 2015 - 2020 has been developed by the Gippsland Coastal Board and provides the framework for the management of coastal land across the region. It identifies coastal flooding as a risk to coastal values and proposes a number of actions to mitigate the effects of flooding and erosion through increased knowledge and adaptation planning.

The West Gippsland Floodplain Management Strategy has been developed by the West Gippsland CMA for the management of flood risks in the West Gippsland Catchment Management region. Where relevant, the EGFMS seeks to be complementary to the WGFMS, particularly in the Gippsland Lakes area. The two strategies were developed in parallel and with cooperation between the two CMAs and associated delivery partners.

1.3.4 Local and municipal strategies

The EGFMS is also linked to a number of Local and Municipal Level strategies that are developed by Local Government in partnership with the community and a range of stakeholders. This includes:

*Municipal Planning Schemes and Strategic Statement*s. These documents include a range of policy approaches that are designed to guide decision making across municipalities. The EGFMS is a key document supporting sound approaches to decision making where land is identified as being subject to flooding, but also places the decision making in the context of broader strategic outcomes sought in particular townships and localities.

Municipal Emergency Management Plans: These documents are prepared by Councils in partnership with a wide range of agencies and organisations involved in Emergency Management activities. They are a legal obligation under the Emergency Management Act. The EGFMS provides context for the way that Councils will work together to plan for, respond to, and recover from events including flooding.

In East Gippsland Shire, the EGFMS also supports the development of locally focussed *Local Incident Management Plans*, which are designed to enable communities to come together to understand their risk exposure and to plan for the way that they will manage events that they might experience.

Community Plans, Master Plans and Township Structure Plans: Local Councils develop a range of plans, together with the community, that provide guidance about the future development needs, direction and physical environment. Flooding is one constraint that is used to guide the development of these plans and they are important because the provide land owners and other stakeholders with broader guidance about preferred long term development outcomes. These documents are frequently used to update policy intent set out in Planning Schemes and Municipal Strategic Statements.

1.4 How this strategy was developed

The East Gippsland Catchment Management Authority (EGCMA) in collaboration with the East Gippsland and Wellington Shire Councils, VICSES, local communities and other

agencies has developed this EGFMS. In doing so, they have adopted an integrated catchment management approach that manages floods and floodplains together with waterways, and the social, economic and environmental values they support.

The EGFMS development process is illustrated in Figure 3. The vision and objectives for regional flood management provide the overarching context to the strategy. The first step was an assessment of flood risks across the region (see Chapter 2). Those risks were then assessed against existing flood mitigation measures and the regional community's tolerance for those risks (see Chapter 3). A range of mitigation measures for intolerable risks were then explored, before a prioritised list of actions was developed (see Chapter 4). Priority has been given to measures that do the most to minimise the difference between existing flood risks, the community's willingness to accept those risks and can be implemented at least cost.

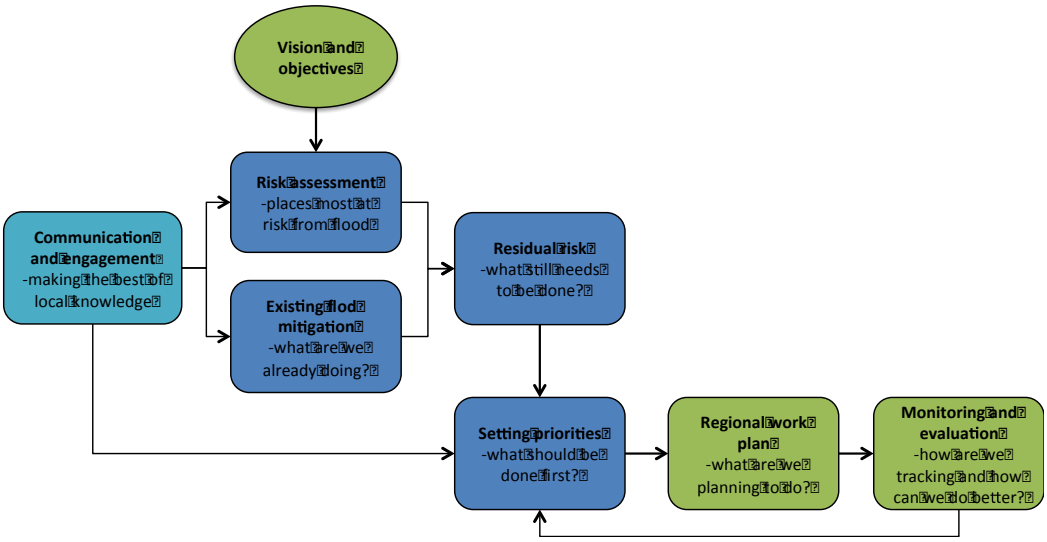


Figure 3: The process for developing the EGFMS (adapted from the Regional Floodplain Management Strategy Guidelines, DELWP 2016).

1.4.1 Principles

Evidence based approach to decision making - best available knowledge has been used to underpin the development of this strategy including the risk assessment and identification and prioritisation of mitigation actions and strategies

Integrating waterway and floodplain management - flood management is just one of several aspects of managing waterways and floodplains in the East Gippsland region. This strategy is cognisant of, and consistent with the actions of strategies for waterway management as provided by the East Gippsland Waterway Strategy to ensure that management actions are complementary and integrated.

Adaptive management - a monitoring evaluation review and improvement process has been built into this strategy to allow for continued improvement and to learn from implementation.

Inclusive with community and stakeholders - this strategy has been developed with the input of a broad range of stakeholders through every phase

Resilience of communities, industries and the environment - this strategy recognises that preventing large floods is not possible and that the region needs to increase its resilience to floods that have and will continue to occur in the region.

1.4.2 Communication and engagement

The importance of stakeholder engagement in the development of management plans and strategies is recognised in the VFMS and the East Gippsland Regional Catchment Strategy. A communication and engagement plan was developed prior to commencing development of the EGFMS, which is consistent with the East Gippsland CMA Communication and Engagement Strategy. Stakeholders were involved in all aspects of the development of the EGFMS (Table 2).

The major groups involved in the development of the EGFMS were:

1. *Project Steering Committee (PSC):* Representatives of agencies primarily responsible for the management of floods and floodplains in the East Gippsland Region:
   - East Gippsland Shire Council (Chair)
   - VICSES Gippsland region
   - Wellington Shire Council
   - East Gippsland CMA
   - Department of Environment, Land, Water and Planning (observer)
   - West Gippsland CMA (observer)

2. *Working Group:* Representatives of organisations and agencies that have an interest and responsibility in management of floods and floodplains in the East Gippsland Region:
   - Technical staff from East Gippsland Shire Council (planning, infrastructure and emergency management)
   - Regional staff and volunteers from VICSES
   - East Gippsland Water
   - Emergency Management Victoria
   - Gippsland Ports
   - Gunaikurnai Traditional Owners Land Management Board
   - Gunaikurnai Land and Water Aboriginal Council
   - Parks Victoria
   - Public Transport Victoria
   - Southern Rural Water
   - SPS AusNet
   - VicRoads
   - Telstra
   - VLine

3. *Community:* Broader community and stakeholder engagement through the EGCMA website and social media and a series of community forums.

Table 2: Summary of stakeholder engagement activities associated with the development of the EGFMS.

Task	Approach	Communication and engagement	Outputs
Assessment of flood risks	DELWP rapid appraisal of flood risk at the management unit scale	Series of regional meetings with stakeholders including: VICSES Unit Controllers and volunteers. Workshop with Project Steering Committee and Working Group to refine risk ratings	Agreed risk ratings for management units across East Gippsland Catchment Management Region
Existing mitigation measures	Identification of existing flood mitigation measures including infrastructure, warning systems, planning schemes and emergency plans at the management unit scale.	Series of regional meetings with stakeholders including: VICSES Unit Controllers and volunteers, technical staff from East Gippsland Shire and Vic Roads.	Documented existing mitigation and residual risk for management units across East Gippsland Catchment Management Region
Development and improvement plan	Identification and prioritisation of actions to be implemented in the next three years and beyond	Workshop with Project Steering Committee and Working Group to refine prioritised actions.	Agreed development and improvement plan with actions, sequencing and lead agency identified.
Draft and Final EGFMS	Draft EGFMS available for public comment for a one month period.	Briefings with relevant agencies Open House events in Orbost and Bairnsdale Individual briefings on request	Final EGFMS

2 Regional risk assessment

2.1 Method

2.1.1 How do floods create risk?

Urban and agricultural development on floodplains place communities, livelihoods, and infrastructure at risk. Floods have the potential to cause significant damages because floodwaters can be deep, fast moving and widespread. This can cause hazard to human life, and also impact the built environment. Understanding potential damages that result from floods is an important first step to prioritising flood risk management options.

Damages from flooding are generally grouped as:

- **Direct (tangible) damages** comprise the impact of the flood upon physical assets, for example, damages to structure and contents of buildings, agricultural enterprises and regional infrastructure.
- **Indirect (tangible) damages** comprise losses from disruption of normal economic and social activities that arise as a consequence of the physical impact of the flood; for example, costs associated with emergency response, clean-up, and disruption to transport and commerce.
- **Intangibles or 'non-market' impacts** comprise losses, which cannot readily be quantified in monetary terms. For example, loss in biodiversity, physical injury or increased stress levels for residents following a major flood event.

Potential flood damages can change over time due to changes to land use, development, or climate and the risks presented here are based on our knowledge of the East Gippsland Catchment at present, and do not factor in potential future changes in population, land use, or climate.

Risks from flooding are created by people's interactions with floodplains and are commonly understood as the combination of both the likelihood and the consequences of flooding (Figure 4).

Figure 4: Understanding flood risk

The **likelihood of flooding** is the probability that a specific flood event (e.g. a flood that has a one percent probability of occurring in any given year) or range of events will occur. Likelihood can range from unlikely to very likely. The **consequence of flooding** is an evaluation of the potential outcome of a flood event in terms of loss, injury, disadvantage or gain. Consequence can be rated from low to severe.

The interaction between the likelihood and consequence of flooding determines the magnitude of flood risk. For example, land that experiences frequent, fast flowing flooding is likely to be better suited to development as urban parkland than for commercial space. This example underlines that while the likelihood of flooding is the same, the potential damages (consequences) of flooding are very different.

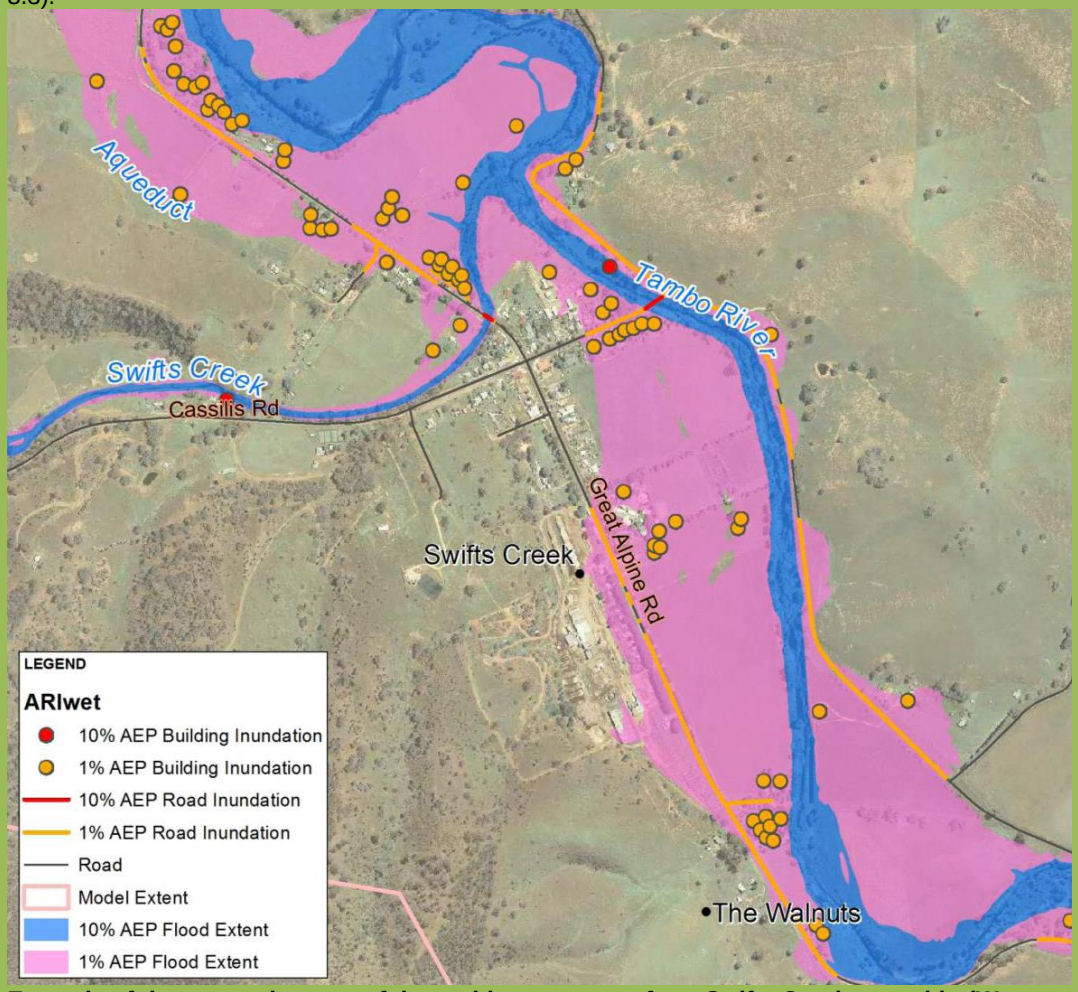
2.1.2 Rapid Appraisal

DELWP's rapid appraisal of flood risk methodology was used to assess flood risks at a regional level. The methodology was developed to provide a simplified appraisal tool that can be used to rapidly gain an understanding of flood risk with an appropriate level of reliability (that is, it provides a preliminary estimate of flood risk).

An assessment of flood risk was undertaken across the East Gippsland region in early 2016 using DELWP's methodology (Aither 2016). A number of information gaps were identified during this assessment, particularly for upper and eastern catchments. In response, additional flood investigations were completed and the results of the original assessment were updated using revised flood data.

Text Box 4: Rapid Estimation of Flood Risk in Upland Floodplain Areas

While there has been work completed on modelling and mapping flood extents in parts of the East Gippsland region, such as the areas around the Gippsland Lakes, little information was available to assess flood risks to upland catchments and areas in the far east of the region. Detailed hydrological models and flood risk assessments can be costly and time consuming. Therefore, a new method was developed and tested to provide a rapid, fit for purpose, cost effective technique. The method was applied to eight upland areas in the East Gippsland Region and proved effective at providing information to assess flood risks, modelling 1% and 10% flood extents and identifying buildings and roads that may be impacted. This information was used to refine the risk assessments for the EGFMS. Noting that this assessment was preliminary and any actions to mitigate risks would require further information and consultation with stakeholders and local communities (see section 3.3).



Example of the mapped output of the rapid assessment from Swifts Creek township (Water Technology 2017).

Establishing regions and management units

To better understand and characterise flood risk, the East Gippsland Catchment Management Region was divided into three broad areas based on floodplain and flood characteristics:

The Gippsland Lakes - communities that live around the Gippsland Lakes, where riverine floods rise slowly and persist and there are added risks from rising Lake waters.

The Lowlands - communities that live in the lower catchments on the alluvial floodplains such as the Mitchell River Flats, with high value agricultural lands, as well as those that live on estuaries such as Mallacoota and Bemm River.

The Uplands - communities that live in the largely forested upland catchments where floodwaters arrive soon after rainfall and move rapidly through the landscape.

Within each of these broad areas, smaller 'management units' were identified and mapped based on different factors including towns, land use, waterways and flood behaviour. Defining management units allows for flood risk to be assessed in a manageable and systematic way. It also allows for the outputs of the assessment to be more effectively communicated and used to inform flood management actions. In the East Gippsland region, there are 31 urban and 39 rural management units (see Figure 5 and Appendix A).

Measures of flood risk

Given differences in the size of each management unit, it is necessary to develop consistent ways of representing flood risk so that damages can be compared. There is no one risk measure that is likely to best capture the severity of flood risk within a management unit.

For the study undertaken in East Gippsland, the flood risk within each management unit was assessed using three measures:

- **Absolute damage** – the estimated yearly average cost of floods, taking into account the possible damage from different sized floods, and how often they are expected to happen. This is also known as Annual Average Damages (AAD)
- **Damage density** – refers to how concentrated damages are in a specific area for a less common flood (1% AEP flood extent)
- **Town resilience** – the proportion of town population affected.

Approach to presenting flood risks from the rapid appraisal

The three measures of flood risk (absolute damage, damage density and town resilience) are assigned a score from 1 to 6; where 6.0 is an extreme risk and 1.0 is a low level of risk. These scores are then used to rank risks into three categories: high, medium and low. Urban and rural management units are assigned a risk rating using a different scale to account for differences in population density. Urban and rural management units are presented as low, medium or high risk based on the average score of the three measures. The ranking approach to flood risk is provided in Table 3.

