Support for emergency management planning

Flood risk management guideline EM01

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Overview

Introduction

This guideline provides advice on how the flood risk management (FRM) framework and process described in the *Flood risk management manual: the policy and manual for the management of flood liable land* (the manual; DPE 2023) can consider and support flood emergency management (EM). It outlines how the NSW State Emergency Service (NSW SES) as the combat agency for flood, storm and tsunami, plans for flooding, as well as the key EM principles and strategies it uses when undertaking EM planning for the community. The guideline also provides an understanding of:

- how information from the FRM process is used to support flood EM planning
- key EM constraints and how these may impact FRM for communities
- the limitations of flood emergency response strategies and how these can inform decision-making.

FRM involves partnerships between government agencies, local councils and communities. This provides for more effective and coordinated FRM to the community through the FRM framework and process, which are supported by the Floodplain Management Program.

The NSW SES is a key stakeholder in this partnership and in local council FRM committees (and technical working groups) that support the development of FRM plans through the FRM process. These plans provide the basis for strategic understanding, and effective consideration and management of EM and public safety risks to the community.

Through the FRM process the NSW SES can provide councils with:

- valuable knowledge of historical flooding and its impacts on the community that can assist councils during the FRM process
- advice on known EM constraints, response strategies or key limitations to effective emergency response by the community where flood plans are in place
- options that may improve the effectiveness of the emergency response, for example, this could include improvements to, or provision of, a total warning system for flood (TWSF) service to facilitate more effective warning and support community action.

Councils in turn can provide flood information developed through the FRM process to the NSW SES. This can inform the development and update of flood intelligence and local flood plans.

The FRM committee provides a forum for sharing information and knowledge and for understanding and considering EM risks and limitations in decisions and assessing management options. The advice provided in this guideline is not intended to endorse or condone a decision for works or to place or manage a development in a given location where the specifics of the proposal are not known. It is intended to inform decision-making under the FRM framework and process.

Structure of the guideline

This EM guideline has 4 parts:

- Part A – an overview of EM planning and linkage to the FRM framework and process
- Part B – flood information to support EM planning
- Part C – flood emergency response classification of communities
- Part D – considering flood EM in decision-making

References and links to webpages are provided at the end of the guideline.

Relationship to the manual and guidelines

This guideline builds on the advice provided in the manual. It supports councils in their role in delivery of the *Flood prone land policy* (the policy) through the FRM process. It replaces *Floodplain risk management guideline: flood emergency response planning classification of communities* (DECC 2007a) and *Floodplain risk management guideline: SES requirements from the FRM process* (DECC 2007b).

This guideline refers to other FRM tools and guidelines, relevant state agencies and legislation. Details on these are provided in the current version of the *Administration arrangements: flood risk management guideline AG01* (FRM guideline AG01). Links to FRM guidelines and relevant websites can be found in the 'More information' section below.

More information on terms used in this guideline is available in the manual and FRM guideline AG01.

Audience

This guideline is written to support local council staff, state agencies and their consultants in understanding and managing flood risk to local communities.

Part A – Flood risk management and emergency management planning

A1 Introduction

The NSW SES undertakes flood EM planning as a legislative responsibility to determine how to best lead the response to floods. Flood EM planning includes the preparation of flood plans which consider the threat, onset and aftermath of flooding at various scales.

The local flood plan (LFP) typically describes the risk to the community, outlines roles and responsibilities for the NSW SES and supporting agencies and describes how the NSW SES will manage the response to flood events at a local scale. The LFP's structure aligns with 4 key stages of EM: prevention, preparedness, response and recovery (PPRR). It also contains information that can be used to inform community engagement and assist the community with their response based on the flood threat.

This part of the guideline provides an overview of flood EM planning and how this links to various stages of the FRM process. It also provides advice on how the NSW SES and councils can work together through the FRM framework and process to manage flood risk to communities.

A2 Flood emergency management planning

The NSW SES leads flood EM planning and associated support to other NSW Government agencies and local councils. Key responsibilities of the NSW SES are defined in the *State Emergency and Rescue Management Act 1989* and the NSW *State emergency management plan* (EMPLAN).

The NSW SES has a legislative responsibility:

- 'to protect persons from dangers to their safety and health, and to protect property from destruction or damage, arising from floods storms and tsunamis'
- 'to act as the combat agency for dealing with floods (including the establishment of flood warning systems) .... and to coordinate the evacuation and welfare of affected communities'

(*State Emergency Service Act 1989* s 8)

As the combat agency for flooding, the role of the NSW SES includes community education, collation of flood intelligence, flood EM planning and flood response, including the evacuation and welfare of affected communities. The NSW SES is also a key agency involved in the establishment of flood warning systems as part of the *Application of the total warning system to flood* (AIDR 2021).

Section 12 of the *State Emergency Service Act 1989* (SES Act) outlines the flood combat agency planning function by provision of authority to the NSW SES whereby:

> The Commissioner is required to undertake such planning and make such preparations as the Commissioner thinks fit for the purpose....

This includes the development of flood plans at different scales in consultation with the relevant agencies, local councils and the community.

A2.1 Levels of NSW SES planning

The NSW SES has identified 2 primary levels of EM plans: the *NSW State flood plan* (SFP) (NSW SES 2018) and LFPs. The SFP includes emergency sub-plans such as the *Hawkesbury-Nepean flood emergency sub plan* (SEMC 2020). LFPs are typically local government area based and are sub-plans of the local EMPLAN. EM planning can also be undertaken at a zone or a regional scale where the scale and complexity of regional evacuation warrants a dedicated plan.

Flood plans are intended to cover all relevant flood threats emanating from rivers, creeks, lakes, the sea (including where catchment flooding and coastal inundation interact in coastal waterways), and from potential dam failure. The principal flood threat in New South Wales is riverine flooding, and the plans reflect that most impacts caused by flooding are from rivers or streams. Similarly, the intelligence that supports the plans primarily relates to the effects of flooding in areas on the state's major waterways where flood warning services are provided.

The common elements of EM plans include:

- the legislative basis for the plan and its relationship to other plans
- the roles and responsibilities of each of the agencies, functional areas, councils and key stakeholders in the key EM stages of PPRR. This provides an understanding of the specific response arrangements during floods
- an outline of the flood threat in the area covered by the plan. This provides an understanding of how flooding impacts communities and the response arrangements during floods. This includes understanding the impacts of more frequent floods through to those that may necessitate large-scale evacuations and/or cause substantial disruption to the community.

The variation in flood plans provides for scaling of the EM arrangements. This allows for the response to be escalated from a local to zone to state command and control, depending on the geographic scale of flooding and resources required to manage the response.

A2.2 Flood plans and community education

Flood plans:

- provide an informed basis for identifying the flood threats and key consequences to the community
- outline the strategies available to emergency managers to minimise risks to the community during floods.

Local flood plans, written on behalf of the community, are generally detailed in nature and contain information suitable for flood EM planning at a community level. As such the community needs to be familiar with actions relevant to them in the plan to ensure they can be effectively implemented during floods.

To support community readiness, the information in the LFP needs to be supplemented with community engagement. The NSW SES may support engagement activities and develop communication material such as FloodSafe guides. These guides provide advice on the flood problem and key triggers for response in plain English and a variety of other languages.

FloodSafe guides can be customised for the local flood conditions. They typically include a summary of the flood problem and actions needed by the community as a ready reckoner for action during an event. These guides may also be produced for specific areas, events, or for a specific sector of the community. There are also general

guides for different sectors such as caravan parks, rural properties and flash flooding. FloodSafe guides are typically found on the NSW SES website and at council offices and libraries.

The NSW SES works closely with councils in its community engagement function. It may conduct or run joint media campaigns or coordinate community activities to increase awareness of flooding. This may involve promotion of existing and development of new community education materials to assist the understanding of actions to be taken before, during and after a flood event, and the key triggers that require a community response.

A2.3 Key considerations in flood EM planning

Floods are highly variable in frequency and severity. This influences critical EM planning assumptions, including the available flood warning time, likely consequences, and the associated actions required during a flood. Flood plans are developed considering the variability between floods and the available information. These plans are also maintained and updated as new information becomes available and considering lessons learnt from events.

Effective implementation of flood plans also depends on a thorough understanding of the risk and of the roles and responsibilities of participants. To experienced emergency managers such as the NSW SES these are areas well known for their uncertainty, so the NSW SES trains and practices to minimise their impact.

The NSW SES, as the flood combat agency, has formalised planning and operational processes that include access to information not available nor feasible to be provided to individuals during a flood. This makes NSW SES flood plans reliable, robust and adaptable during a flood.

A2.4 Site-specific flood response plans

Site-specific flood response plans are different in scope and scale from LFPs. These plans are not considered by the NSW SES to be an effective measure to strategically and effectively manage EM risks to the community during flooding.

Plans developed outside the NSW SES EM planning process are not intended to be used as a long-term risk mitigation measure for community response. When used beyond their intent, they are prone to failure particularly where they do not consider important EM planning factors, do not have formalised and practised EM arrangements or access to information such as:

- the scale of event
- knowledge of a rapidly changing and variable flood situation
- uncertainty associated with predictions and likely consequences
- an understanding of the actions and timing necessary on a strategic community scale considering the local flood conditions.

Further, businesses, occupants of private facilities and households:

- often do not have an awareness of the uncertainties of flooding
- have a much lower capacity to undertake the necessary training and practice
- do not have access to all the information and resources available to the NSW SES during flooding
- may not be aware of new information as it becomes available and therefore may not update plans where needed.

A2.4.1 Home and business emergency plans

The NSW SES encourages owners and occupiers of homes and businesses, infrastructure operators, and institutions in flood affected areas to have a site-specific action plan in place for flooding.

To help home and business owners prepare for flood and other emergencies the NSW SES website has an interactive, step-by-step Home Emergency Plan for home owners and Emergency Business Continuity Plan for business owners. These plans are intended to assist individuals or businesses to prepare for and respond to flooding consistent with responsibilities identified in NSW SES LFPs and educational material. They typically reinforce an individual's understanding of their role or actions necessary to reduce personal losses due to flooding, for example, raising or relocating personal belongings or business equipment or stock, or in some cases, identifying when evacuation may be likely on the direction of the NSW SES.