Table 3: Tiered approach to flood risk for urban and rural management units.

Urban units	Rural units	Flood risk
Average score for all three measures is > 3	Average score for all three measures is > 2	High
Average score for all three measures is 2 - 3	A score for any measure is > 2	Medium
Average score for all three measures is < 2	Scores for all measures < 2	Low

Limitations

The rapid appraisal of flood risk method is a useful and reliable framework for quickly determining flood risk at a local scale to inform regional priority setting. However, the nature of the rapid assessment is such that it cannot provide a complete picture of flood risk for a region. For example, in some cases, available datasets are unable to capture where mitigation works have been undertaken subsequent to the flood study, or where flood risk is already well understood and mitigation measure are planned or implemented.

The method does not account for essential infrastructure, which may result in a greater level of flood risk for some management units or pose risk across the broader region. In addition,

the method does not consider populations that may be more or less vulnerable to flooding (such as the elderly), or community values and tolerance to flood risk. All of these factors will affect the extent to which certain flood management actions are appropriate or adequate at the local scale.

The rapid appraisal method does not consider:

- essential infrastructure
- vulnerable populations
- seasonal population changes due to tourism
- flood risk where flood hazard data is absent
- areas of higher risk to life (e.g. floodways)
- areas intended for future development or land use change
- community values and tolerance to flood risk
- existing or planned mitigation measures
- potential climate change.

2.1.3 Stakeholder involvement

The outputs of the rapid appraisal of flood risks were tested through a stakeholder workshop held in Bairnsdale on March 15, 2017 and a series of meetings with individuals and representatives of agencies and organisations with a role in emergency management in the region. At the workshop and meetings local and expert knowledge of factors which affect flood risk were considered for each management unit and for the region as a whole. This included the identification of important regional and community infrastructure within floodplains in the region, seasonal population changes due to tourism and vulnerable populations such as aged care facilities.

While flood risk for most management units in the East Gippsland Catchment Management Region remained consistent with the results of the rapid appraisal, a more nuanced understanding of the likelihood and consequence of flood damages informs the extent to which particular mitigation strategies are proposed. For example, the extent of community awareness and preparedness for flooding within management units of the same risk rating may require different strategies to ensure that the response to flood risk is appropriate and adequate.

This process confirmed that in the East Gippsland Catchment Management Region there is no essential infrastructure that is likely to be significantly impacted by floods up to the 1% AEP[3]. There were however, several minor refinements to risk ratings in a small number of management units as follows:

- **Swifts Creek** was increased from low to high flood risk on the basis of the number of buildings impacted by 10% and 1% AEP flood.
- **Gipsy Point, Cann River, Lower Nicholson River and Kalimna** were reduced from a high rating to a moderate rating based on local knowledge of the elevation of dwellings and the number of buildings that would actually be impacted by a 1% AEP flood.

2.2 Flood risks in East Gippsland

The risk assessment (including stakeholder inputs) identified 29 management units within the high or medium risk tiers (Figure 5). These higher risk areas are spread across the three broad areas, but unsurprisingly there are more high and medium risks from floods in the Lowlands and Gippsland Lakes where floodwaters can persist for longer periods (Table 4). The communities identified as being most at risk are largely urban (approximately 80% of the identified high and medium risk management units). This is due to the higher density of populations and buildings in these areas, and consequent damages from flood, than in most rural areas.

[3] While there may be loss of power and / or telecommunications, there are no hospitals, aged care facilities, power stations or sub-stations within the 1% AEP.

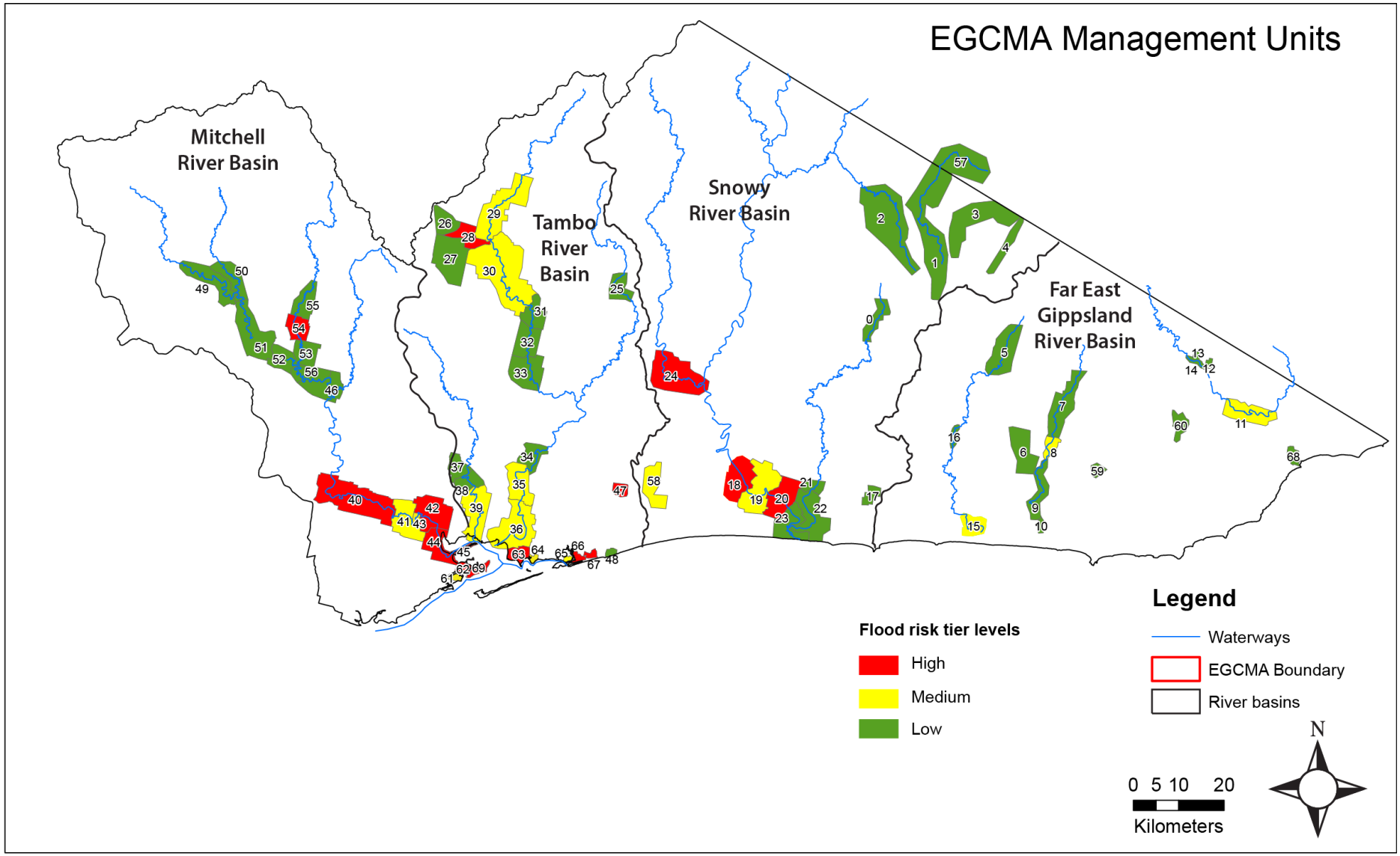


Figure 5: Relative risk ratings for management units in East Gippsland (see Appendix A for a list of management units and more details on risks).

Table 4: Management units within the high or medium flood risk tiers.

ID	Name	Urban/ rural	Region	Risk tier
8	Cann River	Urban	Lowlands	Medium
11	Genoa/Gipsy Point	Urban	Lowlands	Medium
15	Bemm River	Urban	Lowlands	Medium
18	Bete Bolong	Rural	Lowlands	High
19	Orbost	Urban	Lowlands	Medium
20	Orbost East	Rural	Lowlands	High
24	Buchan River	Urban	Uplands	High
28	Swifts Creek	Urban	Uplands	High
29	Upper Tambo River	Rural	Uplands	Medium
30	Central Tambo River	Urban	Uplands	Medium
35	Bruthen	Urban	Lowlands	Medium
36	Lower Tambo River	Urban	Lowlands	Medium
39	Lower Nicholson River	Urban	Lowlands	Medium
40	Mitchell River at Glenaladale	Rural	Lowlands	High
41	Mitchell River at Rosehill	Rural	Lowlands	Medium
42	Bairnsdale	Urban	Lowlands	High
43	Bairnsdale Central	Urban	Lowlands	Medium
44	Lower Mitchell River	Urban	Gippsland Lakes	High
47	Nowa Nowa	Urban	Lowlands	High
54	Dargo River Central	Urban	Uplands	High
58	Hospital Creek	Rural	Uplands	Medium
61	Newlands Arms	Urban	Gippsland Lakes	Medium
62	Paynesville	Urban	Gippsland Lakes	High
63	Metung	Urban	Gippsland Lakes	High
64	Nungurner	Urban	Gippsland Lakes	Medium
65	Kalimna	Urban	Gippsland Lakes	Medium
66	Lakes Entrance	Urban	Gippsland Lakes	High
67	Cunninghame	Urban	Gippsland Lakes	Medium
69	Raymond Island	Urban	Gippsland Lakes	High

2.2.1 Regional scale flood risks

There are several flood related risks that are common to the three broad areas within East Gippsland (or management units within these areas). Some, such as road closures and access can activate at a regional scale across large areas during a major flood, others such as seasonal variability in populations affect individual localities and towns, across the region.

Roads and access

Flood events can impact a number of management units across East Gippsland, and cause impacts beyond the region. For example, there are a number of places across the catchment where the Princes Highway can be inundated and subsequently closed due to flooding, such as Bairnsdale, Orbost, Swan Reach and Cann River. Limited alternative road infrastructure

connecting the region requires a coordinated approach to ensure that connection between towns and larger regional towns and cities is retained.

Flood events in one management unit can also have significant impacts on other management units. For example, residents may live in Lakes Entrance, but work in Bairnsdale. A flood in Lakes Entrance that cuts roads will have impacts for businesses in Bairnsdale. The combined effects of road closures on people getting to work, school bus route closures, school closures and general lack of access disrupts living, income and businesses across multiple management units.

Seasonal populations

Many management units have a high number of tourists or semi-permanent residents that can dramatically increase the population at certain times of the year such as summer or holiday periods. As a result, there may be heightened flood risk during certain peak periods, which must be accounted for. Seasonal spikes in population increases the proportion of population at risk of flooding. Longer term economic impacts of flooding on regional centres can also be significant if floods occur during peak holiday season as the gains from tourism are foregone.

Important regional and community infrastructure

Impacts on important infrastructure including energy and water utilities, services such as schools and hospitals and transport infrastructure can also pose a high degree of localised flood risk for communities. There was no essential infrastructure identified as affected by the 1% AEP. The historical frequency of floods in the region has resulted in good examples of planning for vulnerable communities (such as aged care facilities) and important infrastructure such as hospitals, electricity and water supply services.

Climate change

Climate change predictions are for drier and hotter conditions in southern Victoria (Timball et al. 2016[4]). While this might seem to mean that flood frequency will be reduced, there is also a prediction of an increase in the frequency and intensity of storm events. This may lead to more frequent floods in parts of the East Gippsland Catchment Management Region. This is not accounted for in current flood modelling and in the rapid risk assessment. This is a knowledge gap that we need to consider for future flood emergency planning.

Environmental impacts of floods

Floods are a natural occurrence and natural systems have some resilience to floods and flooding, particularly on floodplains. Alterations to the natural environment can affect the risks to the environment from floods both from direct impacts and from reduced resilience and recovery. Clearing of native riparian vegetation, for example, can increase the velocity of water moving across the floodplain and reduce bank stability resulting in erosion and channel avulsion.

The Gippsland lakes are an internationally important wetland system and the receiving water body for seven major river systems. Floodwaters can carry nutrients, sediments and debris into the Lakes and this can have ecological effects. In 2006/7 there were significant floods that followed large bushfires in the region It is estimated that three times the average annual load of phosphorus and over twice the average annual load of nitrogen entered the lakes after intense rainfall fell on burned catchments mobilising large amounts of sediment and associated nutrients.

2.2.2 Gippsland Lakes flood risks

Urban areas around the Gippsland Lakes were among the highest risk areas from floods and flood related impacts. Raymond Island, Paynesville, Lakes Entrance and Metung scored highly under all risk measures and were among the highest risk management units in the region. Raymond Island, Paynesville and Lakes Entrance all have significant amounts of urban area affected by flood inundation. Higher absolute damage ratings are expected as there are generally a larger number of residential, commercial and urban buildings and

[4] Timbal, B., Ekstrom, M., Fiddes, S., Grose, M., Kirono, D., Lim, E., Lucas, C., and Wilson, L. (2016). Climate Change Science and Victoria. Bureau of Meteorology, Melbourne, Victoria.

people affected as a result of flooding in these areas. With the exception of Raymond Island (where inundation is more extensive), the area inundated by the 1 % AEP event is less than 1.5 square kilometres, which results in a greater density of estimated damages because the damages are highly-focused. This is particularly true for Metung, which has a relatively small proportion of land inundated by flooding, but the potential for damage is quite high.

Sea level rise

Future sea level rise is "virtually certain" to occur under most climate change modelling scenarios. The Gippsland Lakes Coastal Hazard Assessment (Bishop et al. 2014[5]) predicted an increase in the depth of inundation during flood events in the majority of communities around the Gippsland Lakes. This increase, while variable across the Gippsland Lakes, is estimated to be more than 0.8 metres for Lakes Entrance by 2100.

Flooding in the Gippsland Lakes communities is very complex and while flooding of East Gippsland towns on the Lakes is mostly related to inflows from the Mitchell, Nicholson and Tambo Rivers, lake waters can also rise due to flooding in rivers from the West Gippsland Catchment that flow into the system (i.e. Latrobe, Thomson, Macalister and Avon Rivers). In addition, duration of floods is dependent on entrance conditions and the time that it takes for flood waters to flow out to sea. Climate change projections indicate that flood events may have longer durations and are likely to occur more frequently.

Human health risks

Impacts on electricity supply are an issue that may be experienced in all management units but is highlighted with regard to the relatively more built up urban areas including Raymond Island, Paynesville and Lakes Entrance. Blackouts in these management units can cause pump failure for sewerage systems leading to leakage into adjacent waters. Residents are advised to take appropriate action. The effect of untreated sewage on human health is of concern and a risk that needs to be addressed.

Boats and moorings

Communities on the Lakes share a common issue of absentee owners with boats moored in the Lakes (for example Paynesville, Metung). These owners may be unaware of or unable to deal with rising floodwaters. As a result, Gippsland Ports or East Gippsland Shire Council, as the operators of berthing facilities, manage these vessels in flood conditions. This may redirect resources away from other recovery and relief activities and prolong the impacts felt by community members.

Communities on the Lakes also share the problem of large amounts of debris entering the system during a flood event, which can cause damage to infrastructure and vessels. Gippsland Ports spends significant resources on clean-up, however debris can be an ongoing hazard after a flood.

2.2.3 Lowland flood risks

Risks from floods in the lowland area of the East Gippsland Catchment Management Region are predominantly through two pathways:

- Impacts on agricultural lands in alluvial floodplains; and
- Impacts to communities that live on floodplains and near to estuaries.

Impacts to agriculture

High risk ratings in rural management areas (such as Mitchell River at Glenaladale, Bete Bolong and Orbost East) primarily stem from significant damages to agriculture that occurs when high value agricultural land is inundated by flooding. Despite being a predominantly urban management unit, Lower Mitchell River exhibits some damages to grazing land and limited horticulture. There are few assets located on the floodplain that are affected by flooding. The condition of flood mitigation levees and drainage infrastructure can also pose serious risk to rural communities. For example, the levee at Bete Bolong has no effective maintenance regime, which are likely to affect its reliability during flood events. Stakeholders

[5] Bishop, W., Womersley, T., Mawer, J., and Ladson, A. (2014). Gippsland Lakes/90 Mile Beach Local Coastal Hazard Assessment Project: Report 2 Inundation Hazard. Water Technology.

indicate that while damages to livelihoods and agricultural industries are at high risk from flooding, rural communities generally understand flood risks relevant to them and how to respond appropriately.

Communities on or around estuaries

Communities that live in proximity to estuaries may face similar issues. Closed estuaries during flooding can exacerbate the extent of floodwaters which can increase potential flood risk. Current Estuary Opening Protocols do not consider urgent artificial openings of estuaries during flood events and the potential safety issues associated with this.

2.2.4 Upland flood risks

The majority of the knowledge gaps associated with the rapid appraisal method occur in very small upland communities such as Delegate River, (including the NSW reach); Thurra River and Tamboon Inlet. These communities have no data with which to predict flood risk. Stakeholder consultation, however, indicated that these small communities are probably not at high risk of flood impacts. Nevertheless, these knowledge gaps have been noted.

There are few high risk management units in the upland areas. This is largely due to small community sizes, rapid recession of floodwaters and communities in these areas learning from past floods and ensuring that houses and other infrastructure are not on the narrow floodplains.

The exceptions to this are the towns of Swifts Creek and Dargo, which recent flood modelling has shown are at high risk from moderate and major floods. These communities are remote and access during and following a flood can be poor. Floodwaters move swiftly and can have destructive force, with clean up of debris and damage to roads and bridges a potential problem.

3 Analysing risk treatment service levels

3.1 Method

3.1.1 What are we already doing versus what needs to be done?

The outputs of the risk assessment were used as a starting point in identifying management units potentially requiring the reduction of risk through risk treatment measures (mitigation measures). Risks can be considered in three categories (Standards Australia and Standards New Zealand 2006; Figure 6):

- Risks that are at an acceptable level, and do not need to be considered further (i.e. low risks that are a combination of very unlikely events and small impacts or consequences).
- Risks that are currently too high to be acceptable, and for which risk treatment measures have to be considered to bring them to an acceptable level. These risks are sometimes referred to as ' tolerable', because they are tolerated under specific circumstances or for a specified time.
- Risks that are unacceptable in any circumstances or at any level (intolerable).

No amount of mitigation or action will entirely remove the risks from flooding. What is required is to instigate sufficient mitigation measures to reduce the risks of flooding to an acceptable or tolerable level.

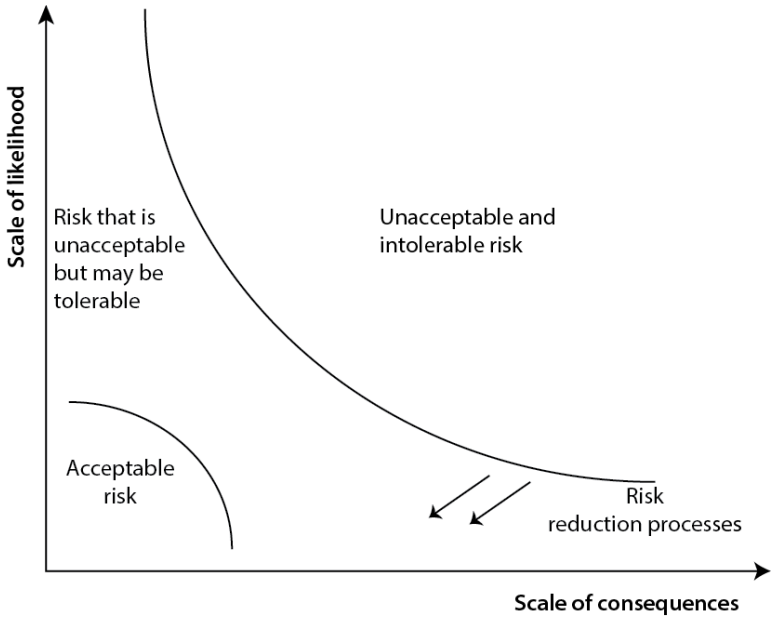


Figure 6: Characterisation of risks (Standards Australia and Standards New Zealand 2006).

The process of identifying what additional measures are required compares the level of risk (from the risk assessment) with current mitigation measures to determine if the residual risk is tolerable or additional mitigation is required.

3.1.2 Understanding existing mitigation measures

Existing flood mitigation measures were identified through two key processes:

1. Review of existing information including
   - Flood risk studies;
   - Flood risk assessments;
   - Planning schemes and Building Act regulations;
   - Flood warning arrangements;
   - Emergency management planning;
   - Road closure data.

2. Gathering local knowledge, through targeted conversations with:
    - VICSES
    - East Gippsland Shire Council
    - Wellington Shire Council
    - V/Line
    - VicRoads
    - East Gippsland Water

3.2 Overview of mitigation in East Gippsland

The purpose of flood mitigation is to reduce the risk to life and property. Mitigation measures can be categorised as follows:

- Structural; and
- Non-structural, which can be broken down further into:
    - Planning scheme controls
    - Flood warning systems
    - Emergency management planning

Structural measures aim to keep water away from people and property. They alter the flow of water and include measures for riverine flooding such as dams, retarding basins, levees, flow diversion channels, and backflow devices.

Non-structural measures recognise the value of floodplains and their processes as well as the economic and social benefits that flow from their development. The emphasis is on modifying how the floodplain is developed or used, rather than physically modifying the floodplain or flow of water. This is achieved through activities such as awareness campaigns, education, warning systems, planning and land management. By changing the way we react to floods and flood risks we can drastically reduce the social, environmental and economic impacts of floods.

3.2.1 Structural flood mitigation

Levees

While there are a number of levees in the region (e.g. on the floodplains of the lower Tambo, Snowy and Cann Rivers) on both private and public land, none have a formal flood mitigation role. Standards of design and construction are unknown, and no formal maintenance regimes are in place. As a result, they provide no assured 'level of service' during large flood events and cannot be relied on to mitigate the impacts of large floods.

Many of these levees do have some beneficial function during frequent smaller 'nuisance' type floods. In concert with drainage works, they can reduce the frequency of flooding across productive land and can reduce the likelihood of river channel instability.

Transport infrastructure

Locations where roads are closed due to flooding are known from a variety of sources including Municipal Flood Emergency Plans (FEPs), FloodZoom and some flood studies from the region. This information, however, is often limited to the location of a closure and at best may be linked to a river gauge height so that it is known that when the river reaches a certain level, a point in the road network is likely to be flooded. Generally, levels of flood immunity and closure durations of the road network are not well understood, especially across larger scales and the regional road network. Understanding the flood immunity and closure durations is important to understand weak links and ensure appropriate service levels are maintained. Priority locations identified by stakeholders include the Great Alpine Road, Monaro Highway and the Prince's Highway east of Bairnsdale.

3.2.2 Planning scheme controls

Planning Schemes include a range of mechanisms to support effective decision making through the inclusion of controls over land use and development where there is an identified constraint that is designed to trigger the need for a planning permit.

Land Subject to Inundation Overlays (LSIO) is an Overlay control included in the municipal Planning Scheme and is the mechanism currently in place in parts of East Gippsland to

identify land in an area affected by the 1% AEP flood. The LSIO sets out the type of development that requires approval in areas that flood by requiring that a Planning Permit be obtained. This allows both Council and the relevant Floodplain Manager to assess the proposal having regard for the implications for the floodplain, and to ensure that any new development or infrastructure does not cause localized impacts including a rise in flood level or flow velocity. Implications for river and wetland health are also considered.

East Gippsland and Wellington Shire Councils refer development applications that fall within the LSIO to the EGCMA for assessment and advice in respect to the application of permit conditions pertaining to flooding. Conditions relating to measures such as minimum floor levels, minimum fill levels, land zoning based on flood hazard, building requirements such as material types and structural integrity, and access and egress requirements are frequently included where development can logically be approved.

LSIO are included in the planning scheme for the following areas in East Gippsland:

- Gippsland Lakes;
- Mitchell Basin - from approximately Glenaladale downstream to Gippsland Lakes; Tambo Basin - from approximately Princes Highway downstream to Gippsland Lakes; and
- Snowy River Basin - from approximately eight kilometres upstream of Orbost downstream to the coastline.

Most of the current LSIOs in Gippsland are based on historical information including outputs from studies completed in 2000 (Flood Data Transfer Project). Since that time there have been several investigations that have improved flood mapping and these are discussed in section 3.3 with respect to each of the broad flood areas in East Gippsland.

3.2.3 Total Flood Warning System (TFWS) services

Flood warning systems are aimed at enabling and persuading people and organisations to take action to increase personal safety and reduce the damage caused by floods. They are an integral part of emergency and floodplain management. To function effectively they must be able to alert at-risk communities to coming floods and their severity in ways that are understood and which result in appropriate flood damage reducing behaviours.

Implementing or improving a flood warning system includes adequate rain and river gauges, to provide information on approaching floods, a flood forecasting tool, and provision of adequate information to businesses and households on how to prepare for a flood, what to do during a flood and recovery from floods.

There are several guides available for residents of and visitors to East Gippsland that help improve flood preparedness. The Local Incident Management Plan (LIMP) is a simple document developed by communities to ensure residents and visitors know where to go, what to take and what to expect if a significant incident affects the area. It covers a range of incidents such as fire and flood and provides links to where additional information can be sought. LIMPs are issued to all households and displayed in all lodgings within a district and reviewed each year, to ensure the details are accurate and timely. Local Flood Guides (LFGs) are developed by VICSES for residents and business owners to explain local flood risks for communities at risk and advise on how to prepare for and respond to flood events.

The Total Flood Warning Service (TFWS) concept is a mechanism used in Victoria to assess whether services related to flood warning and preparedness are matched to the severity of the risk from flooding at the local scale. For the purposes of this strategy, it has been applied at the scale of the management unit. The TFWS Service Level Framework comprises five (5) service level tiers – from zero (0) to four (4) where Tier 0 designates a simple or basic service level and Tier 4 a complex / comprehensive level of service. The system then compares the current services in a management unit against the risks of flooding and determines residual risk and the need for improvements in some or all aspects of the flood warning system.

The assessment for East Gippsland is provided in Appendix B, with a summary for each of the three broad flood areas provided in section 3.3 below.

Text Box 5: Building a more resilient community

The Victorian Government is working to establish more resilient communities. Emergency Management Victoria (EMV) recently issued a discussion paper, which introduces the concept of resilient recovery. The paper defines resilient recovery as:

'*..new concept that considers the whole system of relief and recovery and how diverse components within that system can be organised and empowered to deliver community recovery outcomes for a safer and more resilient future….'*

and goes on to state that resilient recovery:

'..connects community systems and networks to plan for and support community outcomes enabled through the operating arrangements of policy and programs, governance arrangements and accountabilities, capabilities and capacity, and funding and investment…'.

Whilst the initiative is primarily focussed on recovery it identifies the importance of planning for resilient recovery. This is not inconsistent with traditional floodplain management but it does recognise the need for communities to be self-reliant because it is simply not practical to either protect communities against flooding or respond to all communities during a flood event.

This is particularly relevant in the East Gippsland region where outside the major population centres there are a large number of small communities and potentially large itinerant communities (particularly holiday makers and the travelling public) that are at risk and will be isolated through road closures during flood events. Communities in these areas must be self-reliant and resilient and Government has a role in assisting these communities in achieving this. Self-reliance and resilience are also necessary in the larger population centres as these will also become isolated during flooding, but inherently these communities will have more resources at hand to assist during floods.

One tool produced by the East Gippsland Shire is the Building Resilience Guide that provides technical information about current risks (including floods) and the changing climate in East Gippsland, what it means for properties, and how to make homes more resilient.

3.2.4 Municipal Emergency Management Plans

Every municipality is required to develop and maintain a Municipal Emergency Management Plan under S20(1) of the *Emergency Management Act 1986*. The objectives of the plan are to:

- implement measures to prevent or reduce the causes or effects of emergencies
- manage arrangements for the utilisation and implementation of municipal resources in response to emergencies

- manage support that may be provided to or from adjoining municipalities
- assist the affected community to recover following an emergency
- complement other local, regional and state planning arrangements.

In East Gippsland and Wellington Shires, the Municipal Flood Emergency Plans (MFEP) are sub-plans of the Municipal Emergency Management Plans (MEMP), which deal specifically with floods in each local government area. Nested under the MFEP are the Local Flood Guides (LFG) which provide information at a more local scale (Figure 7). The MEMP and MFEP are technical documents that summarise the important information required by emergency management staff and agencies to prepare for and respond to floods. They contain the procedures and structures for forecasting floods (e.g. river levels that indicate major floods are likely); incident control processes (e.g. road closures, flood rescue, essential infrastructure management and risks) and emergency relief and recovery arrangements.

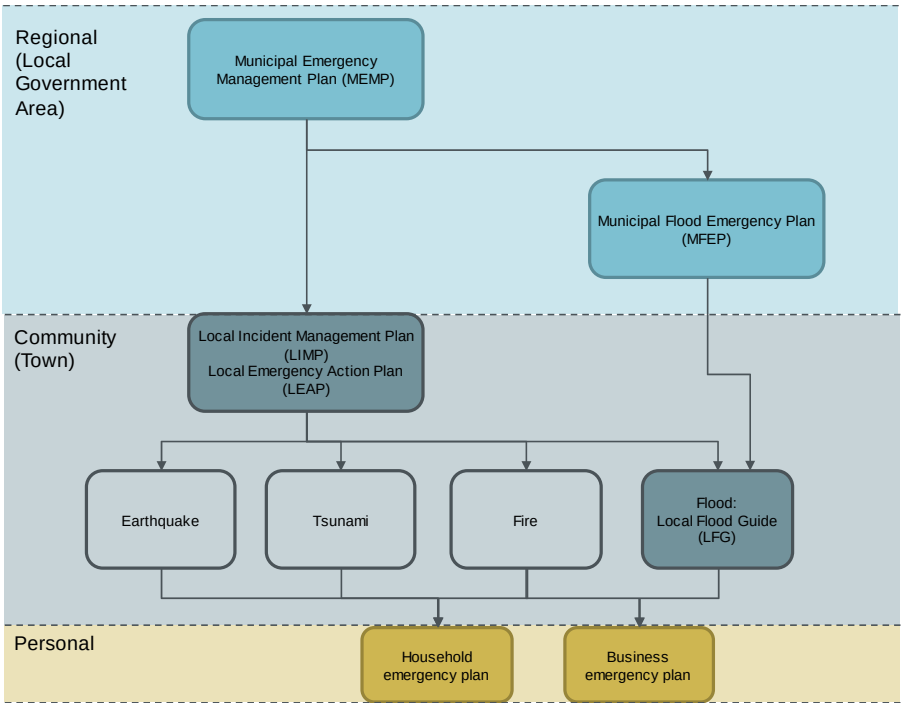


Figure 7: Relationship between regional, local and personal emergency planning documents.

3.3 Mitigation and residual risk

Existing mitigation measures against flood risk levels have been tabulated for each management unit in the region. The outputs of this, together with the TFWS tool have been summarised for each of the broad flood regions to provide an understanding of existing treatment levels and residual risk (Appendix B).

3.3.1 Gippsland Lakes

Structural mitigation

Several towns around the Gippsland Lakes are to some extent reliant on seawalls to mitigate against floods from rising Lake levels. Local knowledge indicated that many of these may not be in good repair and that there was a need for a census, review and improvement program to address flood risks, particularly when future sea level rise is considered.

While structural mitigation measures are not generally considered viable or necessary in East Gippsland communities, local issues specific to individual management units were raised. In particular structural mitigation works may be necessary to manage travel two and from Raymond Island during large, persistent flood events when the ferry cannot operate.

Planning scheme controls

Although there is a LSIO for the Gippsland Lakes towns, it is based on historical information. The *Gippsland Lakes Flood Level Modelling Project*[6], which was completed in June 2004, established updated flood levels and flood extents for the Gippsland Lakes and flood levels were declared in 2005 under the Water Act. The flood extent and levels derived from this project provide a significant increase in accuracy. East Gippsland Shire Council is in discussion with State Government in relation to a planning scheme amendment to reflect the outcomes of this project.

In addition, more recent projects have assessed likely effects of sea level rise (The Effect of Climate Change on Extreme Sea Levels along Victoria's Coast[7] and the Gippsland Lakes Local Coastal Hazard Assessment[8]). Flooding in the Gippsland Lakes will likely become more frequent and to higher levels as a result of rising sea levels and likely changes in rainfall characteristics associated with climate change. The declared flood levels for the Gippsland Lakes do not account for future increases in sea levels or changed rainfall characteristics. Rising sea level in particular has the potential to significantly impact on residents and businesses in Gippsland Lakes communities as a result of more frequent and higher inundation of properties. East Gippsland Shire Council is proposing to commence addressing this issue through the *Lakes Entrance Growth and Adaptation Strategy*. The development of the strategy is currently in its preliminary stages (Text Box 6).

As can be seen from the approach outlined below, East Gippsland Shire is seeking to take a very detailed approach to understand the future growth and development requirements of our coastal towns, having regard for current and future inundation impacts. The intention is to take a staged approach to engaging the community in understanding the current flooding implications for the town as well as supporting community members and a wide range of stakeholders in understanding how the township will change and adapt to future impacts. This starts with updating the existing Planning Scheme and in particular the LISO to reflect the extent of flooding for the Gippsland Lakes Declared Flood Levels.

Flood warning systems

The TFWS assessment for the Gippsland Lakes indicated that there was a residual risk in most high risk management units, with the exception of Metung, where existing measures were largely matched to the level of risk (see accompanying technical document, Total Flood Warning Systems in East Gippsland). While most towns were adequately served with response planning in the form of LIMPs and LFGs, there were shortfalls in the data collection network (the adequacy of river information to enable flood warning in a timely manner) and in forecasting. Concerns were raised about the flood forecast warning times for Lakes communities. In addition, community awareness was especially considered important for communities with a high turnover of residents, with new residents perhaps being less aware of flood risks and responses. It is intended to further clarify requirements for timeliness of warnings in the future as LFGs and LIMPs are updated in each community.