A2.4.2 Site-specific flood response plans as a development consent condition

In some circumstances site-specific flood response plans have been developed in an attempt to manage the EM risks to the future community to support development proposals. The NSW SES does not consider plans developed in this context to be an effective measure for addressing continuing risk to users of new development, nor suitable for addressing the impacts the development may have on the EM risks to the existing community.

These plans do not have the same strategic intent nor scope as EM planning undertaken by the NSW SES for communities. In addition, they generally do not consider the EM needs and implications for the community and the NSW SES in the lead-up to and during flooding nor do they consider the inherent uncertainty in human behaviour during a flood event.

Many considerations for EM planning are beyond the scope, scale or influence of a development proposal. Considerations such as long-term maintenance, EM arrangements and exercising of plans as well as situations beyond the control of the impacted community in the development are unlikely to be successfully managed. Situations like failure of essential services such as power, water or sewer are also key considerations that can influence triggers for evacuation, the ability of occupants to evacuate or the safety of people who remain in isolated areas. These are key aspects to be considered with long-term effective EM planning and response for the community. The NSW SES does not support site-specific flood plans given they:

- are not consistent with the intent of existing EM arrangements identified in Section A2, the relevant SFP or LFP and the flood EM planning practice of the NSW SES
- do not consider the broader impacts on emergency services and EM arrangements during flood events.

Further, the responsibility for the consequences and risks to the users of new development associated with a failed response due to inadequate plans is often not considered in decision-making. Where these are not addressed a significant EM risk to the community will often remain.

In particular, councils should consider that:

- Requiring a site-specific flood response plan as a condition of consent for development is not considered a genuine attempt to manage flood risk to future occupants. The vulnerability or capability of occupants and their ability to enact a plan, as well as the flood characteristics of a future event are not known at the time

of the plan's creation. Unless occupants are able to self-evacuate for all possible flood events in consideration of future development, and the plan is owned, understood, practised and uncertainties of flooding understood by occupiers, it will almost certainly be forgotten or fail to be effective, particularly in events where the plan assumptions are overwhelmed.

- There is no process for quality control for development of site-specific flood response plans. There is no statutory authority nor capacity for the NSW SES as the flood combat agency to review, assess or approve requests by applicants to review these plans.
- Review, assessment and approval of site-specific flood response plans is not within the scope of a local EM committee or FRM committee or other related bodies. The endorsement of these plans by these bodies is not consistent with the legislative status of the NSW SES as the combat agency for flood and is likely to be questioned.
- The role of NSW SES in flood EM planning has been recognised in the NSW Land and Environment Court, which has considered site-specific flood response plans as a consent condition.

A2.5 EM response strategies

Understanding flood behaviour and its impacts is key to identifying the most suitable flood EM response strategy available for the community. **The NSW SES has a legislative responsibility to protect persons from dangers to their safety and health during flooding** (SES Act ss 8(1)(aa) and 8(1)(a)). This requires planning for and managing evacuation during flooding as part of its legislative responsibility.

> Evacuation is a risk management strategy that may be used to reduce loss of life or lessen the effects of an emergency on a community, prior to the onset of, or during, an emergency. It involves the movement of people threatened by a hazard to a safer location and, typically, their eventual safe and timely return. For an evacuation to be as effective as possible, it must be appropriately planned and implemented.
>
> (AIDR 2017)

The National Council for Fire and Emergency Services (AFAC) has stated that: 'If sufficient time is available then properly planned and executed evacuation is the most effective strategy' (AFAC 2018). Whilst evacuation is identified as the most effective strategy for community safety during flooding, the time available to undertake evacuation can be a key limitation in ensuring the strategy can be effectively carried out. This is primarily assessed based on warning time and time available to enact the evacuation before evacuation routes are cut, or evacuees and emergency services are overwhelmed by floodwaters.

AFAC (2018) also identifies the dangers that evacuees may face. These include the possibility of flooding of evacuation routes while the process is underway, exposure to adverse weather conditions such as lightning, hail, heavy rain, strong winds, and other threats such as flying debris or falling trees and power lines. These factors are considered in decisions on whether evacuation is feasible in the available timeframe.

Sections A2.5.1 to A2.5.3 outline the key limitations and considerations in available EM strategies for flooding. These should be considered when assessing FRM options that affect the flood EM evacuation capacity or capability during floods. These options are discussed further in Section A3.1.

A2.5.1 Evacuation

The primary strategy for the NSW SES is evacuation of people to an area outside of the effects of flooding that has adequate facilities to maintain the safety of the community. This is reflected in flood plans developed by the NSW SES in collaboration with councils considering evacuation constraints and logistics.

This requires an understanding of the full range of flood behaviour up to the probable maximum flood (PMF), to understand the key consequences and the sequence in which these occur. This includes understanding event variability and in particular those events with a faster rate of rise or longer duration of isolation.

Evacuation capability

In planning for evacuation, the ability to evacuate is informed by an understanding of flood behaviour. This includes understanding the potential variability in real floods as opposed to design events, as well as the uncertainty associated with warnings and the time taken for the community to respond. This information is typically determined through the FRM process, which in turn informs EM planning by the NSW SES.

Evacuation capability, and in some cases modelling of evacuation using timeline assessments, have been considered in EM planning for a number of years by the NSW SES (Opper 2004; Opper et al. 2009; Molino et al. 2013).

Understanding some of the key factors involved to assist the NSW SES to understand evacuation capability can provide some insight as to whether community evacuation may be feasible. Key considerations for emergency managers in understanding evacuation capability and developing evacuation strategies include an understanding of:

- available warning time including the EM capacity to warn the community
- number of people to be evacuated
- time and location of evacuation route closure
- time to warn people to evacuate
- time people take to accept and act on a warning
- time taken for people to travel along an evacuation route including time for likely convergence and traffic delay issues
- the evacuation capability of the existing community and ensuring this is not affected where new development is being considered
- availability of a safe area to evacuate to with adequate services to support evacuees.

The NSW SES may also consider more comprehensive factors including the development and logistics of evacuation strategies to ensure evacuees are safe and their welfare is sustained. This remains the responsibility of the NSW SES, agencies and entities identified in flood plans. Studies under the FRM process can provide information to assist the NSW SES in its EM planning.

A2.5.2 EM response in fast responding catchments

In fast responding or flash flood catchments, the time to flooding and flood duration are typically very short with minimal warning time. Warnings to the community are often limited to severe weather warnings or flood watches for the general area. There is often no specific advice available on the local impacts of flash flooding, and there may be little time between the start of flood-producing rainfall and flooding of roads, property and potentially buildings.

In some situations, attempting to evacuate may be worse than not evacuating given '… the dangers inherent in moving through flood waters, particularly fast-moving flash flood waters. The timescale over which flash floods occur may limit the feasibility of evacuation as a response measure' (AFAC 2018). However, this is limited to situations where flooding does not directly impact the safety of individuals remaining in place.

Flash flooding can be defined as flooding occurring '… within 6 hours of the precipitating weather event, and often involves rapid water level changes and flood water velocity. This definition excludes flooding caused by dam failure, storm surge or tsunami although similar emergency management principles may apply to these events' (AFAC 2018).

Time to onset of flooding is a key factor in considering evacuation capability and subsequent controls as a risk management measure in these areas. Controls can be placed on development to ensure occupants can have a refuge above even the highest flood level with adequate structural building controls. However, it is recognised that there is no evidence-based method for determining a safe or tolerable duration of isolation that may result from flooding. This is primarily due to the potential for other issues to emerge, including medical emergencies and fire either due to power surges or makeshift lighting or heating. These potential emergencies may result in an avoidable number of rescue attempts that place both the occupants and rescuers in danger. In addition, occupants that may not have evacuated may regret this decision due to concerns about their health, inability to communicate due to power and telecommunication outages, safety or the conditions they are faced with during the flood, and may require rescue or venture out into hazardous conditions.

Further, flood conditions or flood impacts may persist for a number of hours or days with infrastructure surrounding the site possibly damaged or out of service leaving occupants without access to basic needs such as food, water, medications, telecommunications, power or vehicular access from the site even when floodwaters recede. Therefore, isolation of a community or individuals in a community during flooding is a key influence on EM risk that requires careful consideration.

Vulnerability of occupants is also a key consideration in locations where it may appear that risks of remaining in place are minimal for able-bodied adults. The location of developments (such as hospitals and aged care homes) whose users are vulnerable in evacuation needs to consider the consequences of these users being unable to evacuate for both the community and emergency services.

It is also recognised that emergency service response will likely be compromised by the rapid onset of hazardous flood conditions that limit access to development in flash flooding locations. In these areas it is likely that emergency services would have little ability to warn individuals and effectively respond to assist those trapped in buildings.

A2.5.3 Areas with no defined EM response strategy

Regardless of whether an EM response strategy is defined in an LFP, properly planned and executed self-evacuation with adequate evacuation capability and coordinated response through the leadership of the NSW SES is the most effective EM strategy for the community.

Some areas outside existing NSW SES EM strategies will see a significant increase in population due to future development or land release. In these areas, consideration needs to be given to the impact the development is likely to have on evacuation of the existing community. In some instances, it may be appropriate for proponents of larger-scale developments to undertake an evacuation capability assessment based on several key factors including those identified in Section A2.5.1.

The NSW SES can provide advice for strategic assessment, including key local considerations through the FRM process and FRM committee. This advice could be used to inform recommendations for land-use planning (LUP), including considerations for development control plans (DCPs) considering future scenarios (which can consider future development, changes to catchments and climate change) outlined in *Understanding and managing flood risk FRM guideline FB01*. However, whilst key evacuation constraints can be identified, such as flood emergency response classification of communities (FERCCs) (see Parts B and C of this guideline), the ability to assess detailed evacuation capability is out of scope of studies under the FRM process.

Detailed evacuation capability assessment that is fit for purpose requires significantly more information than that derived through the FRM process, including the specifics of a proposal such as proposed land uses, changes in topography, likely vulnerabilities of the development and occupants within the community, information on proposed site access and intersections and internal road layouts, other relevant infrastructure, mitigation works, availability of warning to the future community, etc. This would require a comprehensive assessment of evacuation capability through a flood impact and risk assessment (see *Flood impact and risk assessment FRM guideline LU01*) undertaken on a strategic basis to support a proposal.