Emergency management planning

Flood management planning in the Gippsland Lakes communities is relatively good and by and large matches the level of risk experienced by these towns. There are LEPs in place for high risk locations and a well coordinated emergency response system in place.

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[6] *Gippsland Lakes Flood Level Modelling Project*, Centre for Environmental Applied Hydrology, University of Melbourne, Report 01/04, June 2004

[7] McInnes K.L, Macadam I. and O'Grady J. (2009): The Effect of Climate Change on Extreme Sea Levels along Victoria's Coast: A project undertaken for DSE as part of the "Future Coasts" program. November 2009, CSIRO National Research Flagships: Climate Adaptation

[8] Bishop, W., Womersley, T., Mawer, J., and Ladson, A. (2014). Gippsland Lakes/90 Mile Beach Local Coastal Hazard Assessment Project: Report 2 Inundation Hazard. Water Technology.

Text Box 6: Lakes Entrance Growth and Adaptation Strategy

Lakes Entrance is the largest town on the Gippsland Lakes, and a major tourist destination, working port and a key centre for recreational boating. The town however, like many regional towns faces a number of challenges including an aging population, growing tourist numbers and increased risks from floods and bushfires. Floods are relatively common in Lakes Entrance and while most of the town may be above current mean sea level, the Esplanade and Business District are in low-lying areas and vulnerable to riverine flooding, rising sea levels and storm tides.

East Gippsland Shire, with funds provided by the State Government is developing the *Lakes Entrance Growth and Adaptation Strategy 2050.* The project is expected to be complete by 2019 and will take a holistic approach to planning for Lakes Entrance for the next 35 years and beyond.

The main objective is for the Shire to work with the Lakes Entrance community to develop a sustainable growth plan for the town that considers all interrelated components such as traffic management, land development, public and private land use types, infrastructure and resilience of businesses and the community to flooding in the context of predicted impacts of a changing climate.

It is anticipated that the key lessons learned from the development of the *Lakes Entrance Growth and Adaptation Strategy* will then be utilised by other towns in the Gippsland Lakes and East Gippsland Region.

Photo: Wayne Taylor / Fairfax Syndication

3.3.2 Lowlands

Structural mitigation

There are no significant current structural mitigation measures in place, nor was a need for any future structural works specifically identified for the lowlands area through the assessment process and stakeholder consultation. A number of issues were identified in relation to road closures, particularly bridge approaches becoming inundated during flood events. Specifically, challenges presented by inundation of the approaches to the Wuk Wuk and Lind Bridges across the Mitchell River were identified as warranting investigation to understand options to minimise the resulting impacts on affected communities.

In addition, significant deficiencies in the knowledge of risk to agricultural production and waterway and floodplain health have been identified for lowland areas (Text Box 7). While these may not require traditional hard engineering works, there are options for using native vegetation and woody debris to both manage valuable horticultural land and improve waterway resilience to floods.

Text Box 7: Mitchell River Rehabilitation Plan

Loss of native riparian vegetation and infestations of willows may be increasing the frequency of inundation and velocity of floodwaters on the highly productive Mitchell River Flats. Horticultural production has been severely impacted during recent flood events including in 2007 and 2012, with loss of crops and large movements of sediment. The river condition is poor, with little left in the way of native vegetation, poor structural habitat and impacts to native fish and other biota.

East Gippsland CMA is commencing the Mitchell River Rehabilitation Plan which will work with landholders and local communities to develop a set of actions aimed at improving agricultural production by preventing losses from floods, increase the resilience of the riverine and floodplain environments to flood impacts, and improve waterway health.

The lessons learned from the project will have the potential to then be applied to other similar flood prone areas such as the floodplains of the Tambo, Snowy and Cann Rivers.

Mitchell River floodplain after the June 2007 flood event

Planning scheme controls

The East Gippsland Planning scheme includes LSIOs for the lower Mitchell, Tambo and Snowy Basins, but not for the Far East Gippsland towns in the lowlands. There has been a lack of adequate flood mapping in some of these areas and there are two current projects addressing this in the Mitchell River (*Mitchell River Regional Flood Mapping*) and Snowy Basin (*Snowy River Regional Flood Mapping*). When the 1% AEP flood maps have been completed, the planning scheme should be amended to reflect the improved information.

Flood warning systems

The TFWS assessment for the lowlands management units indicated that there was a residual risk in several of the high and moderate risk locations including: Mitchell River at Glenaladale, Lower Mitchell River, Lower Tambo, Bemm River and Genoa/Gipsy Point (see accompanying technical document, Total Flood Warning Systems in East Gippsland). The residual risk arose from deficiencies across all measures in the TFWS tool including flood forecasting, communication of information during flood events and community planning tools such as LFGs and LIMPs.

Emergency management planning

There are LEPs for high risk locations and a well-coordinated emergency response system in place for several towns, but this becomes more strained in smaller more remote communities.

In general, a lack of emergency procedures for estuary opening was identified as a residual risk for communities around estuaries such as Bemm River, Mallacoota and Lake Tyers.

3.3.3 Uplands

Structural mitigation

There are no significant current structural mitigation measures in place, nor was a need for any future structural works specifically identified for the upland areas through the assessment process and stakeholder consultation. Further investigations, however, are recommended at Buchan, Swifts Creek and Dargo where there are a significant number of houses potentially inundated in the 10% and 1 % AEP events. It is possible that these investigations may recommend minor structural mitigation measures.

Planning scheme controls

There are no LSIOs in place for upland communities, despite some being at significant flood risk. To date there has been a lack of adequate flood mapping in these areas but recent rapid flood assessments in several locations (see Text Box 4) have indicated that some upland communities are at flood risk with a number of buildings within the 1% and even 10% AEP flood extents. The implementation of planning tools could potentially assist in reducing future flood risks in these communities, although such changes would only be considered after extensive consultation with relevant communities.

Flood warning systems

Flood risk in many upland areas is low and generally the current flood warning service levels are adequate to address the level of risk. The exceptions are in the small number of upland communities in the high or moderate risk category including Dargo, Swifts Creek and Buchan, where service levels do not adequately match risk levels (see accompanying technical document, Total Flood Warning Systems in East Gippsland). The residual risk arose from deficiencies across all measures in the TFWS tool including flood forecasting, communication of information during flood events and community planning tools such as LFGs and LIMPs. In these small communities, it is probably better to develop community emergency plans that consider a range of risks including fire and flood.

Emergency management planning

Upland communities are small and isolated and not currently adequately serviced by emergency system planning. In many areas, there are few people and deficiencies in servicing these areas are likely to persist. Resilience planning will be key to flood mitigation for most upland communities.

4 Development and improvement plan

4.1 Method

4.1.1 Prioritisation process for mitigation measures

A set of management actions and strategies has been identified to address flood risks in the East Gippsland region. There will be insufficient resources to implement all identified actions and a two-step process was used to prioritise actions for implementation.

Step 1: Threshold criteria

The action / management strategy must meet all of these threshold criteria to be considered for implementation.

1. Alignment with objectives of the strategy - the action directly contributes to one of the four objectives of the strategy (see Appendix C):
    - To build a flood resilient community
    - To reduce existing flood risks
    - To avoid future flood risks
    - To manage residual flood risks
2. Technical feasibility - the action is technically feasible with a high probability of success.
3. The action is aligned with government policy and priorities.
4. The action is in line with community expectations.

Step 2: Prioritisation criteria

All actions that meet the threshold criteria are then ranked according the following criteria.

1. Cost effectiveness
    - High - action represents excellent value for money (that is the cost of risk/consequence reduction for expected benefits to the community is low).
    - Medium - action represents moderate value for money
    - Low - action represents poor value for money (that is the cost for expected benefits is high).
2. Regional resourcing – acknowledging that there is limited capability and capacity to implement options and assessment of resourcing is also required
    - Low resourcing – the action is in line with 'business as usual' or resources can be reprioritised from other areas with minimal effect on the business
    - High resourcing – the action requires significant additional resources to implement or significantly affect the business ability to implement other options

Rank	Outcome of action against criteria	
1	Meets all threshold criteria	High cost effectiveness Low resourcing
2	Meets all threshold criteria	Medium cost effectiveness Low resourcing
3	Meets all threshold criteria	High cost effectiveness High resourcing
4	Meets all threshold criteria	Medium cost effectiveness High resourcing

4.1.2 Stakeholder engagement

A stakeholder workshop was held in Bairnsdale on April 20, 2017 to identify and prioritise flood mitigation actions for the EGFMS. Local and expert knowledge of likely mitigation actions were considered for each management unit and for the three broad flood regions. Workshop participants also ratified the review of existing mitigation actions and residual risk.

Mitigation actions identified through this process have been consolidated and tabulated into four development and improvement plans, one for each flood area and one that covers more general mitigation that is required at a regional scale.

4.2 Region-wide component of the Development and Improvement Plan

The regional component of the Development and Improvement Plan is underpinned by several key principles:

1. Good practice of updating databases and documentation will be adopted. This includes activities such as:
   - loading updated flood mapping and information to FloodZoom and the West and East Gippsland CMA Flood Portals; and
   - updating Local Incident Management Plans (LIMPs) with any new links to MFEPs, LFGs or other relevant information.
2. The priority of mitigation actions has been assigned according to the method described in section 4.1.1 above. This means for some actions, there is a higher priority at specific locations. This is related to both the level of risk within a management unit and the level of residual risk considering existing mitigation.
3. Links between related mitigation actions have been identified and tabulated. This is largely related to the sequence of actions. For example, a regional action to develop a program to roll out additional flood studies would need to occur prior to commissioning a flood study at a specific location.
4. High priority actions for the region and each of the three areas (Gippsland Lakes, Uplands and Lowlands) have been tabulated below, together with responsibilities and a timetable for implementation. The full list of actions for every management unit is provided in Appendix B. A more comprehensive development and improvement plan that includes costs and lower priority actions is provided in the accompanying technical document.
5. Consistent with national and state approaches to emergency management, there is a focus on building awareness and resilience in local communities, households and businesses.

4.2.1 Region-wide component of the Development and Improvement Plan

Action no.	Lead agency	Action	Links	Year of implementation			
				1	2	3	4+
R1	EGCMA	Develop quick look flood prediction tools that can be used in areas with sparse data to support VICSES.	U1				
R2	EGSC / WSC/ VICSES	2a. Obtain funding for a position to support delivery of the flood resilience activities of this strategy.	R2b				
		2b. In consultation with EMV, review emergency management and coordination arrangements with the aim of achieving an all-hazards all-agency approach to incident planning at community level. 1) Develop and implement a program for producing and maintaining currency of LFGs and LIMPs for priority locations; and, 2) Local Government in partnership with VICSES and CFA to support the development of house-hold response plans for floods (and other emergencies).	R2a U2 U3 L4 L5				
R3	EGSC	Through the MEMP, investigate mechanisms to improve the reliability and coverage of telecommunications during flood events to ensure level of service is acceptable for emergency response.					
R4	EGSC (MEMP)	Through the MEMP, and in conjunction with road managers: a. undertake a regional road network link study to identify roads at risk from floods and priority structural mitigation measures; and, b. review current processes for managing the safety of road users during flood events and the ability to move out of flood prone areas					
R5	EGSC/ WSC	In association with EGCMA, routinely identify suitable updated flood information and ensure relevant Planning Schemes are amended to account for the most recent data.	GL1 L5				
R6	VICSES	Review flood class levels at all East Gippsland river gauge locations, advise BoM of new levels, include in MFEPs and ensure extensive community consultation.					
R7	VICSES	Develop a process and template to incorporate the outcomes of future flood studies into Flood Intel Products (currently Flood Intel Cards)	L1 L2 L5				

4.2.2 Gippsland Lakes component of the Development and Improvement Plan

Action no.	Lead agency	Action	Links	Year of implementation			
				1	2	3	4+
GL1	EGSC	Undertake a Planning Scheme Amendment in order to incorporate the flood levels and related extents that were declared under the Water Act in 2005. *(Priority MUs: Raymond Island, Lakes Entrance, Paynesville, Metung, Lower Mitchell River)*	R5				
GL2	EGSC	2a. Develop the Lakes Entrance Adaptation and Growth Strategy, with support from EGCMA. *(Priority Management Unit: Lakes Entrance)*					
		2b. Commence Implementation of the Lakes Entrance Adaptation and Growth Strategy, with support from EGCMA. *(Priority Management Unit: Lakes Entrance)*					
		2c. Apply the learnings from the Lakes Entrance Adaptation and Growth Strategy in order to develop a framework for adaptation to sea level rise. *(Priority MUs: Raymond Island, Lakes Entrance, Paynesville, Lower Mitchell River)*					
GL3	EGSC	3a. Investigate options to maintain access to the Raymond Island ferry and / or water taxi during larger flood events. *(Priority MUs: Raymond Island and Paynesville)*					
GL4	EGCMA	In conjunction with DELWP and WGCMA, approach BoM to improve the flood forecast services for the Lakes communities. *(Priority MUs: All Gippsland lakes communities and Lower Mitchell River)*					
GL5	Gippsland Ports	In conjunction with EGSC and DELWP, develop a strategy to reduce risk to private and commercial boats during flood events. *(Priority MUs: Lakes Entrance, Paynesville, Raymond Island and Metung)*					

4.2.3 *Uplands component of the Development and Improvement Plan*

Action no.	Lead agency	Action	Links	Year of implementation			
				1	2	3	4+
U1	EGCMA	Develop quick look indicative flood prediction tools for VICSES. *(Priority MUs: Dargo River Central, Swifts Creek)*	R1				
U2	VICSES	Extract flood intelligence and update MFEPs. *(Priority MUs: Dargo River Central, Swifts Creek)*					
U3	VICSES	Prepare LFGs to build and maintain community resilience *(Priority MUs: Dargo River Central, Buchan River, Swifts Creek)*	R2b				
U4	EGCMA	Investigate opportunities to improve data availability for Tambo Valley rain and river gauges. *(Priority MUs: Central Tambo River, Bruthen)*					

4.2.4 *Lowlands component of the Development and Improvement Plan*

Action no.	Lead agency	Action	Links	Year of implementation			
				1	2	3	4+
L1	EGCMA	Support DELWP to conduct a flood study of the Mitchell River from Glenaladale to river mouth.					
L2	EGCMA	Continue to support DELWP in conducting the Snowy River Regional Flood Mapping project.					
L3	EGSC	Conduct rapid flood risk assessment study for Boggy Creek at Nowa Nowa, including consideration of a range of water levels in Lake Tyers.					
L4	VICSES	Prepare LFGs to build and maintain community resilience in priority locations	R2b				
L5	VICSES	Extract flood intelligence and update MFEPs: - Snowy River from Jarrahmond to Marlo - Mitchell River from Glenaladale to the mouth - Boggy Creek Catchment	R2b				
L6	EGCMA	Investigate opportunities to improve data availability at priority gauges, including Bemm River gauges at the highway and the pumphouse. Reinstate the gauge board on the Coast Road Bridge.					

5 Monitoring, evaluation, review and improvement

5.1 Monitoring and evaluation

5.1.1 MERI Fundamentals

Programs and investments that embed robust MERI processes are more resilient to change, more often return maximum value on every dollar spent, and also allow for more effective demonstration of this value. Effective MERI enhances the performance of program activities themselves, but is also critical to ensuring the availability of data on outputs or outcomes that can help answer a range of critical questions for decision-makers.

The more embedded the MERI approach and the stronger and more immediate the feedback loops, the more value that can be delivered through the ability to adaptively manage the program over its duration.

5.1.2 Program logic

The program logic demonstrates the rationale for the EGFMS and expresses how change is expected to occur through implementation of program activities (Figure 8). The program logic also identifies how the EGFMS will contribute to the vision of the Victorian Floodplain Management Strategy and the East Gippsland Regional Catchment Strategy (RCS). In floodplain management, there are also a range of short-term outcomes that are sought before, during and after flood events, these are listed in Table 5.

Table 5: Short-term outcomes (before, during and after flood events) for community, business and government

<table>
<tr><th></th><th colspan="2">Community</th><th>Business</th><th>Government</th></tr>
<tr><td rowspan="2">Before</td><td colspan="2">Community and business are engaged and understand their role in flood risk management

Community and business has the information they need to understand and plan for future flood risks</td><td rowspan="2">Government assesses and communicates dependable and reliable flood risk information to community and business that matches their needs

Flood risk is incorporated into infrastructure investment, planning provisions and future development

Government provides certainty around the ongoing costs, benefits, management and maintenance of flood risk mitigation measures</td></tr>
<tr><td>Community and individuals take action to minimise the consequences of flood risks on their life and property</td><td>Businesses take action to minimise the consequences of flood risks on their property and assets</td></tr>
<tr><td>During</td><td>Community and Individuals take action to minimise the consequences of flood risks on their life and property</td><td>Businesses take action to minimise the consequences of flood risks on their property and assets</td><td>Government provides information that community needs at the right time

Government and agency response to floods is well coordinated</td></tr>
<tr><td>After</td><td colspan="2">Individuals, communities, and businesses support each other to quickly recover from flood events</td><td>Government and non-government organisation recovery is well coordinated

Government empowers business and communities to recover quickly</td></tr>
</table>

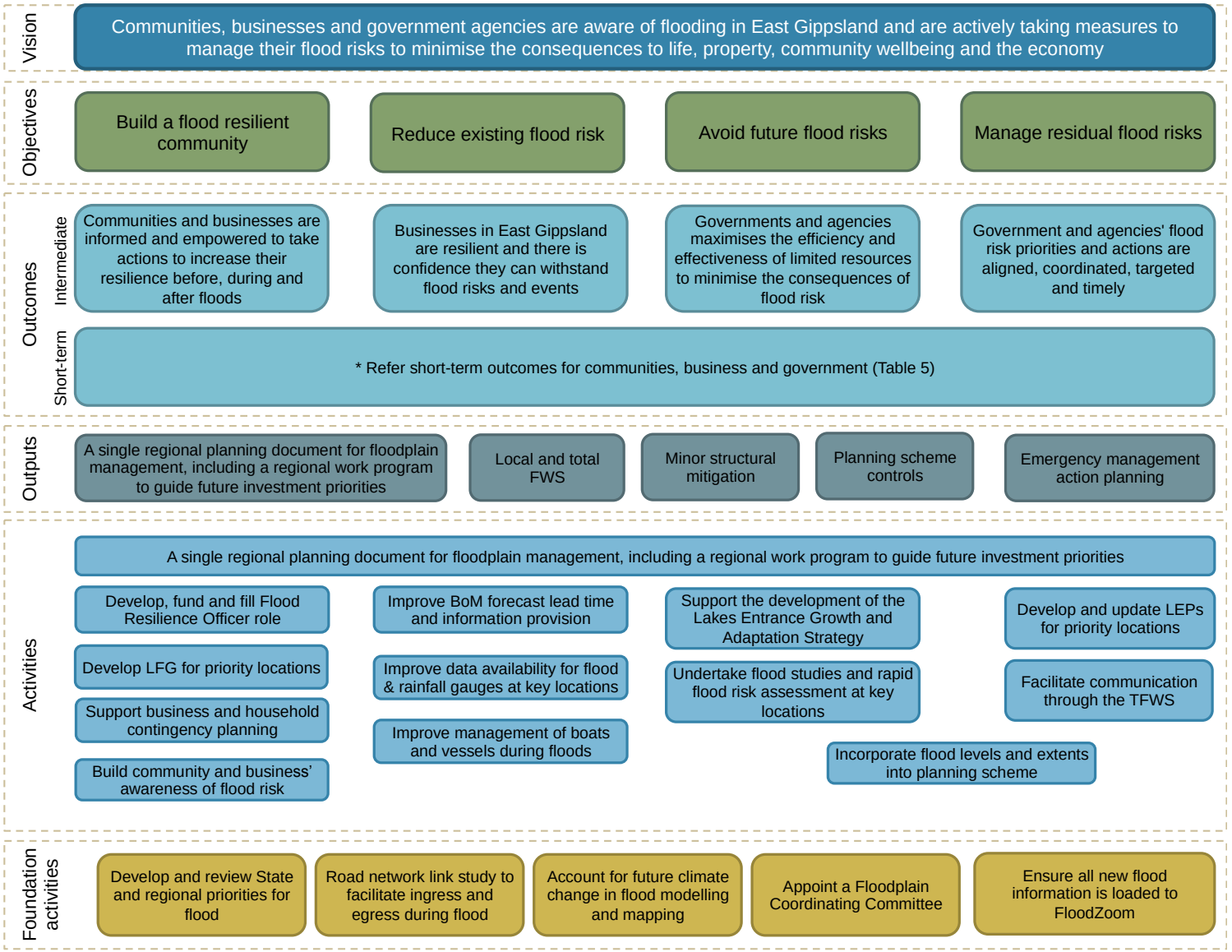

Figure 8: Program logic for the EGFMS.

5.1.3 Monitoring

Monitoring includes the ongoing collection of data to track progress towards delivery of agreed inputs, activities and outputs, and individual project progress. Monitoring can help identify issues, trends and risks so that these can be managed.

A monitoring plan is required to ensure that outcomes and objectives are consistently monitored at an appropriate time step. This MERI Plan has been developed to draw as much as possible on existing data sources and monitoring programs already being undertaken in the East Gippsland region.

Monitoring activities will be assessed, and adjusted if required, on a regular basis, including to ensure alignment between the activities undertaken to evaluate the EGFMS and those dictated by the MER framework for the broader Victorian Floodplain Management Strategy.

5.1.4 Key evaluation questions, indicators and data sources

Key evaluation questions (KEQs) have been developed based on the EGFMS program logic. Each KEQ will be linked to one or more indicators and for each indicator; one or more data sources (established or new) will also need to be determined. These will be finalised once prioritised actions within the strategy are determined. The monitoring of activities required to establish and track these indicators is described in more detail in the following section. Table 6 lists KEQs, against EGFMS's short-term outcomes.

Targets, aligned with indicators, will also be developed where appropriate. Targets drive performance by making outcomes sought clear, transparent, specific and easily measurable.

Table 6: EGFMS short-term outcomes and associated KEQs, indicators and data sources

Short term outcome	KEQ
Before	Is there evidence of good engagement by community and business in relation to flood risk? Are target/high risk cohorts sufficiently engaged?
	Does business and the community report that they have access to information that informs their understanding of flood risk and is it influencing their actions?
	Is there evidence that business and the community are taking steps/actions/investing to mitigate known risks prior to an event
	Is the business case for flood risk mitigation in place/clear/demonstrating a positive BCR?
	Is there evidence of flood risk being incorporated into development planning and investment?
During	Is there evidence that Business and the Community took steps to mitigate flood impact during an event
	Do individuals/business/community report that the actions they took were initiated or enhanced as a result of the timely and high quality/easy to access information
	All parties (Community/Business/Government) report that the flood response was well coordinated – attributes to test: clear, consistent, few gaps or overlaps, timely.
After (recovery)	All parties report an increased level of shared responsibility and support during recovery
	All parties (Community/Business/Government) report that the flood recovery was well coordinated – attributes to test: clear, consistent, few gaps or overlaps, timely.
	Business and Community report that they recorded better (time/lower cost/better quality) as a result of government investment/initiative that moved effort to "before" event and where appropriate devolved responsibility to community and business.

5.2 Reporting and improvement

5.2.1 Reporting

EGCMA will report evaluation outcomes and follow-up actions in accordance with the reporting schedule provided below, and will account for how evaluation findings were used as part of this commitment to transparent reporting.

EGCMA currently completes its own publicly available annual reports, contributes to the Victorian Catchment Management Authorities' publicly available annual Actions and Achievements Report, and provides internal reports to DELWP. EGCMA also publishes various community newsletters and bulletins. Results from monitoring can be reported in these frequent publications.

5.2.2 Improvement

Evaluation is an investment, and to maximise the return on investment evaluation results should be acted on and communicated widely to inform decision makers, stakeholders and the community.

Improvement results from continuous review, learning and adaptation. In the context of the EGFMS, a learning environment needs to be created where all parties are encouraged to reflect critically on the efficacy of particular investments and activities. Critical reflection enables those involved in a program to learn from mistakes, to generate ideas for making improvements, and to provide strategic and operational guidance.

Program logic and outcome reports are integral tools to drive reflection on the assessment of the effectiveness of different actions and the development of alternative pathways for action to achieve desired outcomes.

5.3 MERI Implementation

Responsibility for implementation of the EGFMS is shared by the EGCMA and it's delivery partners, particularly East Gippsland Shire, Wellington Shire and VICSES. Accountability for implementation of specific actions from the EGFMS will rest with the organisations nominated to lead the delivery of that action.

EGCMA will coordinate implementation of the MERI Plan monitoring and evaluation program. This will include interpretation of the results of evaluations to determine how evaluation findings should be used, and whether the EGFMS is delivering on its intended outcomes.

Implementation of the MERI Plan will also require inputs from community members, businesses, and local and state government. Effective and useful monitoring and evaluation will depend on the considered and timely provision of information and data from each of these stakeholders.

5.3.1 Evaluation timeline

A longitudinal approach to evaluation reflects the ongoing nature of flood risk management. Best practice evaluation should occur over three distinct phases to match the immediate, short-term and intermediate timeframes.

Initial evaluation should review the basis and processes for each board activity within the EGFMS, and enable the stakeholders to gather important baseline data for indicators in order to assess the impact of the actions. The formative evaluation should be undertaken before or during the early stages of implementation of the strategy.

An interim or mid-term evaluation will enable stakeholders to gather data against indicators to track, review and communicate progress of the strategy. The interim evaluation focuses on implementation of activities and progress towards short-term outcomes. A significant benefit of interim evaluation is the "take stock" of the performance of the actions and make changes during delivery to maximise their effect and drive continuous improvement.

A final evaluation, during the last year of EGFMS implementation will allow stakeholders to make a final judgement of the strategy's performance and understand the implications for future policy interventions. This evaluation is outcome-focused and provides insights into unintended outcomes and lessons for improvement. The method for each stage is outlined in Table 7.

5.3.2 *East Gippsland Floodplain Committee*

An East Gippsland Floodplain Committee (EGFC) comprising representatives of the partner agencies primarily responsible for the management of floodplains in the region (East Gippsland Shire, Wellington Shire and VICSES) will be convened and co-ordinated by EGCMA.

Each partner organisation will be responsible for developing annual implementation plans for the actions that they have lead responsibility for in this Strategy. Bi-annual meetings of the EGFC will seek to ensure that the responsibilities for individual management actions are clearly established, priorities and sequencing is logical, implementation is focused and coordinated, and funding opportunities are identified.

Table 7: Evaluation stages and activities.

Evaluation method	Timeframe	Evaluation activities
Initial evaluation	*Early 2018*	Develop data collection method for use throughout the life of strategy, in particular leveraging off existing data capture processes such as system data and periodic surveys wherever possible Establish method and survey for collecting qualitative data relating to community and business engagement and perceptions Undertake initial data gathering, including qualitative and quantitative data, and review Establish baseline for indicators Prepare formative evaluation report
Interim / mid-term evaluation	2020	Undertake second review of progress against indicators, based on quantitative and qualitative data Address evaluation questions relating to activities and participation Document progress towards evaluation questions relating to short-term outcomes Capture any insights and feedback that provide supporting evidence for why performance may (or may not) be as expected Consider any areas that may need attention to ensure funds achieve intended outcomes Produce interim evaluation report
End of strategy evaluation	Final year of strategy	Final review of progress against indicators, based on quantitative and qualitative data Conduct end-of-program consultations with stakeholders and delivery agencies Address evaluation questions relating to short-term and intermediate outcomes Based upon observed performance, determine likelihood of achieving long term outcomes and insights for future policy and strategy design Produce final evaluation report

Appendix A: Risk assessment outputs

Each measure of flood risk (damage density, absolute damage and town resilience) is assigned a score form 1 (low risk) to 6 (extreme risk). The overall risk is the average across they three measures. NA = no data available. For more information on the method and its application see: Aither, 2016, *East Gippsland CMA Regional Flood Risk Assessment,* Report to the East Gippsland Catchment Management Authority.

Results for Higher Risk urban management units

ID	Management unit	Damage density	Absolute damage	Town Resilience	Overall risk
69	Raymond Island	5.0	5.3	5.7	5
62	Paynesville	5.7	5.4	4.8	5
66	Lakes Entrance	5.9	5.4	3.6	5
63	Metung	4.8	3.5	3.6	4
42	Bairnsdale	3.6	4.9	3.4	4
44	Lower Mitchell River	1.8	4.7	5.3	4
54	Dargo River Central	3.4	2.9	5.3	4
28	Swifts Creek	Risk ratings adjusted by local knowledge			
67	Cunninghame	4.8	1.4	3.3	3
24	Buchan River	1.6	2.8	4.5	3
47	Nowa Nowa	2.8	1.9	3.5	3

Results for Higher Risk rural management units

ID	Management unit	Damage density	Absolute damage	Town Resilience	Overall risk
40	Mitchell River at Glenaladale	1.4	4.9	NA	2
18	Bete Bolong	1.3	3.5	NA	2
20	Orbost East	1.2	3.4	NA	2

Results for Medium Risk urban management units

ID	Management unit	Damage density	Absolute damage	Town Resilience	Overall risk
65	Kalimna	5.3	1.8	2.4	3
11	Gipsy Point	1.1	1.6	5.3	3
39	Lower Nicholson River	1.1	2.5	3.9	3
8	Cann River	1.2	1.8	4.6	3
64	Nungurner	3.7	1.3	2.5	2
30	Central Tambo River	1.2	1.5	3.7	2
36	Lower Tambo River	1.1	1.6	3.5	2
61	Newlands Arms	1.7	1.1	3.0	2

35	Bruthen	1.1	2.6	1.8	2
15	Bemm River	1.0	1.1	2.9	2
19	Orbost	1.3	3.5	0.0	2
43	Bairnsdale Central	1.8	1.8	1.2	2

Results for Medium Risk rural management units

ID	Management unit	Damage density	Absolute damage	Town Resilience	Overall risk
29	Upper Tambo River	1.6	2.7	NA	1
41	Mitchell River at Rosehill	1.3	2.6	NA	1
58	Hospital Creek	1.2	2.5	NA	1

Results for Lower Risk urban management units

ID	Management unit	Damage density	Absolute damage	Town Resilience	Overall risk
38	Sarsfield	1.1	1.1	1.2	1
68	Mallacoota	1.1	1.0	1.0	1
7	Noorinbee	1.0	1.3	NA	1
26	Cassilis	1.0	1.0	NA	1
17	Cabbage Tree Creek	1.0	1.0	NA	1
21	Brodribb River	1.0	1.0	NA	1
48	Lake Tyers Beach	1.0	1.0	NA	1
10	Tamboon	NA	NA	NA	NA

Results for Lower Risk rural management units

ID	Management unit	Damage density	Absolute damage	Town Resilience	Overall risk
23	Marlo Jetty	1.1	1.8	NA	1
22	Brodribb	1.0	1.8	NA	1
3	Bendoc	1.1	1.6	NA	1
34	Tambo River DS of Ramrod Crk	1.4	1.3	NA	1
49	Crooked River	1.1	1.4	NA	1
51	Wonnangatta River	1.1	1.3	NA	1
31	Ensay South	1.2	1.2	NA	1
25	Timbarra River	1.1	1.2	NA	1
33	Tambo Crossing	1.2	1.1	NA	1
56	Mitchell River at Tabberabbera, WS	1.1	1.1	NA	1
27	Brookville	1.1	1.2	NA	1

ID	Management unit	Damage density	Absolute damage	Town Resilience	Overall risk
1	Delegate River	1.1	1.2	NA	1
45	Mitchell River at Jones Bay	1.1	1.2	NA	1
2	Dellicknora	1.1	1.1	NA	1
52	Wonnangatta River Lower	1.1	1.1	NA	1
50	Wongungarra River	1.1	1.1	NA	1
5	Combienbar	1.1	1.1	NA	1
0	Goongerah	1.1	1.1	NA	1
37	Upper Nicholson River	1.1	1.1	NA	1
55	Dargo River Upper	1.1	1.0	NA	1
32	Battle Point	1.1	1.0	NA	1
60	Wingan River	1.0	1.1	NA	1
16	Club Terrace	1.1	1.1	NA	1
6	Tonghi Creek	1.0	1.1	NA	1
53	Dargo River Lower	1.1	1.0	NA	1
12	Coopracambra Cottages	1.0	1.0	NA	1
46	Mitchell River at Tabberabbera, EGS	1.0	1.0	NA	1
13	Wangarabell	1.0	1.0	NA	1
14	Wangarabell South	1.0	1.0	NA	1
4	Bendoc East	1.0	1.0	NA	1
57	Delegate River, NSW	NA	NA	NA	NA
9	Downstream Cann River	NA	NA	NA	NA
59	Thurra River	NA	NA	NA	NA

Appendix B: Mitigation measures by management unit

Note that the mitigation actions listed here are simply a reproduction of the actions in the full development and improvement plan, but presented for each management unit.