Any agreed community EM response strategy determined on a strategic basis through or in conjunction with the FRM process should be formally recommended for inclusion and subsequently included in the relevant local or state flood plan by the NSW SES.

A2.6 Flood warning

The NSW/ACT Flood Warning Consultative Committee (FWCC), chaired by the Bureau of Meteorology (BoM), aims to coordinate and improve the effectiveness of flood warning services consistent with the national total warning system (TWS) (Figure 1) to NSW/ACT communities. The NSW members of the committee include the NSW SES and NSW Department of Planning and Environment's Environment Heritage Group.

The flood warning arrangements for New South Wales are outlined in the current version of the *Provision and requirements for flood warning in New South Wales* (NSW SES 2019). These arrangements include advice on where warnings are provided to communities, the anticipated timeliness of warnings to different locations and advice on the gauge levels that are expected to lead to minor, moderate or major consequence to the community.

The NSW SES works with the NSW/ACT FWCC members, including BoM (primarily for riverine flooding), and councils to develop effective warning products and messaging that are consistent and understood by communities. Flood warning systems are identified and incorporated into EM planning for communities. These arrangements allow the NSW SES to plan a coordinated response consistent with the relevant components of the TWSF and TWS.

The components of a TWSF must be integrated for a system of operate effectively. The components of a TWSF include:

- monitoring of rainfall and river flows that may lead to flooding
- prediction of flood severity and the time of onset of particular levels of flooding
- interpretation of the prediction to determine the likely flood impacts on the community
- construction of warning messages describing what is happening and will happen, the expected impact and what actions should be taken

- dissemination of warning messages
- response to the warnings by the agencies involved and community members
- review of the warning system after flood events.

Figure 1 Total warning system

The NSW SES maintains a flood intelligence system that describes the impacts of flooding and intended response actions at key locations throughout New South Wales. This system supports community warnings, informs emergency planning and assists emergency decision-making as outlined in the current version of the NSW SFP.

Flash flood warning systems have significant limitations in their effectiveness to deliver a TWSF service compared to flood warning systems for larger rivers. These systems can generally provide some form of notification of flooding, however, they cannot always provide detailed information on the severity of the event, location of rainfall until it is occurring nor adequate lead time to communicate the warning to the community and allow for safe evacuation. These systems also increasingly use forecast rainfall, often prior to detection of rain on the ground or within a very short period of detected rainfall or rising water levels. They are therefore likely to provide limited timely advice to the community and issues with false alerts can be expected.

These systems typically cannot be used in planned evacuation where time is critical. This limits their effectiveness in maintaining community safety, particularly where there

is insufficient time for effective response or limited indication of the scale of flood impacts. In these cases, the response required by the community is unclear. With very little warning time, the system may at best notify the community that local flooding may be expected, and roads may be cut off by floodwaters. It may also provide limited advice, such as to seek refuge on higher ground or the highest location in a building. This is ineffective in situations where no higher ground is available or if buildings are not known to have been designed for the expected depths and forces due to floodwaters and associated debris.

The most appropriate community messaging and response may be unique to each situation or area and the specifics of the flood event. Messaging also needs to consider whether impacts are influenced by riverine and/or flash flooding mechanisms in the same or different events. These situations require warning messages and response actions that consider the potential range and variation in behaviour and response from the flooding mechanisms.

Comprehensive community awareness strategies are also required to ensure the community understands the relevant issues. However, the effectiveness of flash flood warning systems at minimising risk to life cannot be guaranteed due to potential misinterpretation of the messages and potentially failed response.

To be effective, flood warning systems require:

- significant ongoing investment in operations, maintenance, testing and exercise of systems and flood warning arrangements relative to their upfront installation cost
- EM planning arrangements led by the combat agency that are coordinated and robust and that allow for the inherent uncertainties in predictions and event-driven variations
- significant upfront and ongoing effort to raise community awareness as discussed in Section A2.2.

This is best achieved by systems and arrangements managed or overseen by government. The NSW flood warning arrangements provide for coordinated advice and information on flooding and its impacts on communities. The ability of new or upgraded government flood warning systems to improve community safety can be tested for efficacy against the EM principles in Section A2.7. Where private or site-specific flood warning systems and associated arrangements are proposed, consideration needs to be given to how these aspects are addressed along with the associated issues identified in Section A2.4.

Having areas with multiple private or site-specific flood warning systems, each with varying efficacy, increases the complexity of deriving flood warning advice at the community scale. It is also more challenging to monitor these flood warning systems and effectively incorporate information into strategic EM response for the community in the LFP. The NSW SES, therefore, generally does not support the use of private or site-specific warning systems for individual developments that have not been developed in a strategic context.

A2.7 EM principles to consider in assessing FRM options

The NSW SES's primary strategy is evacuation out of the floodplain to remove the community from the hazard to an area of safety with available resources as described in Section A2.5. However, there are areas affected by flooding without adequate warning time where the risk of evacuating may be greater than that of remaining in place. This is typically due to risks outside of buildings and the potential flood range and behaviour and associated issues such as debris and potential for other emergencies in these areas as described in Section A2.5.2.

A set of 7 principles for EM (see box below) have been developed based on:

- research and understanding of the authoritative sources of forecast provision and prediction
- limitations of EM strategies
- experience and training in undertaking EM planning including logistical and operational considerations that are applicable when considering flood EM constraints and their impacts on the existing and future community.

These principles are primarily applicable for councils when:

- setting strategic directions for a community through recommendations under the FRM process with technical assistance from the NSW SES
- strategically considering redevelopment in existing evacuation constrained areas.

Considering these principles collectively, along with broader flood constraints of the locality and the existing EM response strategy, can assist in minimising the potential increase in risk to the existing and future community. The principles and considerations for making decisions based on EM and minimising risk to community safety are introduced below and further discussed in Part D of this guideline.

These principles should not be considered in isolation but rather within the broader FRM principles that are outlined in the manual. These documents take account of the full range of flooding risks and the constraints they place on land to manage flood risk to the community.

Principle 1

Any proposed EM strategy should be compatible with any existing community EM strategy

Any proposed EM strategy for an area should be compatible with the evacuation strategies identified in the relevant local or state flood plan or by the NSW SES.

Principle 2

Decisions should be informed by understanding the full range of flood EM risks to the community

Decisions relating to future development should be risk-based and ensure EM risks to the community of the full range of floods are effectively understood and managed.

Principle 3

Development of the floodplain does not impact on the ability of the existing community to safely and effectively respond to a flood

The ability of the existing community to effectively respond (including self-evacuating) within the available timeframe on available infrastructure is to be maintained. It is not to be impacted on by the cumulative impact of new development.

Principle 4

Decisions on redevelopment within the floodplain are supported by an EM strategy that does not increase risk to life from flooding

The preferred EM approach is evacuation, where evacuation capacity and capability has been demonstrated as the most effective strategy to manage EM risks (i.e. a strategy that enables the users of development to self-evacuate to an area outside the floodplain that has adequate services to sustain the community in an orderly planned outcome). This includes consideration of flood warning and evacuation demand on existing and future access/egress routes considering potential impacts of localised flooding.

Where this is not possible any decision involving redevelopment, and in particular increasing population at risk, needs to consider the safety of the community. This may include provisions such as effective flood warning, a practical safe refuge for the full range and behaviour of flooding (i.e. above the PMF and designed to withstand the associated forces of flooding), and provisions to be able to safely self-sustain for short duration flooding. Managing these risks requires careful consideration of development type, likely users, and their ability respond to minimise their risks. This includes consideration of:

- **Isolation** – There is no known safe period of isolation in a flood, the longer the period of isolation the greater the risk to occupants who are isolated.
- **Secondary risks** – This includes fire and medical emergencies that can impact on the safety of people isolated by floodwater. The potential risk to occupants needs to be considered and managed in decision-making.
- **Consideration of human behaviour** – The behaviour of individuals such as choosing not to remain isolated from their family or social network in a building on a floor above the PMF for an extended flood duration, or attempting to return to a building during a flood, needs to be considered when adopting any EM strategy.

Principle 5

Risks faced by the itinerant population need to be managed

Any EM strategy needs to consider people visiting the area or using a development. This may be relevant for the transient population visiting for shopping, during holiday periods or utilising an area for an entertainment or tourism event.

Principle 6

Recognise the need for effective flood warning and associated limitations

An effective flood warning strategy with clear and concise messaging understood by the community is key to providing the community an opportunity to respond to a flood threat in an appropriate and timely manner.

Principle 7

Ongoing community awareness of flooding is critical to assist effective emergency response

Councils and government play an important role in ensuring communities have and retain an awareness of flooding and the strategies that will help them respond appropriately to a flood threat.

A2.8 The FRM process and EM planning

EM planning in the flood context refers to the making of flood plans led by the NSW SES at various scales such as those described in Section A2.1. The FRM and EM planning processes are complementary and provide useful information in a mutually beneficial way. The content of LFPs, flood intelligence systems, community engagement material such as FloodSafe guides and flood warning products draw heavily from the outputs of flood studies, FRM studies and need to consider the implementation of FRM measures. However, EM planning also needs to consider information sources outside the FRM process, such as:

- other studies or reports such as post-flood data collection and behaviour reviews
- dam safety studies and outputs
- infrastructure studies
- historic flood information
- information on critical infrastructure and services
- evacuation capability or difficulties
- community characteristics
- available community facilities to support evacuees.

The EM planning process typically requires research, verification of different sources of information and analysis to turn information into flood intelligence. This intelligence is then used for EM planning that may include identification of:

- the primary EM response strategy (such as evacuation)
- actions for the community, agencies, councils and other stakeholders
- the logistics of implementing these actions
- what typical warning is available
- how the community will be informed of flooding and what the messaging will be.

This requires a coordinated and formal approach to achieve effective EM planning that is both robust and tailored to the local flood situation. The EM planning process and linkages to information sources (including those from the FRM process) are summarised in Figure 2.