ID	Management Unit	Risk Tier	Existing Mitigation Measures What has been done to mitigate (assist mitigation of) flood risk	Mitigation Actions
69	Raymond Island	H	▪ Gippsland Lakes - Local Coastal Hazard Assessment, May 2016 ▪ Gippsland Lakes Flood Warning System, 2011 ▪ McInnes K.L, Macadam I. and O'Grady J. (2009): The Effect of Climate Change on Extreme Sea Levels along Victoria's Coast: A project undertaken for DSE as part of the "Future Coasts" program. November 2009, CSIRO National Research Flagships: Climate Adaptation ▪ Climate change, sea level rise and coastal subsidence along the Gippsland coast, Gippsland Coastal Board, 2006 ▪ Gippsland Lakes Flood Level Modelling Project, CEAH Report 01/04, June 2004 ▪ Declared 1% AEP flood levels ▪ FWS – quantitative forecast location – overall Service Level score is less than flood risk score. Service Level score for DCN, forecasting, dissemination & communication and awareness & education is less than flood risk score. Improvements warranted. ▪ LIMP – January 2015 ▪ FEP (V1, July 2012) – detailed Flood Emergency Plan for location ▪ LFG – January 2014 ▪ FloodSafe Guide – Gippsland Lakes Flood Warning System: Frequently Asked Questions ▪ The residual risk for this community is low as they are well prepared and resilient to floods.	▪ Undertake a Planning Scheme Amendment in order to incorporate the flood levels and related extents that were declared under the Water Act in 2005. ▪ Apply the learnings from the Lakes Entrance Adaptation and Growth Strategy in order to develop a framework for adaptation to sea level rise. ▪ Investigate options to maintain access to the Raymond Island ferry and / or water taxi during larger flood events. ▪ In conjunction with EGSC and DELWP, develop a strategy to reduce risk to private and commercial boats during flood events. ▪ Support EGSC to investigate and implement strategic mitigation and adaptation actions. ▪ Implement activities to maintain and build community awareness within the Lakes management units (e.g. work with communities to develop and maintain currency of LFGs). ▪ In conjunction with DELWP and WGCMA, approach BoM to improve the flood forecast services for the Lakes communities' ▪ In conjunction with other infrastructure providers, investigate the condition of seawalls in priority locations and implement appropriate actions.
62	Paynesville	H	▪ Gippsland Lakes - Local Coastal Hazard Assessment, May 2016 ▪ Gippsland Lakes Flood Warning System, 2011 ▪ McInnes K.L, Macadam I. and O'Grady J. (2009): The Effect of Climate Change on Extreme Sea Levels along Victoria's Coast: A project undertaken for DSE as part of the "Future Coasts" program. November 2009, CSIRO National Research Flagships: Climate Adaptation ▪ Climate change, sea level rise and coastal subsidence along the Gippsland coast, Gippsland Coastal Board, 2006 ▪ Gippsland Lakes Flood Level Modelling Project, CEAH Report 01/04, June 2004	▪ Undertake a Planning Scheme Amendment in order to incorporate the flood levels and related extents that were declared under the Water Act in 2005. ▪ Apply the learnings from the Lakes Entrance Adaptation and Growth Strategy in order to develop a framework for adaptation to sea level rise. ▪ Investigate options to maintain access to the Raymond Island ferry and / or water taxi during larger flood events. ▪ In conjunction with EGSC and DELWP, develop a strategy to reduce risk to private and commercial boats during flood events.

			▪ Declared 1% AEP flood levels ▪ FWS – quantitative forecast location – overall Service Level score is less than flood risk score. Service Level score for DCN, forecasting, dissemination & communication and awareness & education is less than flood risk score. Improvements warranted. ▪ FEP (V1, July 2012) – detailed Flood Emergency Plan for Paynesville & Eagle Point. ▪ LFG for Paynesville and Eagle Point (both January 2014) ▪ FloodSafe Guide – Gippsland Lakes Flood Warning System: Frequently Asked Questions ▪ No vulnerable places (hospitals, aged care facilities) go under in a 1% flood	▪ Support EGSC to investigate and implement strategic mitigation and adaptation actions. ▪ Implement activities to maintain and build community awareness within the Lakes management units (e.g. work with communities to develop and maintain currency of LFGs). ▪ In conjunction with DELWP and WGCMA, approach BoM to improve the flood forecast services for the Lakes communities' ▪ In conjunction with other infrastructure providers, investigate the condition of seawalls in priority locations and implement appropriate actions. ▪ Develop a plan to accommodate vehicles evacuated from Raymond Island during floods.
66	Lakes Entrance	H	▪ Gippsland Lakes - Local Coastal Hazard Assessment, May 2016 ▪ Gippsland Lakes Flood Warning System, 2011 ▪ McInnes K.L, Macadam I. and O'Grady J. (2009): The Effect of Climate Change on Extreme Sea Levels along Victoria's Coast: A project undertaken for DSE as part of the "Future Coasts" program. November 2009, CSIRO National Research Flagships: Climate Adaptation ▪ Climate change, sea level rise and coastal subsidence along the Gippsland coast, Gippsland Coastal Board, 2006 ▪ Eastern Creek Lakes Entrance - Drainage Study, January 2006 ▪ Gippsland Lakes Flood Level Modelling Project, CEAH Report 01/04, June 2004 ▪ FWS – quantitative forecast location – overall Service Level score is less than flood risk score. Service Level score for DCN, forecasting, dissemination & communication and awareness & education is less than flood risk score. Improvements warranted. ▪ Declared 1% AEP flood levels ▪ FEP (V1, July 2012) – detailed Flood Emergency Plan for location. ▪ LFG – January 2014 ▪ FloodSafe Guide – Gippsland Lakes Flood Warning System: Frequently Asked Questions ▪ No hospitals, aged care facilities or other vulnerable places are within the flood affected area.	▪ Undertake a Planning Scheme Amendment in order to incorporate the flood levels and related extents that were declared under the Water Act in 2005. ▪ Develop and implement the Lakes Entrance Adaptation and Growth Strategy. ▪ In conjunction with EGSC and DELWP, develop a strategy to reduce risk to private and commercial boats during flood events. ▪ Support EGSC to investigate and implement strategic mitigation and adaptation actions. ▪ Implement activities to maintain and build community awareness within the Lakes management units (e.g. work with communities to develop and maintain currency of LFGs). ▪ In conjunction with DELWP and WGCMA, approach BoM to improve the flood forecast services for the Lakes communities' ▪ In conjunction with other infrastructure providers, investigate the condition of seawalls in priority locations and implement appropriate actions.
63	Metung	H	▪ Gippsland Lakes - Local Coastal Hazard Assessment, May 2016 ▪ Gippsland Lakes Flood Warning System, 2011 ▪ McInnes K.L, Macadam I. and O'Grady J. (2009): The Effect of Climate Change on Extreme Sea Levels along Victoria's Coast: A project undertaken for DSE as part of the "Future Coasts" program. November 2009, CSIRO National Research Flagships: Climate Adaptation ▪ Climate change, sea level rise and coastal subsidence along the	▪ Undertake a Planning Scheme Amendment in order to incorporate the flood levels and related extents that were declared under the Water Act in 2005 ▪ Apply the learnings from the Lakes Entrance Adaptation and Growth Strategy in order to develop a framework for adaptation to sea level rise. ▪ In conjunction with EGSC and DELWP, develop a strategy to reduce risk to private and commercial boats during flood

			Gippsland coast, Gippsland Coastal Board, 2006 ▪ Gippsland Lakes Flood Level Modelling Project, CEAH Report 01/04, June 2004 ▪ Declared 1% AEP flood levels ▪ FWS– quantitative forecast location - overall Service Level score is consistent with flood risk score. Service Level score for DCN is marginally less than flood risk score. Improvements probably not warranted. ▪ FEP (V1, July 2012) – detailed Flood Emergency Plan for location. ▪ LFG – March 2014 ▪ LIMP – March 2015 ▪ FloodSafe Guide – Gippsland Lakes Flood Warning System: Frequently Asked Questions	events. ▪ Support EGSC to investigate and implement strategic mitigation and adaptation actions. ▪ Implement activities to maintain and build community awareness within the Lakes management units (e.g. work with communities to develop and maintain currency of LFGs). ▪ In conjunction with DELWP and WGCMA, approach BoM to improve the flood forecast services for the Lakes communities' ▪ In conjunction with other infrastructure providers, investigate the condition of seawalls in priority locations and implement appropriate actions.
42	Bairnsdale	H	▪ FWS – quantitative forecast location – overall Service Level score is less than flood risk score. Service Level score for forecasting, dissemination & communication and interpretation is less than flood risk score. Improvements warranted. ▪ FEP (V1, July 2012) – detailed Flood Emergency Plan for location. ▪ No hospitals, aged care facilities or other vulnerable places are within the flood affected area	▪ Support DELWP to conduct a flood study of the Mitchell River from Glenaladale to river mouth. ▪ Extract flood intelligence and update MFEP. ▪ Undertake a Planning Scheme amendment to incorporate the outputs of the Mitchell River flood study. ▪ Complete the Mitchell River Rehabilitation Project and apply learnings to other areas. ▪ Prepare LFG Prepare LFG to build and maintain community resilience.
44	Lower Mitchell River	H	▪ FWS – generalised service only – overall Service Level score is substantially less than flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Improvements warranted.	▪ Undertake a Planning Scheme Amendment in order to incorporate the flood levels and related extents that were declared under the Water Act in 2005 ▪ Apply the learnings from the Lakes Entrance Adaptation and Growth Strategy in order to develop a framework for adaptation to sea level rise. ▪ Support DELWP to conduct a flood study of the Mitchell River from Glenaladale to river mouth. ▪ Extract flood intelligence and update MFEP. ▪ Undertake a Planning Scheme amendment to incorporate the outputs of the Mitchell River flood study. ▪ Complete the Mitchell River Rehabilitation Plan and apply learnings to other locations. ▪ Implement activities to maintain and build community awareness within the Lakes management units (e.g. work with communities to develop and maintain currency of LFGs).
54	Dargo River Central	H	▪ Flood Risk Report – Dargo Valley – Rapid Estimation of Flood Risk in Upland Floodplain Areas, February 2017 ▪ FWS – generalised service only and data available from BoM website – overall Service Level score is substantially less than	▪ Develop quick look indicative flood prediction tools for VICSES. ▪ Extract flood intelligence and update MFEPs. ▪ Prepare LFG to build and maintain community resilience. ▪ Investigate feasibility of minor structural works or other

			flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Improvements warranted.	measures aimed at reducing potential for over-floor flooding.
67	Cunninghame	M	▪ Gippsland Lakes - Local Coastal Hazard Assessment, May 2016 ▪ McInnes K.L, Macadam I. and O'Grady J. (2009): The Effect of Climate Change on Extreme Sea Levels along Victoria's Coast: A project undertaken for DSE as part of the "Future Coasts" program. November 2009, CSIRO National Research Flagships: Climate Adaptation ▪ Climate change, sea level rise and coastal subsidence along the Gippsland coast, Gippsland Coastal Board, 2006 ▪ Gippsland Lakes Flood Level Modelling Project, CEAH Report 01/04, June 2004 ▪ FWS – no formal FWS – overall Service Level score is substantially less than flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Improvements warranted. ▪ FloodSafe Guide – Gippsland Lakes Flood Warning System: Frequently Asked Questions	▪ Undertake a Planning Scheme Amendment in order to incorporate the flood levels and related extents that were declared under the Water Act in 2005. ▪ Apply the learnings from the Lakes Entrance Adaptation and Growth Strategy in order to develop a framework for adaptation to sea level rise ▪ Support EGSC to investigate and implement strategic mitigation and adaptation actions. ▪ Implement activities to maintain and build community awareness within the Lakes management units (e.g. work with communities to develop and maintain currency of LFGs). ▪ Extract flood intelligence from Gippsland Lakes Flood Level Modelling Project and update the Municipal Flood Emergency Plan (MFEP). ▪ In conjunction with DELWP and WGCMA, approach BoM to improve the flood forecast services for the Lakes communities' ▪ In conjunction with other infrastructure providers, investigate the condition of seawalls in priority locations and implement appropriate actions.
24	Buchan River	H	▪ Flood Risk Report – Buchan Valley – Rapid Estimation of Flood Risk in Upland Floodplain Areas, February 2017 ▪ FWS – qualitative forecast location – overall Service Level score is substantially less than flood risk score. Service Level score for DCN, dissemination & communication, awareness & education, interpretation and response planning is less than flood risk score. Improvements warranted. ▪ LIMP – December 2014	▪ Develop quick look indicative flood prediction tools for VICSES. ▪ Extract flood intelligence and update MFEP. ▪ Prepare LFG to build and maintain community resilience. ▪ Investigate feasibility of minor structural works or other measures aimed at reducing potential for over-floor flooding. ▪
47	Nowa Nowa	H	▪ FWS – no formal FWS – overall Service Level score is substantially less than flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Improvements warranted. ▪ LIMP – August 2016	▪ Conduct rapid flood risk assessment study for Boggy Creek at Nowa Nowa, including consideration of a range of water levels in Lake Tyers. ▪ Review risk mitigation measures (including improvements in the FWS) after completion of the rapid flood risk assessment. ▪ Prepare LFG to build and maintain community resilience. ▪ Review the protocol for emergency estuary / river mouth opening.
28	Swifts Creek	H	▪ Flood Risk Report – Tambo Valley – Rapid Estimation of Flood Risk in Upland Floodplain Areas, February 2017 ▪ FWS – no formal FWS but some data available from BoM website - overall Service Level score is substantially less than flood risk score. Service Level score for all TFWS elements	▪ Develop quick look indicative flood prediction tools for VICSES. ▪ Extract flood intelligence and update MFEP. ▪ Prepare LFG to build and maintain community resilience. ▪ Using the rapid risk assessment hydraulic model, investigate the effects of in-stream and on-bank vegetation on flood

			(DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Improvements warranted. ▪ LIMP – November 2013	behavior through Swifts Creek. ▪ Investigate feasibility of minor structural works or other measures aimed at reducing potential for over-floor flooding.
40	Mitchell River at Glenaladale	H	▪ FWS – quantitative forecast location – overall Service Level score is less than flood risk score. Service Level score for dissemination & communication, interpretation and response planning is less than flood risk score. Improvements warranted. ▪ LIMP – October 2015	▪ Support DELWP to conduct a flood study of the Mitchell River from Glenaladale to river mouth. ▪ Extract flood intelligence and update MFEP. ▪ Prepare LFG to build and maintain community resilience. ▪ Undertake a Planning Scheme amendment to incorporate the outputs of the Mitchell River Flood Study.
18	Bete Bolong	H	▪ Snowy River Regional Flood Mapping – from the confluence with Wibenduck Creek (just upstream of Jarrahmond) to the confluence with the Brodribb River (just upstream of Marlo) – in progress ▪ FWS – Jarrahmond is a quantitative forecast location – overall Service Level score is the same as the flood risk score. Service Level score for dissemination & communication is less than flood risk score. Some improvements warranted. ▪	▪ Continue to support DELWP in conducting the Snowy River Regional Flood Mapping project. ▪ Extract flood intelligence and update MFEP. ▪ Prepare LFG to build and maintain community resilience. ▪ Undertake a Planning Scheme amendment to incorporate the outputs of the Snowy and Mitchell River flood studies.
20	Orbost East	H	▪ Snowy River Regional Flood Mapping – from the confluence with Wibenduck Creek (just upstream of Jarrahmond) to the confluence with the Brodribb River (just upstream of Marlo) – in progress ▪ FWS – Orbost is a quantitative forecast location - overall Service Level score is the same as the flood risk score. Service Level score for forecasting and dissemination & communication is less than flood risk score. Some improvements warranted.	▪ Continue to support DELWP in conducting the Snowy River Regional Flood Mapping project. ▪ Extract flood intelligence and update MFEP. ▪ Prepare LFG to build and maintain community resilience. ▪ Undertake a Planning Scheme amendment to incorporate the outputs of the Snowy and Mitchell River flood studies.
64	Nungurner	M	▪ Gippsland Lakes - Local Coastal Hazard Assessment, May 2016 ▪ McInnes K.L, Macadam I. and O'Grady J. (2009): The Effect of Climate Change on Extreme Sea Levels along Victoria's Coast: A project undertaken for DSE as part of the "Future Coasts" program. November 2009, CSIRO National Research Flagships: Climate Adaptation ▪ Climate change, sea level rise and coastal subsidence along the Gippsland coast, Gippsland Coastal Board, 2006 ▪ Gippsland Lakes Flood Level Modelling Project, CEAH Report 01/04, June 2004 ▪ FWS – no formal FWS – overall Service Level score is the same as the flood risk score. Service Level score for dissemination & communication is less than flood risk score. Some improvements warranted. ▪ LIMP – September 2015 ▪ FloodSafe Guide – Gippsland Lakes Flood Warning System: Frequently Asked Questions	▪ Undertake a Planning Scheme Amendment in order to incorporate the flood levels and related extents that were declared under the Water Act in 2005. ▪ Apply the learnings from the Lakes Entrance Adaptation and Growth Strategy in order to develop a framework for adaptation to sea level rise ▪ Support EGSC to investigate and implement strategic mitigation and adaptation actions. ▪ Implement activities to maintain and build community awareness within the Lakes management units (e.g. work with communities to develop and maintain currency of LFGs). ▪ Extract flood intelligence from Gippsland Lakes Flood Level Modelling Project and update the MFEP. ▪ In conjunction with DELWP and WGCMA, approach BoM to improve the flood forecast services for the Lakes communities' ▪ In conjunction with other infrastructure providers, investigate the condition of seawalls in priority locations and implement

				appropriate actions.
30	Central Tambo River	M	▪ Flood Risk Report – Tambo Valley – Rapid Estimation of Flood Risk in Upland Floodplain Areas, February 2017 ▪ FWS – no formal FWS but some data available from BoM website --overall Service Level score is less than flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Improvements warranted.	▪ Extract flood intelligence and update MFEP. ▪ Prepare LFG to build and maintain community resilience.. ▪ Investigate opportunities to improve data availability for Tambo Valley rain and river gauges. ▪ Develop quick look indicative flood prediction tool for VICSES.
36	Lower Tambo River	M	▪ Tambo River Flood Warning and Mapping Project, 2016 ▪ FWS – no formal FWS but some data available from BoM website - overall Service Level score is less than flood risk score. Service Level score for DCN, forecasting, dissemination & communication and response planning is less than flood risk score. Improvements warranted. ▪ LIMP for Swan Reach – draft – March 2013 ▪ LIMP for Tambo Bay – draft – February 2017	▪ Investigate opportunities to improve data availability for Tambo Valley rain and river gauges. ▪ Develop quick look indicative flood prediction tools for VICSES. ▪ Prepare LFG to build and maintain community resilience.
61	Newlands Arms	M	▪ Gippsland Lakes - Local Coastal Hazard Assessment, May 2016 ▪ McInnes K.L, Macadam I. and O'Grady J. (2009): The Effect of Climate Change on Extreme Sea Levels along Victoria's Coast: A project undertaken for DSE as part of the "Future Coasts" program. November 2009, CSIRO National Research Flagships: Climate Adaptation ▪ Climate change, sea level rise and coastal subsidence along the Gippsland coast, Gippsland Coastal Board, 2006 ▪ Gippsland Lakes Flood Level Modelling Project, CEAH Report 01/04, June 2004 ▪ FWS – no formal FWS – overall Service Level score is the same as the flood risk score. Service Level score for forecasting, dissemination & communication and response planning is less than flood risk score. Some improvements warranted. ▪ FloodSafe Guide – Gippsland Lakes Flood Warning System: Frequently Asked Questions	▪ Undertake a Planning Scheme Amendment in order to incorporate the flood levels and related extents that were declared under the Water Act in 2005. ▪ Apply the learnings from the Lakes Entrance Adaptation and Growth Strategy in order to develop a framework for adaptation to sea level rise ▪ Support EGSC to investigate and implement strategic mitigation and adaptation actions. ▪ Implement activities to maintain and build community awareness within the Lakes management units (e.g. work with communities to develop and maintain currency of LFGs). ▪ Extract flood intelligence from Gippsland Lakes Flood Level Modelling Project and update the MFEP. ▪ In conjunction with DELWP and WGCMA, approach BoM to improve the flood forecast services for the Lakes communities' ▪ In conjunction with other infrastructure providers, investigate the condition of seawalls in priority locations and implement appropriate actions.
35	Bruthen	M	▪ Tambo River Flood Warning and Mapping Project, 2016 ▪ FWS – no formal FWS but some data available from BoM website - overall Service Level score is the same as the flood risk score. Service Level score for DCN, forecasting, dissemination & communication and awareness & education is less than flood risk score. Some improvements warranted. ▪ FEP (V1, July 2012) – detailed Flood Emergency Plan for location. ▪ LIMP – December 2012	▪ Develop quick look indicative flood prediction tools for VICSES. ▪ Extract flood intelligence and update MFEP. ▪ Prepare LFG to build and maintain community resilience. ▪ Investigate opportunities to improve data availability for Tambo Valley rain and river gauges.

15	Bemm River	M	▪ Flood Risk Report – Bemm River – Rapid Estimation of Flood Risk in Upland Floodplain Areas, February 2017 ▪ McInnes K.L, Macadam I. and O'Grady J. (2009): The Effect of Climate Change on Extreme Sea Levels along Victoria's Coast: A project undertaken for DSE as part of the "Future Coasts" program. November 2009, CSIRO National Research Flagships: Climate Adaptation ▪ Climate change, sea level rise and coastal subsidence along the Gippsland coast, Gippsland Coastal Board, 2006 ▪ FWS – no formal FWS - overall Service Level score is substantially less than flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Improvements warranted. ▪ LIMP – December 2016	▪ Investigate opportunities to improve data availability at priority gauges, including Bemm River gauges at the highway and the pumphouse ▪ Reinstate the gauge board on the Coast Road Bridge. ▪ Develop quick look indicative flood prediction tools for VICSES. ▪ Investigate opportunities to improve data availability for rain and river gauges in the Bemm River catchment. ▪ Review the protocol for emergency estuary / river mouth opening.
19	Orbost	M	▪ Snowy River Regional Flood Mapping – from the confluence with Wibenduck Creek (just upstream of Jarrahmond) to the confluence with the Brodribb River (just upstream of Marlo) – in progress ▪ FWS – Basin Creek is a qualitative forecast location – Service Level score is higher than flood risk score. Service Level score for dissemination & communication is less than flood risk score. Some improvements warranted. ▪ FEP (V1, July 2012) – detailed Flood Emergency Plan for location.	▪ Continue to support DELWP in conducting the Snowy River Regional Flood Mapping project. ▪ Extract flood intelligence and update MFEP. ▪ Prepare LFG to build and maintain community resilience. ▪ Undertake a Planning Scheme amendment to incorporate the outputs of the Snowy and Mitchell River flood studies.
43	Bairnsdale Central	M	▪ FWS – Bairnsdale is a quantitative forecast location - overall Service Level score is the same as the flood risk score. Service Level score for dissemination & communication and interpretation is less than flood risk score. Some improvements warranted.	▪ Support DELWP to conduct a flood study of the Mitchell River from Glenaladale to river mouth. ▪ Extract flood intelligence and update MFEP. ▪ Undertake a Planning Scheme amendment to incorporate the outputs of the Mitchell River flood study. ▪ Complete the Mitchell River Rehabilitation Project and apply learnings to other areas. ▪ Prepare LFG to build and maintain community resilience.
11	Genoa /Gipsy Point	M	▪ Flood Risk Report – Genoa Valley – Rapid Estimation of Flood Risk in Upland Floodplain Areas, February 2017 ▪ FWS – no formal FWS and limited data available from BoM website - overall Service Level score is less than flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Improvements warranted.	▪ Develop quick look indicative flood prediction tools for VICSES. ▪ Prepare LFG to build and maintain community resilience..

39	Lower Nicholson River	M	▪ FWS – no formal FWS - overall Service Level score is less than flood risk score. Service Level score for DCN, forecasting, dissemination & communication, interpretation and response planning is less than flood risk score. Improvements warranted.	▪ Extract flood intelligence and update MFEP. ▪ Prepare LFG to build and maintain community resilience. ▪ Investigate opportunities to improve data availability at priority gauges
65	Kalimna	M	▪ Gippsland Lakes - Local Coastal Hazard Assessment, May 2016 ▪ McInnes K.L, Macadam I. and O'Grady J. (2009): The Effect of Climate Change on Extreme Sea Levels along Victoria's Coast: A project undertaken for DSE as part of the "Future Coasts" program. November 2009, CSIRO National Research Flagships: Climate Adaptation ▪ Climate change, sea level rise and coastal subsidence along the Gippsland coast, Gippsland Coastal Board, 2006 ▪ Gippsland Lakes Flood Level Modelling Project, CEAH Report 01/04, June 2004 ▪ FWS – no formal FWS – overall Service Level score is the same as the flood risk score. Service Level score for dissemination & communication and response planning is less than flood risk score. Some improvements warranted. ▪ FloodSafe Guide – Gippsland Lakes Flood Warning System: Frequently Asked Questions	▪ Undertake a Planning Scheme Amendment in order to incorporate the flood levels and related extents that were declared under the Water Act in 2005. ▪ Apply the learnings from the Lakes Entrance Adaptation and Growth Strategy in order to develop a framework for adaptation to sea level rise ▪ Support EGSC to investigate and implement strategic mitigation and adaptation actions. ▪ Implement activities to maintain and build community awareness within the Lakes management units (e.g. work with communities to develop and maintain currency of LFGs). ▪ Extract flood intelligence from Gippsland Lakes Flood Level Modelling Project and update the MFEP. ▪ In conjunction with DELWP and WGCMA, approach BoM to improve the flood forecast services for the Lakes communities' ▪ In conjunction with other infrastructure providers, investigate the condition of seawalls in priority locations and implement appropriate actions.
8	Cann River	M	▪ Flood Risk Report – Cann Valley – Rapid Estimation of Flood Risk in Upland Floodplain Areas, February 2017 ▪ FWS – data location only with some data available from BoM website – overall Service Level score is less than flood risk score. Service Level score for DCN, forecasting, dissemination & communication, awareness & education and response planning is less than flood risk score. Improvements warranted. ▪ LIMP – November 2012	▪ Develop quick look indicative flood prediction tools for VICSES. ▪ Prepare LFG to build and maintain community resilience. ▪ Investigate opportunities to improve data availability at priority gauges.
29	Upper Tambo River	M	▪ Flood Risk Report – Tambo Valley – Rapid Estimation of Flood Risk in Upland Floodplain Areas, February 2017 ▪ FWS – no formal FWS but some data available from BoM website - overall Service Level score is the same as the flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Some improvements warranted.	▪ Develop quick look indicative flood prediction tools for VICSES. ▪ Extract flood intelligence and update MFEP. ▪ Prepare LFG to build and maintain community resilience. ▪ Investigate opportunities to improve data availability for Tambo Valley rain and river gauges.
41	Mitchell River at Rosehill	M	▪ FWS – Bairnsdale is a quantitative forecast location - Service Level score is higher than flood risk score. Service Level score for dissemination & communication and interpretation is less than flood risk score. Some improvements warranted. ▪ LIMP for Lindenow – draft - December 2014	▪ Support DELWP to conduct a flood study of the Mitchell River from Glenaladale to river mouth. ▪ Extract flood intelligence and update MFEP.

58	Hospital Creek	M	▪ FWS – no formal FWS - overall Service Level score is less than flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Improvements warranted.	▪ Develop quick look indicative flood prediction tools for VICSES. ▪ Extract flood intelligence and update FEPs ▪ Prepare LFG to build and maintain community resilience.
38	Sarsfield	L	▪ FWS – no formal FWS - overall Service Level score is the same as the flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Some improvements warranted.	▪ Consider rapid flood risk assessment study. ▪ Assess the need to develop quick look indicative flood prediction tool for local use; develop if required. ▪ Extract flood intelligence and update MFEP. ▪ Prepare LFG to build and maintain community resilience. ▪
68	Mallacoota	L	▪ FWS – no formal FWS - overall Service Level score is the same as the flood risk score. Service Level score for forecasting, dissemination & communication, awareness & education, interpretation and response planning is less than flood risk score. Some improvements warranted. ▪ LIMP – June 2013 ▪ McInnes K.L, Macadam I. and O'Grady J. (2009): The Effect of Climate Change on Extreme Sea Levels along Victoria's Coast: A project undertaken for DSE as part of the "Future Coasts" program. November 2009, CSIRO National Research Flagships: Climate Adaptation ▪ Climate change, sea level rise and coastal subsidence along the Gippsland coast, Gippsland Coastal Board, 2006	▪ Develop quick look indicative flood prediction tool for VICSES. ▪ Update MFEP. ▪ Prepare LFG to build and maintain community resilience. ▪ Review the protocol for emergency estuary / river mouth opening.
7	Noorinbee	L	▪ Flood Risk Report – Cann Valley – Rapid Estimation of Flood Risk in Upland Floodplain Areas, February 2017 ▪ FWS – no formal FWS - overall Service Level score is the same as the flood risk score. Service Level score for DCN, forecasting, dissemination & communication, interpretation and response planning is less than flood risk score. Some improvements warranted.	▪ Investigate opportunities to improve data availability for Cann River gauges. ▪ Develop quick look indicative flood prediction tool for local use. ▪ Extract flood intelligence and update MFEP. ▪ Prepare LFG to build and maintain community resilience.
26	Cassilis	L	▪ Flood Risk Report – Tambo Valley – Rapid Estimation of Flood Risk in Upland Floodplain Areas, February 2017 ▪ FWS – no formal FWS - overall Service Level score is the same as the flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Some improvements warranted.	▪ Extract flood intelligence and update MFEP. ▪ Prepare LFG to build and maintain community resilience.. ▪ Investigate opportunities to improve data availability for Tambo Valley. ▪ Develop quick look indicative flood prediction tool for VICSES.
17	Cabbage Tree Creek	L	▪ Flood Risk Report – Cabbage Tree Creek – Rapid Estimation of Flood Risk in Upland Floodplain Areas, February 2017 ▪ FWS – no formal FWS - overall Service Level score is the same as the flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is	▪ Extract flood intelligence and update MFEP. ▪ Prepare LFG to build and maintain community resilience. ▪ Develop quick look indicative flood prediction tool for VICSES.

			less than flood risk score. Some improvements warranted.	
21	Brodribb River	L	▪ FWS – no formal FWS but some data available from BoM website - overall Service Level score is the same as the flood risk score. Service Level score for DCN, forecasting, dissemination & communication, awareness & education and response planning is less than flood risk score. Some improvements warranted.	▪ Continue to support DELWP in conducting the Snowy River Regional Flood Mapping project. ▪ Extract flood intelligence and update MFEP. ▪ Prepare LFG to build and maintain community resilience.
48	Lake Tyers Beach	L	▪ FWS – no formal FWS - overall Service Level score is less than flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Improvements warranted. ▪ McInnes K.L, Macadam I. and O'Grady J. (2009): The Effect of Climate Change on Extreme Sea Levels along Victoria's Coast: A project undertaken for DSE as part of the "Future Coasts" program. November 2009, CSIRO National Research Flagships: Climate Adaptation ▪ Climate change, sea level rise and coastal subsidence along the Gippsland coast, Gippsland Coastal Board, 2006.	▪ Conduct rapid flood risk assessment study, including consideration of a range of water levels in Lake Tyers. ▪ Develop quick look indicative flood prediction tool for VICSES. ▪ Extract flood intelligence and update MFEP. ▪ Prepare LFG to build and maintain community resilience.
10	Tamboon	L	▪ Flood risk not determined – insufficient data. ▪ FWS – no formal FWS but some data available from BoM website – overall Service Level score is zero. Some improvements probably warranted. ▪ McInnes K.L, Macadam I. and O'Grady J. (2009): The Effect of Climate Change on Extreme Sea Levels along Victoria's Coast: A project undertaken for DSE as part of the "Future Coasts" program. November 2009, CSIRO National Research Flagships: Climate Adaptation ▪ Climate change, sea level rise and coastal subsidence along the Gippsland coast, Gippsland Coastal Board, 2006	▪ No mitigation measures identified as being required.
23	Marlo Jetty	L	▪ Snowy River Regional Flood Mapping – from the confluence with Wibenduck Creek (just upstream of Jarrahmond) to the confluence with the Brodribb River (just upstream of Marlo) – in progress ▪ Hydrodynamic Study of the Snowy Estuary July 2010 ▪ McInnes K.L, Macadam I. and O'Grady J. (2009): The Effect of Climate Change on Extreme Sea Levels along Victoria's Coast: A project undertaken for DSE as part of the "Future Coasts" program. November 2009, CSIRO National Research Flagships: Climate Adaptation ▪ Climate change, sea level rise and coastal subsidence along the Gippsland coast, Gippsland Coastal Board, 2006 ▪ Sole Gas Plant Flood Level Analysis, May 2004 ▪ Sole Gas Plant Flood Response Plan ▪ FWS – generalised service only – Service Level score is higher	▪ Continue to support DELWP in conducting the Snowy River Regional Flood Mapping project. ▪ Extract flood intelligence and update MFEP.