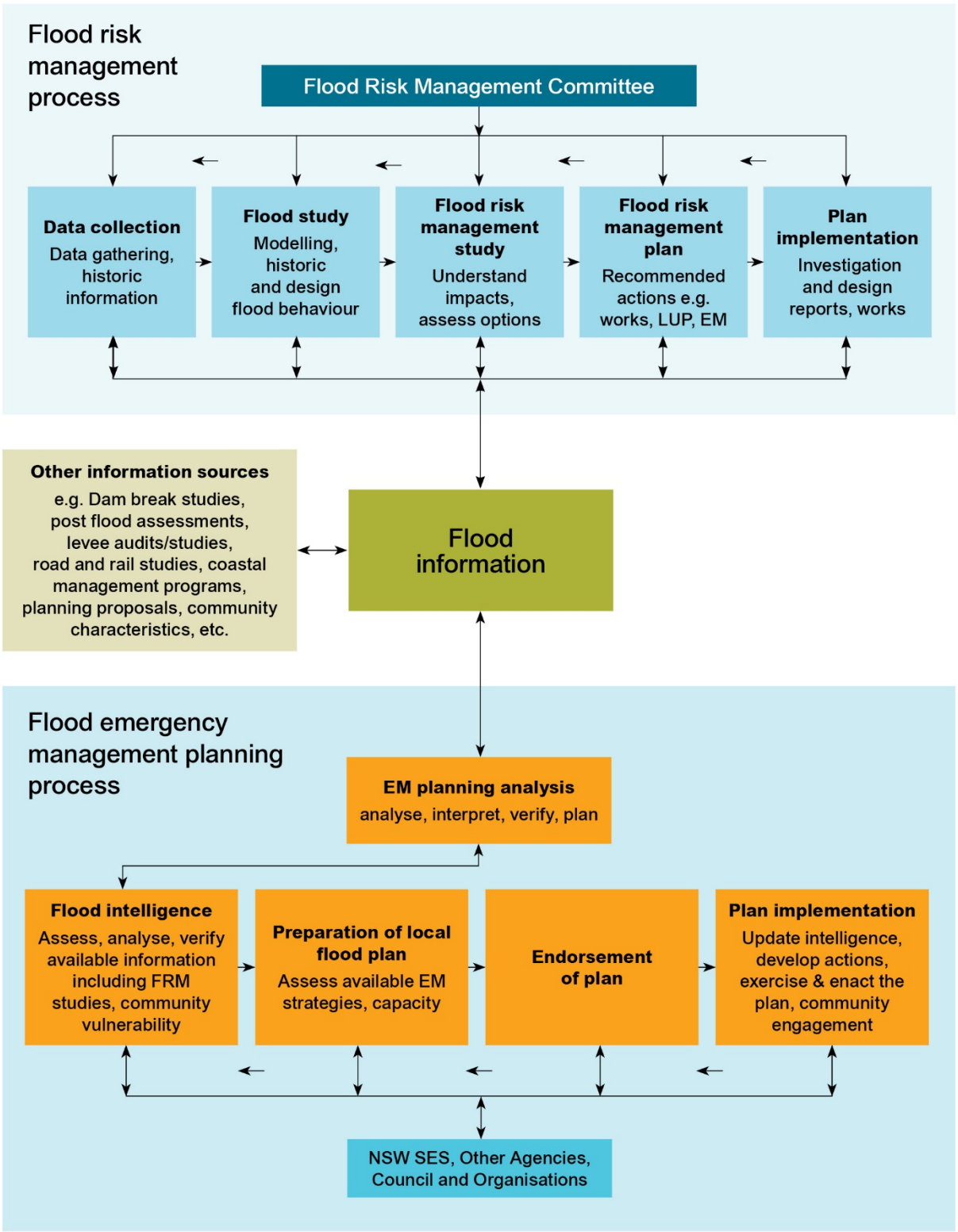


Figure 2 **Information sources and their interaction with flood emergency management planning processes**

A3 Flood risk management support for emergency management planning

To develop robust flood emergency response strategies as part of flood EM planning, the NSW SES needs to understand flood behaviour and how it may vary, and how this impacts on emergency response logistics. This requires information on:

- historic floods
- a range of design events resulting in peak flood levels, up to and including the PMF
- shorter duration design events that may not reach peak flood levels but may reach critical levels or tipping points for community response (e.g. inundating an evacuation route) more quickly, giving less time for the community to respond. This is likely to require consideration of an ensemble of historic and design flood temporal patterns.

The types of information required include information on:

- flood behaviour, including flood progression, extent and height throughout the floodplain for the full range of flooding, and understanding how this impacts the community
- timing of flood impacts on the community and the associated consequences
- the potential variability in flood behaviour including timing of key impacts.

Outputs from the FRM process provide the basis for understanding flood behaviour and its impact on the community within a study area. They also provide an understanding of the variation in flood behaviour for a range of design events including:

- how flooding may behave over time during an event
- how flooding can vary from event to event depending on intensity and temporal patterns of rainfall and catchment conditions
- how flood behaviour and levels at a location can vary depending on the complexity and size of a catchment and its floodplain.

Much of this information is a typical output in studies undertaken within the FRM process through the generation of reporting, spatial outputs and electronic data. However, some information provided in studies also requires specific presentation to make it more readily usable in flood EM planning, developing response strategies and in communicating flood risk and response actions to communities.

Part B of the guideline discusses deriving information to support flood EM planning including in relation to the impacts FRM measures may have on EM.

A3.1 Involvement of the NSW SES in the FRM process

The FRM committee and its technical working group (TWG) is a key resource for councils when setting FRM direction under the FRM framework and undertaking studies under the FRM process. Councils and their FRM committees maintain a close relationship with the NSW SES throughout the FRM process, typically through a local NSW SES commander supported by NSW SES staff.

Involvement in the FRM committee allows the NSW SES to assist councils by providing EM input throughout the FRM process. It also enables the NSW SES to have studies under the FRM process produce a range of outputs that can inform the development of flood intelligence, EM planning, and community education and awareness activities.

NSW SES input into the FRM process includes:

- review and input to draft project briefs, including consideration of existing information contained in LFPs, historic information and intelligence systems
- advice on existing EM constraints and strategies
- provision of information – such as 'request for assistance' data, post-event flood behaviour studies, key vulnerable facilities, evacuation routes – through the initial brief development and/or flood study data collection process
- participation and input into community consultation throughout the process
- review and input into the derivation of FERCCs (outlined in Part C)
- review of draft studies and plans including draft FRM and strategic LUP options and recommendations that impact EM
- review and input into FRM options and FRM plan recommendations particularly those that may alter flood behaviour or response and therefore impact on EM strategies. For example, altering flow conveyance (in floodways), flood levels, hazard, time to inundation, and time of isolation, the availability or adequacy of warnings, and evacuation route capacity may all have an impact on the existing EM response strategy. The options that typically require careful consideration from an EM perspective include:
  - warning systems
  - major structures that can alter evacuation routes, tipping points, timelines or response strategies, such as levees, detention basins or road and bridge upgrades
  - updated information to support EM planning and the update of LFPs
  - community engagement activities that have synergies or require NSW SES involvement
  - investigations into cumulative impacts of development in evacuation constrained areas.

Figure 3 outlines the:

- the key stages of the FRM process
- outputs relevant to EM planning
- key input and consultation points with the NSW SES
- product updates the NSW SES considers at each phase of the FRM process.

The suggested information derived in studies to support EM planning considerations is outlined in Part B of this guideline.

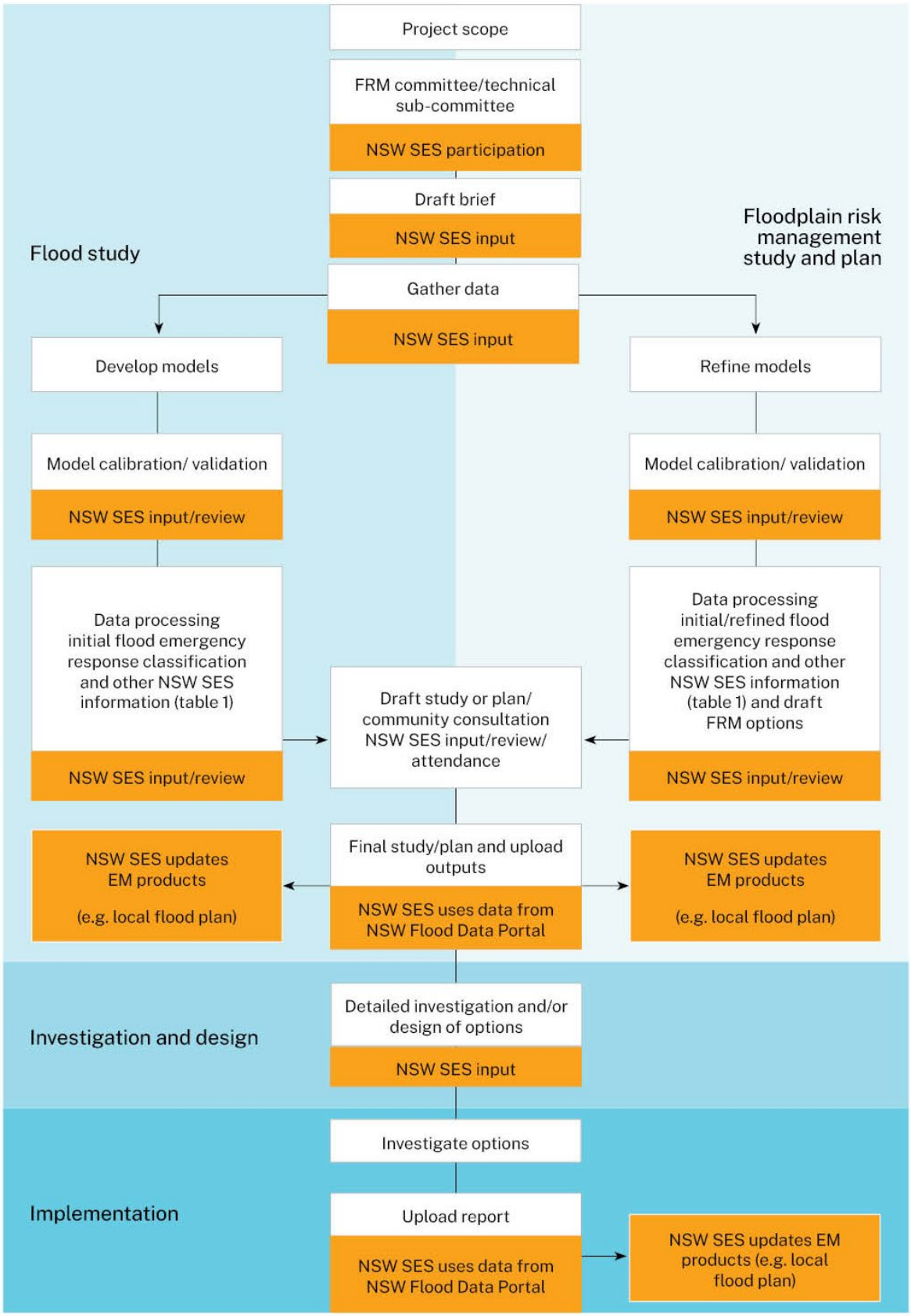


Figure 3 **Typical NSW SES involvement in and necessary outputs from the flood risk management process**

A3.2 Information for EM planning

The NSW SES regularly updates or develops its EM planning products including LFPs, flood intelligence, flood action cards, flood warnings and FloodSafe brochures when new information (from within or outside the FRM process) becomes available or where changes impact on how the community may need to respond to a flood threat.

The FRM process may result in new flood information and the implementation of FRM measures, both of which may impact on EM planning. Therefore, it is important for the NSW SES to be informed when:

- studies and FRM plans are being completed and when they are adopted
- design is completed of FRM measures that may influence how the community needs to respond to a flood threat (e.g. flood warning systems, evacuation route upgrades and levees)
- implementation of such FRM measures:
  - is commenced
  - is completed. Any differences between the FRM measures originally proposed and those completed that may influence the flood response of the community are to be identified.

The provision of this advice allows the NSW SES to plan for and commence the process of updating EM planning products where necessary, and to schedule and undertake priority community awareness activities.

Other information from outside the FRM process may also result in changes to EM products. This may include post-event data collection, post-flood behaviour studies or other new studies or works.

The provision of final reports and information through the NSW Flood Data Portal ensures the latest strategic flood information is available to the NSW SES to support the update of EM planning, warning products and community education.

Part B – Emergency management information from the flood risk management process

B1 Introduction

To effectively undertake and use EM planning the NSW SES needs access to flood information. This includes information on the variability of:

- flood behaviour
- the availability of warning and related gauges (both water level and rainfall gauges)
- the effective warning time
- the key impacts of a range of flood events up to the PMF on the community
- the tipping points that may cause isolation or inundation of an area or a change in how the community needs to respond to flooding.

The NSW SES also needs information on:

- FRM works implemented
- FRM measures proposed in FRM plans that may influence EM in future
- FERCCs (outlined in Part C).

This information can come from a range of sources (see Section A2.8 and Figure 2).

This part of the guideline aims to assist consultants completing studies to understand the scope and scale of information required to support EM planning from the different stages of the FRM process. It needs to be read in conjunction with Part C, which outlines how to develop FERCCs. At the completion of studies, the information identified in Parts B and C of this guideline is to be provided through the NSW Flood Data Portal as part of data handover requirement in projects undertaken under the NSW Floodplain Management Program.

B2 Key information requirements

Studies under the FRM process consider the full range of flooding up to and including the PMF and the potential variability in flood behaviour recognising that no 2 floods are the same. Study outputs will vary depending on the known local risks, purpose and scope of the study as well as the maturity of EM planning and existing information outlined in LFPs and similar documents.

Similarly, the key information requirements from studies will vary depending on:

- flood behaviour, source of flooding, flood impacts on the community
- the study being undertaken, whether a flood study or an FRM study
- information from previous studies, including whether FERCCs exist
- locality-specific information that supports EM planning, including information in the LFP. This may break the community down into smaller EM sectors (or areas) based on their required response, including consideration of important aspects such as tipping points, for example, when an evacuation route is cut by floodwaters and the sector becomes effectively isolated
- key community infrastructure in the study area.

B2.1 EM information from the FRM process

Much of the information required to inform the development or update of EM planning (LFPs) is produced in study reports and supporting deliverables under the FRM process, as identified in Table 1. This information is valuable for developing flood intelligence, breaking the community into evacuation sectors and informing triggers for action, including flood warnings or evacuation. Implementation of FRM measures (such as levees and flood warning systems) may lead to changes in community flood response and require an update of flood intelligence and the LFP.

The scale of analysis, reporting and information required in studies to support EM, however, requires careful consideration. The level of detail in the EM information produced in studies needs to be balanced against the time, effort and cost. This balance needs to consider the:

- type and scale of flood impacts and the severity of consequences to the community
- impacts on key infrastructure and facilities and road closure locations
- timing in different events
- available information.

Typically, where no information exists it will initially be produced in the flood study. The FRM study refines this information and addresses information gaps. The FRM plan provides advice on how the implementation of recommended FRM measures will influence EM planning.

Where the LFP or previous studies already contain relevant information, the revised information derived from the study should be compared with existing information and the differences clearly identified and documented in reporting.

In some cases, additional or alternative information may be needed. Different flooding behaviour, such as fast responding catchments and overland flow situations can provide unique challenges for EM planning, requiring judgement in determining the degree of analysis required.

This is particularly true for analysis of FERCCs (discussed in Part C) as well as the detailed analysis and reporting outlined in this part of the guideline. Sections B3 and B4 are provided in the form of sample EM information reporting that should be included in EM appendices for flood studies and FRM studies. Section B5 provides advice on the additional information that should be provided in an FRM study where a flood levee protects urban areas. These sections should be used as a guide only and adapted to suit the flooding problem being addressed and the technology being used in deriving the study outputs. For example, local overland flood studies generally require less information than riverine flood studies where impacts on the community are likely to be more significant.

Where a combined flood study and FRM study and plan is being undertaken, or where there are substantial changes in flood modelling from the flood study to FRM study and plan, the reporting should provide the information outlined in Sections B3, B4 and, where relevant, B5.

In each case, an understanding of tipping points, and the variation in the timing for floods to reach these tipping points, is to be developed so it can inform the development or update of EM planning. Judgement should be employed in developing requirements and information that are fit for purpose depending on the complexity of the flood problem and degree of risk in the study area.

Where information has been provided in a different format to that specified in the templates, it should be clearly described in an alternative format considered suitable for the study area.

Table 1 Sources of typical flood information required to inform emergency management planning

Information	Source		
	Flood study	FRM study & plan	Specifically produced for EM
Flood behaviour			
Spatial extents of flooding for key design events and historical modelled events	✓	✓	
Plain English description of flood behaviour for historic and design flood events. This is to include a description and pattern of flood behaviour including depths and velocities	✓		
A spreadsheet of building coordinates, addresses and ground and floor levels for properties impacted by design and historic flood events relative to gauge height where available	✓ *	✓ *	
Modelling of flood behaviour that defines the variation over time of flood levels, extents and velocities for each of the critical design events. This may require modelling of flood events from the ensemble including short time to onset for 1% annual exceedance probability (AEP) and PMF and long duration events to provide advice on potential response time variations	✓	✓	✓ Australian Rainfall and Runoff (Ball et al. 2019) would cover variations
Spatial identification of properties affected over floor for flood events modelled		✓	
Describe typical range of rainfall intensities and durations or temporal patterns that can lead to key consequences such as isolation or inundation of floor levels for fast responding catchments	✓ *	✓	
Flood emergency response classification			
Spatial identification of FERCCs for varying design events and key tipping points where known	✓		✓
Description of specific risk areas in the context of the potential consequences of flooding from more frequent, major and extreme events. The description should be consistent with that identified in the FERCCS used to delineate areas of the floodplain for different scale events	✓		✓
Refined spatial identification of FERCCs based on key tipping points		✓	✓
Updated description of consequences based on FERCC tipping points		✓	✓
Review of existing EM sectorisation in LFP	✓	✓	✓

Information	Source		
	Flood study	FRM study & plan	Specifically produced for EM
Gauges			
Description of flood travel time between gauges for different floods where applicable	✓		✓
Description of the flood warning system and key warning reference gauge(s) for the area and the basis of the available warning	✓	✓	✓
The name, ID number and gauge zero (in metres Australian Height Datum (AHD)) for the relevant flood warning gauge	✓	✓	✓
Table showing design floods relative to gauge height including warning classification where applicable (minor, moderate, major)	✓	✓	✓
Spatial layer and description of gauge reference area	✓		
Levees and key flood mitigation structures			
Description of the levee, detailing location, construction type and the areas protected	✓		
Link to information on the levee including a description and long section of design height, overtopping levels and crest low points, spillway heights, likely locations of overtopping and flooding. This also includes a description of the length of time taken to fill the basin area behind each levee once overtopped	✓		✓
Size of the population, the number of residential and commercial properties, and critical infrastructure affected by levee overtopping or failure. This output should be expressed in relation to a variety of flood magnitudes, including a worst case scenario such as the PMF	✓		✓
Spatial details of ground profile inside the levee and potential high areas of land related to the warning gauge datum	✓	✓	✓
Description of potential variation in flood gradients and location of overtopping of levees		✓	✓
Description of potential changes to downstream impacts of key storage structures such as detention basins during long duration, volume driven events		✓	✓
Local flood plan/flood intelligence			
Review of the LFP to identify known deficiencies, where clarification is required, and provide select draft input that addresses the study area		✓	✓
Indicate the shortest time and potential variation in time between flood producing rain and exceedance of critical flood levels (typically overtopping of key evacuation routes or to exceed levee design height as discussed with the NSW SES) at key warning reference gauges based on the hydrological modelling. Section B3.1 indicates the		✓	✓

Information	Source		
	Flood study	FRM study & plan	Specifically produced for EM
range of floods to be considered and associated information necessary			
Compare these times with warning lead times provided by the BoM in its warnings specified in the NSW Service Level Specification		✓	✓

* May be conducted in a flood study or FRM study.