			than flood risk score. Service Level score for dissemination & communication and response planning is less than flood risk score. Some improvements warranted. ▪ FEP	
22	Brodribb	L	▪ FWS – no formal FWS but some data available from BoM website - overall Service Level score is the same as the flood risk score. Service Level score for DCN, forecasting, dissemination & communication and response planning is less than flood risk score. Some improvements warranted.	▪ Continue to support DELWP in conducting the Snowy River Regional Flood Mapping project. ▪ Prepare LFG to build and maintain community resilience. ▪ Develop quick look indicative flood prediction tool for VICSES. ▪
3	Bendoc	L	▪ FWS – no formal FWS - overall Service Level score is the same as the flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Some improvements warranted.	▪ Conduct rapid flood risk assessment study. ▪ Assess the need to develop quick look indicative flood prediction tool for VICSES; develop if required. ▪ Extract flood intelligence and update MFEP. ▪ Prepare LFG to build and maintain community resilience.
34	Tambo River DS of Ramrod C	L	▪ Tambo River Flood Warning and Mapping Project, 2016 ▪ FWS – no formal FWS but some data available from BoM website - overall Service Level score is the same as the flood risk score. Service Level score for forecasting, dissemination & communication and interpretation is less than flood risk score. Some improvements warranted.	▪ Extract flood intelligence from Tambo River Flood Warning and Mapping Project deliverables and update MFEP. ▪ Develop quick look indicative flood prediction tool for VICSES. ▪ Investigate opportunities to improve data availability for Tambo Valley. ▪ Develop quick look indicative flood prediction tool for VICSES.
49	Crooked River	L	▪ FWS – no formal FWS but some data available from BoM website - overall Service Level score is the same as the flood risk score. Service Level score for forecasting, dissemination & communication, interpretation and response planning is less than flood risk score. Some improvements warranted.	▪ Assess need for flood awareness material and flood prediction tools. ▪ Extract flood intelligence and update MFEP.
51	Wonnangatta River	L	▪ FWS – no formal FWS but some data available from BoM website - overall Service Level score is the same as the flood risk score. Service Level score for DCN, forecasting, dissemination & communication, interpretation and response planning is less than flood risk score. Some improvements warranted.	▪ Assess need for flood awareness material and flood prediction tools. ▪ Extract flood intelligence and update MFEP.
31	Ensay South	L	▪ Flood Risk Report – Tambo Valley – Rapid Estimation of Flood Risk in Upland Floodplain Areas, February 2017 ▪ FWS – no formal FWS - overall Service Level score is the same as the flood risk score. Service Level score for DCN, forecasting, dissemination & communication, interpretation and response planning is less than flood risk score. Some improvements warranted. ▪ LIMP – January 2011	▪ Assess need for flood awareness material and flood prediction tools. ▪ Extract flood intelligence and update MFEP. ▪ Investigate opportunities to improve data availability for Tambo Valley.
25	Timbarra River	L	▪ FWS – no formal FWS but some data available from BoM website - overall Service Level score is the same as the flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness &	▪ Assess need for flood awareness material and flood prediction tools. ▪ Extract flood intelligence and update MFEP. ▪ Investigate opportunities to improve data availability for Tambo

			education, interpretation and response planning) is less than flood risk score. Some improvements warranted.	Valley.
33	Tambo Crossing	L	▪ Flood Risk Report – Tambo Valley – Rapid Estimation of Flood Risk in Upland Floodplain Areas, February 2017 ▪ FWS – no formal FWS but some data available from BoM website - overall Service Level score is the same as the flood risk score. Service Level score for DCN, forecasting, dissemination & communication, interpretation and response planning is less than flood risk score. Some improvements warranted. ▪ LIMP – December 2014	▪ Extract flood intelligence and update MFEP. ▪ Prepare LFG or include flood intelligence in the LIMP. ▪ Investigate opportunities to improve data availability for Tambo Valley. ▪ Develop quick look indicative flood prediction tool for VICSES.
56	Mitchell River at Tabberabbera, WSC	L	▪ FWS – no formal FWS - overall Service Level score is the same as the flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Some improvements warranted.	▪ Assess need for flood awareness material and flood prediction tools. ▪ Extract flood intelligence and update MFEP. ▪ . ▪
27	Brookville	L	▪ Flood Risk Report – Tambo Valley – Rapid Estimation of Flood Risk in Upland Floodplain Areas, February 2017 ▪ FWS – no formal FWS but some data available from BoM website - overall Service Level score is the same as the flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Some improvements warranted.	▪ Extract flood intelligence and update MFEP. ▪ Prepare LFG or include flood intelligence in the LIMP. ▪ Investigate opportunities to improve data availability for Tambo Valley. ▪ Develop quick look indicative flood prediction tool for VICSES.
1	Delegate River	L	▪ FWS – no formal FWS - overall Service Level score is the same as the flood risk score. Service Level score for forecasting, dissemination & communication, awareness & education, interpretation and response planning is less than flood risk score. Some improvements warranted. ▪ LIMP for Bonang & District – September 2016	▪ Assess need for flood awareness material and flood prediction tools. ▪ Extract flood intelligence and update MFEP.
45	Mitchell River at Jones Bay	L	▪ Gippsland Lakes - Local Coastal Hazard Assessment, May 2016 ▪ McInnes K.L, Macadam I. and O'Grady J. (2009): The Effect of Climate Change on Extreme Sea Levels along Victoria's Coast: A project undertaken for DSE as part of the "Future Coasts" program. November 2009, CSIRO National Research Flagships: Climate Adaptation ▪ Climate change, sea level rise and coastal subsidence along the Gippsland coast, Gippsland Coastal Board, 2006 ▪ Gippsland Lakes Flood Level Modelling Project, CEAH Report 01/04, June 2004 ▪ FWS – no formal FWS - overall Service Level score is the same as the flood risk score. Service Level score for dissemination & communication, interpretation and response planning is less than flood risk score. Some improvements warranted.	▪ Support DELWP to conduct a flood study of the Mitchell River from Glenaladale to river mouth. ▪ Extract flood intelligence and update MFEP. ▪ Undertake a Planning Scheme amendment to incorporate the outputs of the flood study. ▪ Prepare LFG to build and maintain community resilience.

2	Dellicknora	L	▪ FWS – no formal FWS but some data available from BoM website - overall Service Level score is the same as the flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Some improvements warranted. ▪ LIMP for Deddick – December 2015	▪ Assess need for flood awareness material and flood prediction tools. ▪ Extract flood intelligence and update MFEP.
52	Wonnangatta River Lower	L	▪ FWS - no formal FWS - overall Service Level score is the same as the flood risk score. Service Level score for DCN, forecasting, dissemination & communication, interpretation and response planning is less than flood risk score. Some improvements warranted.	▪ Assess need for flood awareness material and flood prediction tools. ▪ Extract flood intelligence and update MFEP.
50	Wonungurra River	L	▪ FWS – no formal FWS - overall Service Level score is the same as the flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Some improvements warranted.	▪ Assess need for flood awareness material and flood prediction tools. ▪ Extract flood intelligence and update MFEP.
5	Combienbar	L	▪ FWS – no formal FWS - overall Service Level score is the same as the flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Some improvements warranted. ▪ LIMP – January 2014 (Draft 2016)	▪ Assess need for flood awareness material and flood prediction tools. ▪ Extract flood intelligence and update MFEP.
0	Goongerah	L	▪ Flood Risk Report – Goongerah – Rapid Estimation of Flood Risk in Upland Floodplain Areas, February 2017 ▪ FWS – no formal FWS - overall Service Level score is the same as the flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Some improvements warranted.	▪ Assess need for flood awareness material and flood prediction tools. ▪ Extract flood intelligence and update MFEP.
37	Upper Nicholson River	L	▪ FWS – no formal FWS - overall Service Level score is the same as the flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Some improvements warranted.	▪ Assess need for flood awareness material and flood prediction tools. ▪ Extract flood intelligence and update MFEP.
55	Dargo River Upper	L	▪ Flood Risk Report – Dargo Valley – Rapid Estimation of Flood Risk in Upland Floodplain Areas, February 2017 ▪ FWS – no formal FWS - overall Service Level score is the same as the flood risk score. Service Level score for DCN, forecasting, dissemination & communication, interpretation and response planning is less than flood risk score. Some improvements warranted.	▪ Extract flood intelligence and update MFEP.
32	Battle Point	L	▪ Flood Risk Report – Tambo Valley – Rapid Estimation of Flood Risk in Upland Floodplain Areas, February 2017	▪ Extract flood intelligence and update MFEP. ▪ Prepare LFG to build and maintain community resilience.

			▪ FWS – no formal FWS - overall Service Level score is the same as the flood risk score. Service Level score for DCN, forecasting, dissemination & communication, interpretation and response planning is less than flood risk score. Some improvements warranted.	▪ Investigate opportunities to improve data availability for Tambo Valley rain and river gauges. ▪ Develop quick look indicative flood prediction tool for VICSES.
60	Wingan River	L	▪ FWS – no formal FWS - overall Service Level score is less than the flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Improvements warranted.	▪ No priority mitigation measures identified as being required.
16	Club Terrace	L	▪ FWS – no formal FWS - overall Service Level score is the same as the flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Some improvements warranted. ▪ LIMP – December 2014	▪ No priority mitigation measures identified as being required.
6	Tonghi Creek	L	▪ FWS – no formal FWS - overall Service Level score is the same as the flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Some improvements warranted.	▪ No priority mitigation measures identified as being required.
53	Dargo River Lower	L	▪ Flood Risk Report – Dargo Valley – Rapid Estimation of Flood Risk in Upland Floodplain Areas, February 2017 ▪ FWS – no formal FWS but some data on BoM website - overall Service Level score is the same as the flood risk score. Service Level score for forecasting, dissemination & communication, interpretation and response planning is less than flood risk score. Some improvements warranted.	▪ Extract flood intelligence and update FEP. ▪
12	Coopracambra Cottages	L	▪ FWS – no formal FWS - overall Service Level score is the same as the flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Some improvements warranted.	▪ No priority mitigation measures identified as being required. ▪
46	Mitchell River at Tabberabbera, EGSC	L	▪ FWS – generalised FWS - overall Service Level score is the same as the flood risk score. Service Level score for DCN, dissemination & communication, awareness & education, interpretation and response planning is less than flood risk score. Some improvements warranted.	▪ No priority mitigation measures identified as being required.
13	Wangarabell	L	▪ FWS – no formal FWS - overall Service Level score is the same as the flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Some improvements warranted.	▪ No priority mitigation measures identified as being required.

14	Wangarabell South	L	▪ FWS – no formal FWS - overall Service Level score is the same as the flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Some improvements warranted.	▪ No priority mitigation measures identified as being required.
4	Bendoc East	L	▪ FWS – no formal FWS - overall Service Level score is the same as the flood risk score. Service Level score for all TFWS elements (DCN, forecasting, dissemination & communication, awareness & education, interpretation and response planning) is less than flood risk score. Some improvements warranted.	▪ Assess the need to develop quick look indicative flood prediction tool for VICSES; develop if required. ▪ Extract flood intelligence and update MFEP. ▪ Prepare LFG to build and maintain community resilience.
57	Delegate River, NSW	U	▪ Flood risk not determined – insufficient data ▪ FWS – no formal FWS - overall Service Level score is one. Service Level score for DCN is also one while for all other TFWS elements is zero. Some improvements probably warranted.	▪ Assess the need to develop quick look indicative flood prediction tool for VICSES; develop if required. ▪ Extract flood intelligence and update MFEP. ▪ Prepare LFG to build and maintain community resilience.
9	Downstream Cann River	U	▪ Flood risk not determined – insufficient data ▪ Flood Risk Report – Cann Valley – Rapid Estimation of Flood Risk in Upland Floodplain Areas, February 2017 ▪ FWS – no formal FWS - overall Service Level score is one. Service Level score for DCN and awareness & education is also one while for all other TFWS elements is zero. Some improvements probably warranted.	▪ Investigate opportunities to improve data availability for Cann River gauges. ▪ Develop quick look indicative flood prediction tool for VICSES. ▪ Extract flood intelligence and update MFEP.
59	Thurra River	U	▪ Flood risk not determined – insufficient data ▪ FWS – no formal FWS - overall Service Level score is zero. Some improvements probably warranted.	▪ No priority mitigation measures identified as being required.

Appendix C: Cross reference of actions objectives.

A summary of actions of this strategy against the four objectives was completed using the following assumptions:

1. *Build a flood resilient community*
   - Actions that contribute to a community being better prepared for a flood (response and recovery) and reducing the reliance of the community on outside help (particularly during a flood)
2. *Reduce existing flood risk*
   - Primarily structural measures or an action that may lead to a structural measure, e.g., flood studies
3. *Avoid future floods*
   - Primarily actions related to the planning scheme or climate change
4. *Manage residual risk*
   - Primarily actions related to TFWS

Action no.	Action	Objective			
		1	2	3	4
R1	Develop quick look flood interpretation tools that can be used in areas with sparse data to support VICSES.	■	■	■	■
R2	2a. Obtain funding for a position to support delivery of the flood resilience activities of this strategy.	■	■		■
	2b. In consultation with EMV, review emergency management and coordination arrangements with the aim of achieving an all-hazards all-agency approach to incident planning at community level. 3) Develop and implement a program for producing and maintaining currency of LFGs and LIMPs for priority locations; and, 4) Local Government in partnership with VICSES and CFA to support the development of house-hold response plans for floods (and other emergencies).	■	■	■	■
R3	Through the MEMP, investigate mechanisms to improve the reliability and coverage of telecommunications during flood events to ensure level of service is acceptable for emergency response.	■			■
R4	Through the MEMP, and in conjunction with road managers: c. undertake a regional road network link study to identify roads at risk from floods and priority structural mitigation measures; and, d. review current processes for managing the safety of road users during flood events and the ability to move out of flood prone areas	■	■		■
R5	In association with EGCMA, routinely identify suitable updated flood information and ensure relevant Planning Schemes are amended to account for the most recent data.	■	■		
R6	Review flood class levels at all East Gippsland river gauge locations, advise BoM of new levels, include in MFEPs and ensure extensive community consultation.	■			■
R8	Develop a process and template to incorporate the outcomes of future flood studies into Flood Intel Products (currently Flood Intel Cards)	■			■
R9	In conjunction with DELWP, liaise with BoM to improve flood forecasting and warning services for East Gippsland, with a view to:	■			■

Action no.	Action	Objective			
		1	2	3	4
	a. improving the flood forecast lead times for existing forecast locations where achievable to match requirements identified by EM agencies; b. improving real-time access to data from rain and river gauges; and c. enhancing services in other priority locations to better reflect risks and community requirements.	■			■
R10	Developing a method to capture and store information gathered during flood events and implement a pilot study of that method in the Gippsland Region as a proof of concept trial.				■
R11	In conjunction with DEWLP and EGSC, approach EMV with a proposal to adopt a flood classification scheme similar to the six-step Fire Danger Rating Scheme.	■			■
R12	In conjunction with CMAs investigate opportunities for accounting for climate change (rainfall, temperature and sea level rise) into flood modelling and mapping.			■	
R13	Council in partnership with VICSES, to support businesses in developing continuity plans for floods (and other emergencies).	■			■
R14	With partner agencies explore the most appropriate governance arrangements for the management of flood mitigation infrastructure.		■		
R15	Investigate the resilience of sewer and water supply systems and implement necessary mitigation measures.		■		
GL1	Undertake a Planning Scheme Amendment in order to incorporate the flood levels and related extents that were declared under the Water Act in 2005.	■			■
GL2	2a. Develop the Lakes Entrance Adaptation and Growth Strategy, with support from EGCMA.			■	
	2b. Commence Implementation of the Lakes Entrance Adaptation and Growth Strategy, with support from EGCMA.			■	
	2c. Apply the learnings from the Lakes Entrance Adaptation and Growth Strategy in order to develop a framework for adaptation to sea level rise.			■	
GL3	3a. Investigate options to maintain access to the Raymond Island ferry and / or water taxi during larger flood events.	■	■		
	3b. Develop a plan to accommodate vehicles evacuated from Raymond Island during floods.	■			■
GL4	In conjunction with DELWP and WGCMA, approach BoM to improve the flood forecast services for the Lakes communities'	■			■
GL5	In conjunction with EGSC and DELWP, develop a strategy to reduce risk to private and commercial boats during flood events.	■	■		
GL6	Support EGSC to investigate and implement strategic mitigation and adaptation actions.	■	■	■	■
GL7	Implement activities to maintain and build community awareness within the Lakes management units (e.g. work with communities to develop and maintain currency of LFGs).	■			■
GL8	Extract flood intelligence from Gippsland Lakes Flood Level Modelling Project, update the Municipal Flood Emergency Plans (MFEPs).	■			■
GL9	In conjunction with other infrastructure providers, investigate the condition of seawalls in priority locations and implement appropriate actions.			■	

Action no.	Action	Objective			
		1	2	3	4
U1	Develop quick look indicative flood interpretation tools for VICSES.	■	■	■	■
U2	Extract flood intelligence and update MFEPs	■	■	■	■
U3	Prepare LFGs to build and maintain community resilience	■			■
U4	Investigate opportunities to improve data availability for Tambo Valley rain and river gauges.	■			■
U5	Using the rapid risk assessment hydraulic model, investigate the effects of in-stream and on-bank vegetation on flood behavior through Swifts Creek.	■			■
U6	Investigate feasibility of minor structural works or other measures to reducing potential for over-floor flooding.		■		
L1	Support DELWP to conduct a flood study of the Mitchell River from Glenaladale to river mouth.	■	■	■	■
L2	Continue to support DELWP in conducting the Snowy River Regional Flood Mapping project.	■	■	■	■
L3	Conduct rapid flood risk assessment study for Boggy Creek at Nowa Nowa, including consideration of a range of water levels in Lake Tyers.	■	■	■	■
L4	Prepare LFGs to build and maintain community resilience in priority locations	■			■
L5	Extract flood intelligence and update MFEPs: - Snowy River from Jarrahmond to Marlo - Mitchell River from Glenaladale to the mouth - Boggy Creek Catchment	■	■	■	■
L6	Investigate opportunities to improve data availability at priority gauges, including Bemm River gauges at the highway and the pumphouse. Reinstate the gauge board on the Coast Road Bridge.	■			■
L7	Develop quick look indicative flood interpretation tools for VICSES.	■	■	■	■
L8	Review the protocol for emergency estuary / river mouth opening.				■
L9	Undertake a Planning Scheme amendment to incorporate the outputs of the Snowy and Mitchell River flood studies.			■	