B3 Typical flood study emergency management information

B3.1 Flood study information – sample data

- Description of the study area and catchment. This should include an overview map that includes as a minimum: study area boundary, key towns/communities, flood gauges and estimated gauge reference areas, and major dams. A separate map may be provided for the catchment area.
- Description of the type of flooding that can affect the area (i.e. riverine, flash, overland or coastal inundation/storm surge).
- Stage hydrographs at key gauges and impacted locations provided for each modelled historic and selected design event and temporal pattern. These should include peak level and short duration events to enable an understanding of the varying warning time to key impacts such as time available for evacuation.
- Description of the at-risk community in terms of:
  - flood behaviour and hazard
  - FERCC and description of the progression of these classifications up to the PMF. This includes defining tipping points for change in classification or review considering at least the 5% AEP, 1% AEP and PMF extents. This should include key road closures that result in the isolation of parts of / all of the community related to a key gauge height (where known)
  - description of whether the community is isolated and/or inundated
  - number of properties at risk of isolation/inundation during different design events (or else done at the FRM study stage if not completed in the flood study)
  - likely timeframes of flooding to peak and key tipping points.
- Identification of where flood warning gauges exist (either as part of the statewide network or a local flood warning system) that are relevant to the study area and the summary warning information outlined in Table 2 provided. This information should include, where relevant and available:
  - an indication of the range of rainfall intensities over periods that can lead to flooding for local flood warning systems and rapid onset flood catchments
  - a description and figure of the area where the gauge informs warnings, called the estimated gauge reference area, and advice on limitations of this area.

Current versions of *Provision and requirements for flood warning in New South Wales* (NSW SES 2019), a supplementary document to the SFP, may provide information to assist. These documents are available on the NSW SES website.

- A table such as Table 3, that links design floods in metres AHD to an equivalent gauge height where a gauge exists. Flood slope in the vicinity of the gauge, that is, for the estimated gauge reference area, should also be included.
- A summary of the at-risk community information such as in Table 4.

B3.2 Flood study information – sample spatial layers

Identify simple FERCCs (detailed where classification at this scale exists) on a map that shows classification based on flood study information described in text against cadastre and flood extent (noting design event/tipping point level and equivalent gauge height where this exists).

B4 Typical emergency management information from a flood risk management study and plan

B4.1 FRM study and plan information – sample data

In the FRM study the initial step is to review the information provided in the flood study and refine this information in consideration of new information identified in the FRM study. Where this information is not available from the flood study it will need to be developed in the FRM study. This includes:

- gauge information (as outlined in Table 2)
- flood gauge and gauge height relationships (as shown in Table 3)
- review of typical FERCC summary information (as per Table 4) but updated to include additional information on the scale of impacts, as shown in Table 5.

The information in the following tables should also be provided:

- key road closure information as in Table 6 and potential variation in time from a gauge location such as in Figure 4 and Figure 5
- a sequential understanding of the key consequences to the study area, where possible related to a gauge height where available or design event for all flooding mechanisms as in Table 7. This may also be shown in the form of a stage hydrograph as shown in Figure 6
- the likely changes in EM sectorisation in the LFP as a result of the revised classification
- any recommended changes to the LFP.

Where FRM plans identify recommended FRM measures that may influence EM planning the impacts of each of these measures need to be clearly identified in the plan. This is done to ensure that potential impacts are considered in implementation of these measures.

Reporting should be guided by the understanding gained from modelling the flood behaviour and potential difficulties in evacuation based on the complexities of flooding interaction with the community and subsequent results of the FERCCs (see Part C).

B4.2 FRM study and plan EM information – sample spatial layers

Spatial layers and mapping that may be needed to inform EM planning include:

- updates to spatial outputs generated in a flood study, where relevant
- community classifications including study area boundary
- flood design event or tipping point extents (e.g. 20% and 1% AEP, or tipping points and PMF)

- key evacuation route road closure locations including major transport route closures
- properties impacted including identification of those flooded over floor.

B5 Typical additional information related to a levee

B5.1 Additional information – sample levee information

If a levee is protecting an urban community in the study area additional information should be provided to assist in EM planning. Some information on the levee structure may be available from council. The following tables need to be completed:

- Table 8 describes key levee details and the sequence of levee overtopping including estimated time to overtopping.
- Summary information should be included to provide an indication of levels and timing of when key consequences occur. This should be based on the consequence of a levee being overtopped, the location/name of the sector that will be affected, the time to isolation/inundation of those areas, considering the potential variation in flood gradient. An example of typical evacuation route inundation times is provided in Table 9. Where existing evacuation arrangements are identified in LFPs, these should be reviewed based on the revised study information and described in the FRM study and plan.

  Provide a typical warning time to levee overtopping chart similar to Figure 6 for a fast responding PMF that results in the least time to reach critical levels or tipping points. Summary information may also be produced in the form of consequence charts such as Figure 4 and Figure 5.

B6 Flood risk management measure investigation and design information

Investigation, design and construction of measures such as changes to road or bridge levels, levees or detention basins needs to consider potential impacts to EM planning. Changes to these measures may change the time impact or potential EM considerations or actions during flooding. These potential changes should be identified in the relevant documentation for investigation and design projects and any variation included in a final construction handover report. This will ensure the NSW SES is made aware of progress on implementation so LFPs and intelligence can be updated as necessary.

Table 2 Example gauge/warning system summary information

Gauge/warning systems	Name (type)	AWRC #	Bureau #	Warning system?	Min.	Mod.	Maj.	Comments
Wherever possible relate design events to key warning gauge heights to allow for pre-emptive actions based on gauge predictions. Where no water level gauge exists, relate warning to upstream rainfall intensity.	e.g. Bega North (telemeter)	219900	Bureau warning	Bureau provides warning	4.6	7.0	8.0	Gauge locations and gauge reference area shown on maps Equivalent gauge heights referenced throughout the study. For riverine flooding relate each design event to an equivalent gauge height
	Depth at gauge (m)	Gauge level (m AHD)		Approximate AEP (for each design event)	Rainfall intensity			
	e.g. 10.7	68.7		20%	200 mm in 3 hrs			
	e.g. 24.3	82.3		PMF	600 mm in 3 hrs			

Table 3 Example design flood and gauge height relationships

Classification (minor, moderate, major)	Depth at gauge (m)	Gauge level (m AHD)	Approximate AEP %	Flood slope in vicinity of gauge (m/m)	Gauge reference area comments
	10.7	68.7	20%		e.g. gauge reference area typically as shown in Figure x.x however, this may vary based on inflows from xxxxxx tributary including timing, etc.
Minor	11.4	69.1			
	12.3	70.3	10%		
Moderate	12.9	70.9			
	15.6	73.6	2%		
Major	15.8	73.8			
	16.5	74.5	1%		
	17.5	75.5	0.5%		
	24.3	82.3	PMF		

Table 4 Typical flood emergency response classification of communities: summary information for a flood study

AEP/ tipping point	Gauge height (m)	Emergency response classification area ID	No. of dwellings	Approximate evacuation route closure on gauge/level (m)	Approximate depth over road (m)	Approximate time to road closure (range in hrs)	Time to tipping point isolated access available until closed (hrs)	Period of inundation/ isolation (range in hrs/days)
20%	10.7	e.g. High flood island area 1 / Rising road access area 2						
Min.	11.4	e.g. High flood island area 1 / Rising road access area 2						
Mod.	12.9	e.g. High flood island area 1 / Rising road access area 2						
Maj.	15.8	e.g. Low flood island area 1 / High flood island area 2						
1%	16.5	e.g. Low flood island area 1 / High flood island area 2						
PMF	24.3	e.g. Low flood island area 1 / Low flood island area 2						

Note: Identify whether this has been undertaken with or without detailed survey of road low points.

Table 5 Typical flood emergency response classification of communities: information for a flood risk management study and plan

AEP/ tipping point	Emergency response classification area ID	Key evacuation route closure location	Key evacuation route closure height at gauge (m or level m AHD)	Flooded			Isolated		Approximate time available from rainfall to impact (hrs/ days)
				No. of properties flooded	No of properties flooded over floor	Depth of flooding over floor (range in m)	Number of properties isolated	Period of isolation/ inundation (hrs)	
20%	e.g. High flood island area 1 e.g. Rising road access area 1								
1%	e.g. Low flood island area 1 e.g. Rising road access area1								
PMF	e.g. Low flood island area 1 e.g. Low flood island area 2								

Note: Identify whether this has been undertaken with or without detailed survey of road low points

Table 6 Road closure summary table

Community/Sector	Road name	Closure location	Gauge height (m)	Design event AEP %	Flood depth over road (m)	Consequence of closure	Time to closure from start of rainfall (range in hrs)
Windsor	Hawkesbury Valley Way	Jim Anderson Bridge	17.3 m	1%	0.1 m	Isolates Windsor (high flood island at 1% AEP)	21–24 hrs

Notes:

1. Identify whether this has been undertaken with or without detailed survey of road low points.
2. Key road closures should be included on the FERCC map (or else a separate map depending on scale).

Table 7 Key sequential flood impacts

Sequential key community consequences	Gauge height	AEP % and/or minor, moderate, major	Typical design rainfall intensity (for fast responding catchments)	Study area consequence description
Used to update flood intelligence cards and develop community flood warning products	5.6 m	Min. 10% AEP	e.g. 50 mm/hr	Smithtown isolated
	6.0 m	10% AEP		5 properties inundated above floor
	6.3 m	20% AEP		
	7.0 m	1% AEP		
	8.2 m	0.2% AEP		

Table 8 Key levee impacts

Name and details of mitigation system				Description of flood behaviour and known issues/deficiencies		
e.g. location, properties/infrastructure protected				Description		
Design height or other at gauge (m)	Design event AEP %	Overtopping height at gauge (m)	Evacuation trigger height at gauge (m)	Known deficiencies	Time range (hrs) overtop or fill	Flooding duration (hrs/days)
5.6 m	1%	6.1 m	5.6 m	Low point at 5.2 m SW corner	e.g. 15 hrs to overtop, 3 hrs to fill	2 days

Note: Levee locations should be shown on all relevant maps. The location of spillways or low points should also be mapped.

Table 9 Key levee detail information including evacuation route inundation times

Evacuation routes	Hours before route cut					
	Gauge height (m) (e.g. 2% AEP) 9.5		Gauge height (m) (e.g. 1% AEP) 10.2		Gauge height (m) (e.g. PMF/short duration PMF) 10.9	
	Post overtopping (hrs)	Time (hrs)	Post overtopping (hrs)	Time (hrs)	Post overtopping (hrs)	Time (hrs)
Levee name (e.g. Smith Street)/Time to overtopping from onset of rainfall		16		16.5		12.1/11.5
Sector A						
E.g. John St	Not inundated	Not inundated	5.2	21.1	4.4/3.9	16.5/15.4
E.g. Bill St	4.0	20.0	3.2	19.7	3.2/2.8	15.3/14.3
Sector B						
E.g. Ann St	3.0	19.0	2.4	18.9	2.5/2.3	14.6/13.8
E.g. Jill St	5.2	21.2	4.1	20.6	3.2/2.9	15.3/14.4

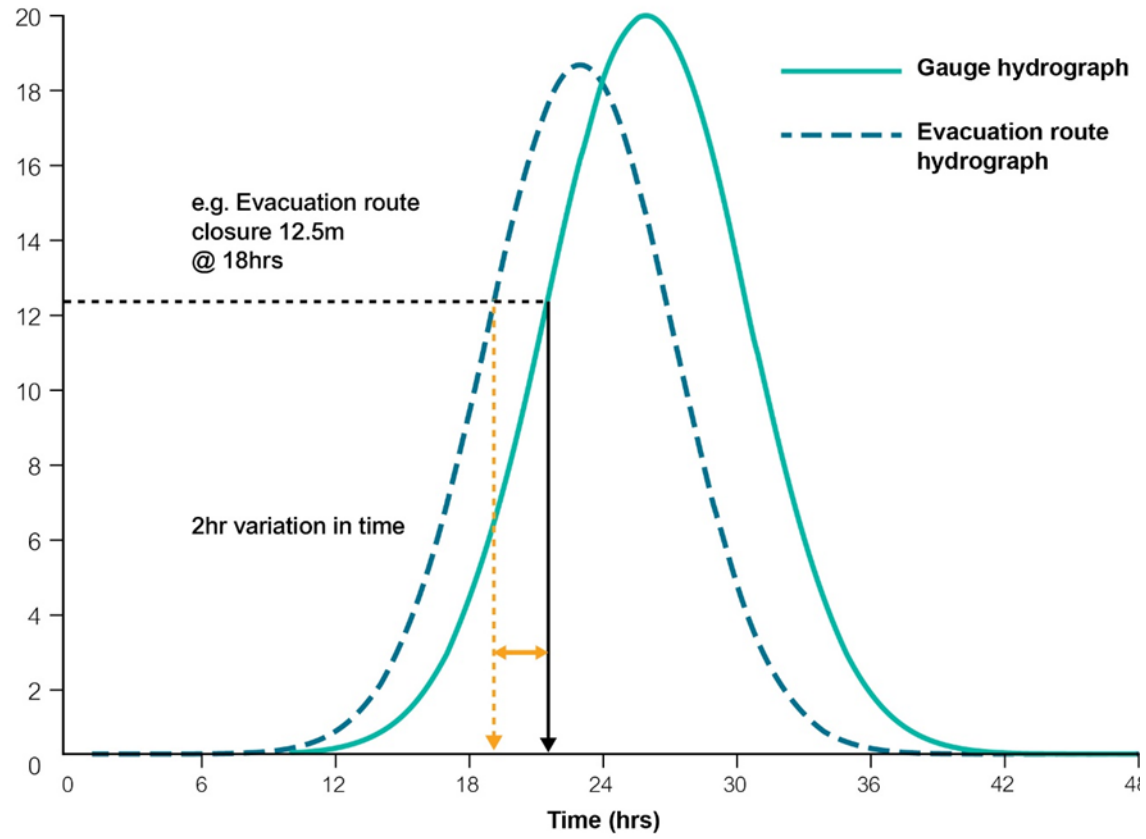


Figure 4 Sample variation in timing to key consequence chart

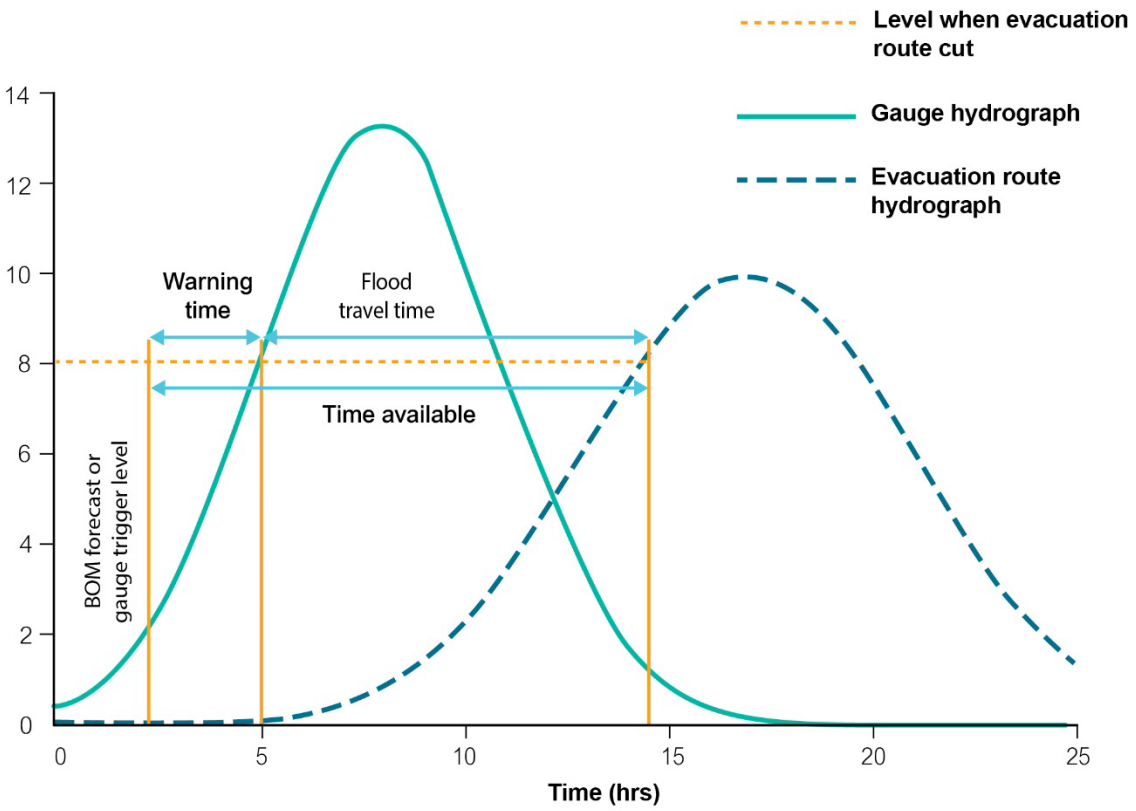


Figure 5 Sample variation in flood hydrograph at site vs gauge location chart

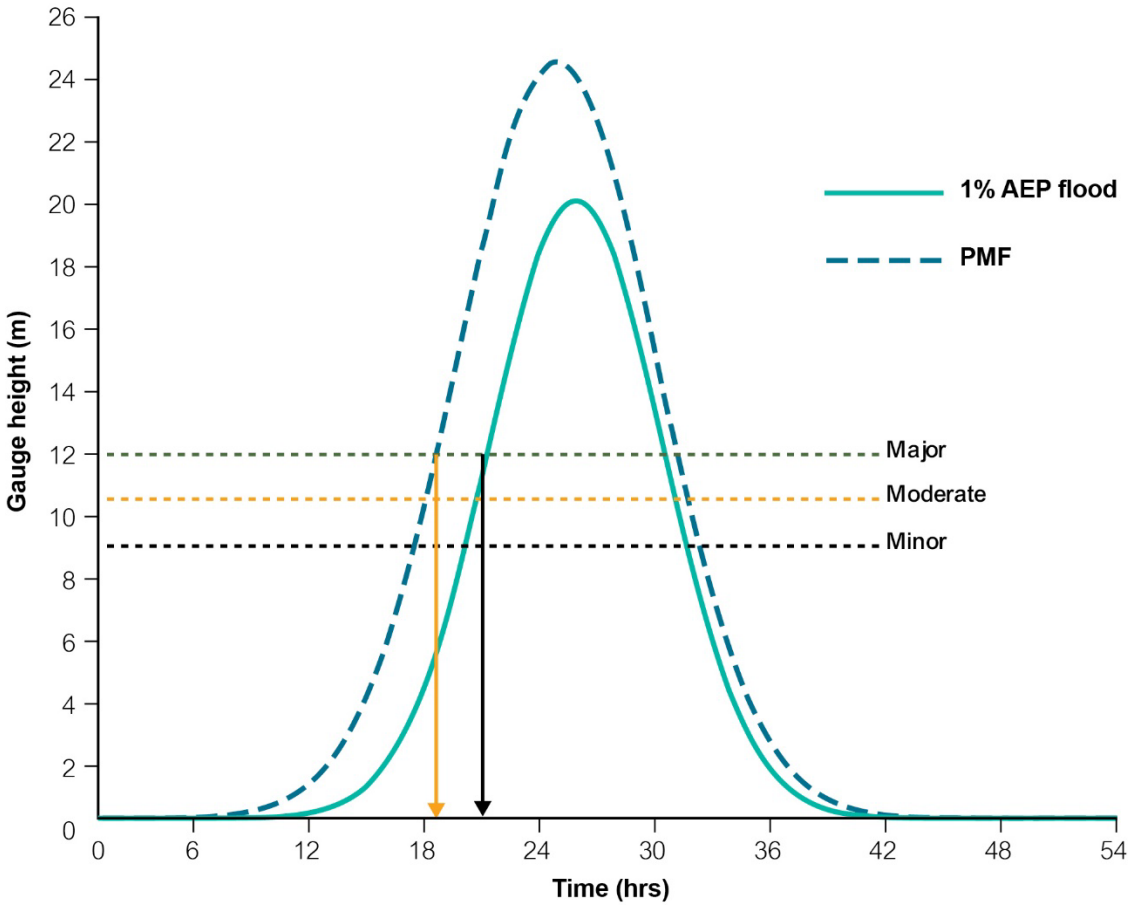


Figure 6 **Sample warning time to key consequences chart**

Part C – Flood emergency response classification of communities

C1 Introduction

When flooding occurs in developed areas it not only inundates land, potentially causing a risk to people and damage to property and infrastructure, but it can also isolate parts of the landscape and cut off evacuation routes to flood-free land. This can restrict access to medical facilities and community services and drastically reduce the ability of emergency services to reach isolated areas (e.g. fire units to respond to a fire threat). Snakes, spiders and other animals may also seek refuge from floodwaters in isolated areas.

People may perceive a need to cross floodwaters to access services, employment or family members. Many flood fatalities result from the interaction of people, often in vehicles, with floodwaters. Any situation that increases people's need to interact with floodwaters increases the likelihood of an injury or fatality.

Isolated areas can also become fully submerged as flood levels rise leading to people isolated requiring rescue or to fatalities.

To understand these issues, one of the key information requirements to support NSW SES EM planning, as described in Part B, is the flood emergency response classification of communities, or FERCCs.

This part of the guideline outlines definitions and approaches to developing FERCCs based on differences in isolation due to the potential for an area to become surrounded or inundated by floodwaters, potentially in combination with impassable terrain. It also considers the ramifications for an isolated area based on its potential to be completely submerged in events including the PMF. It should be read in conjunction with Part B of this guideline.

FERCCs support EM decision-making at a precinct or community scale, and for rivers and creeks where flowpaths and flood behaviour can readily be defined. They are not intended for application at a smaller scale, such as for individual developments, structures or streets and where flood depths creating isolation and associated risks are low, such as in many local overland flood areas. When identifying FERCCs for these areas it should be a simple classification where there are multiple dwellings impacted by over floor flooding and where classifications can be broadly defined.

FERCCs cannot be directly related to a specific EM response strategy. They provide an indication of the likely consequences of flooding for varying events. Emergency managers may use the FERCCs with information including the timing to onset of flooding and availability of services or accommodation to support a community, to inform an EM response strategy for a location.

C1.1 Uses of flood emergency response classification

It is important to understand how flood emergency response classification varies across the floodplain so this knowledge can be considered in decision-making. Following this guideline can provide knowledge of this variation and can support:

- **EM planning** – FERCCs assist in informing an understanding of isolation of areas and the potential consequences and risks associated with these areas in different flood events. This allows EM planning to develop emergency response sectorisation

for the affected community. EM planning for floods would then consider other risk factors, including the rate of rise of floodwaters, the effective warning time, the duration of isolation, the effectiveness of mitigation, and appropriate management measures. EM planning can also consider information on the likelihood of flood impacts to community infrastructure and the associated implications to the community.

- **Management of flood risk** – FERCCs can also be used to inform management actions to address isolation and the associated risk, such as the upgrading or raising of evacuation routes. It may also be a factor to consider when examining the need for new or improved flood warning systems.
- **Land-use planning** – FERCCs are also an important constraint to consider in the development of land. Information on the varying degree of isolation of land and the potential consequences of flooding to isolated areas can inform the setting of strategic land-use directions for a community. It is a key consideration used to determine flood planning constraint categories. These categories can inform the development and implementation of environmental planning instruments and policies as discussed in FRM guideline FB01.
- **Infrastructure planning** – Flood risk managers can convey information on exposure and isolation of infrastructure due to flooding to infrastructure providers so that it can be considered in their provision of services. This is particularly important for areas that rely on key utilities such as power, water and sewer during flooding. The information can also be used for considering regional road upgrades or similar where the community relies on these for evacuation.

C2 Defining flood emergency response classifications

Classification generally needs to be undertaken based on information for a range of flood events covering the full range of flood risk, local topography and evacuation routes.

Classification is undertaken using 3 key considerations:

- **Is the area flooded?** – This question examines whether the area or access to the area is flooded by the PMF or the event being considered for classification.
- **Is the area isolated?** – This examines isolation of an area (such as a community or precinct) and identifies whether the area has an exit (road or overland) to a flood-free area of safety with adequate facilities outside the broader floodplain.
- **What are the consequences of flooding?** – This relates to the potential consequences of flooding to the area including the nature of isolation or inundation. It can also relate to whether there are any indirect consequences that affect an area that is not flooded, for example, due to the lack of availability of services or utilities.

There are several classifications used to describe the different situations that assist emergency managers to understand the consequences of flooding in these areas. These areas can generally be broken down into flood islands, areas with rising access and indirectly affected areas. Subcategories of these areas also exist, such as trapped perimeter areas and overland refuge areas, as described in detail below. However, these subcategories should typically only be used when classifying floodplains with complex emergency response requirements. Descriptions of each of the classifications stemming from these questions and used in this guideline are outlined in Sections C2.1 to C2.4.

C2.1 Flood islands

These are areas of higher ground within a floodplain, which can be linked to areas outside the floodplain by a road or roads. These roads can be cut by floodwater, closing all the evacuation routes and creating an island. After closure of the road the only access to the area is by boat or aircraft. Flood islands are classified according to what can happen after the evacuation route is cut, as follows.

High flood island. The flood island has land higher than the limit of flooding for the event being considered (Figure 7 shows a high flood island in the PMF). During a flood these high islands are isolated from other areas of the community by floodwater, terrain, development, or infrastructure. However, there is an opportunity for people to retreat to higher ground within the island, and therefore, the direct risk to life is reduced. The area may require resupply by boat or air if not evacuated before the road is cut. If it is not possible to provide adequate support (such as community and medical facilities) during the period of isolation, evacuation will have to take place before isolation occurs. Isolation without these services is more likely to result in fatal decisions to cross floodwaters.

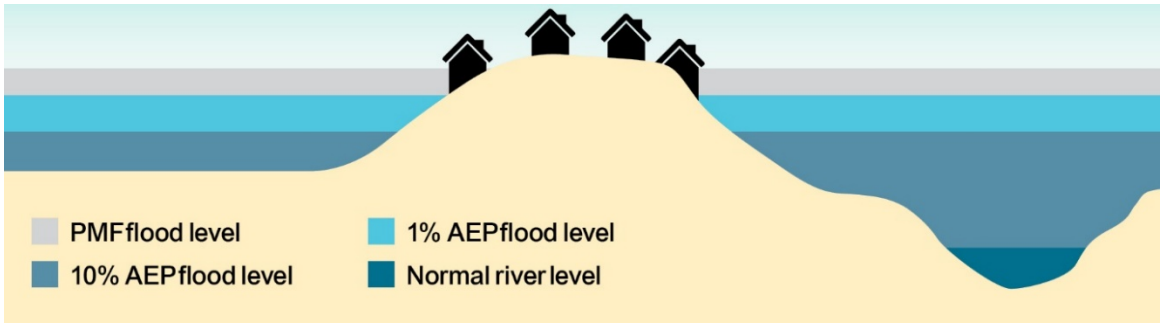


Figure 7 **High flood island**

Low flood island. The flood island is lower than the limit of flooding for the event being considered (Figure 8 and Figure 9 show a low flood island in the PMF). During a flood event the area initially becomes isolated by floodwater, terrain, development or infrastructure. If floodwater continues to rise after it is isolated, the land on the island will eventually be completely inundated by floodwaters. Evacuation of the community will be required prior to evacuation routes being closed as people left stranded on the island may drown.

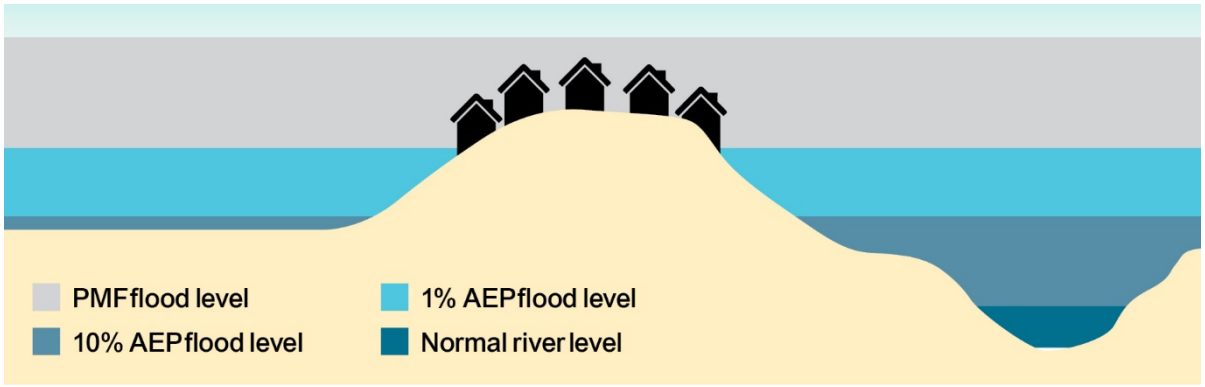


Figure 8 **Low flood island**

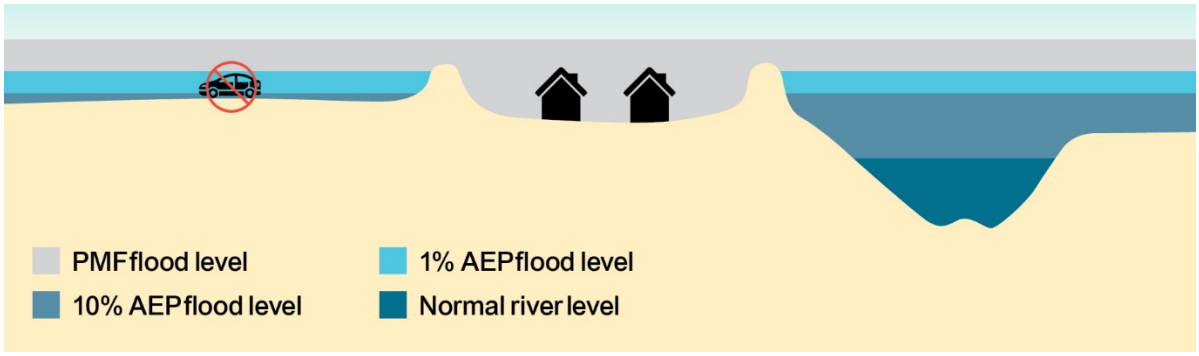


Figure 9 **Low flood island created by a ring levee**

C2.1.1 Trapped perimeter areas

These would generally be areas at the fringe of the floodplain where the only practical road or overland access is through flood prone land. In these areas, the ability to retreat to adjacent higher ground does not exist due to topography and/or impassable structures. These areas are for all intents and purposes very similar to flood islands, however, instead of being surrounded primarily by floodwater they are also trapped by impassable terrain.

Trapped perimeter areas are classified according to what can happen after the evacuation route is cut, as follows.

High trapped perimeter area. There is an area of land above the limit of flooding in the event being considered that can accommodate the number of people in the area (Figure 10 shows a high trapped perimeter area for the PMF). During a flood event the area is isolated by floodwater and land/property may be inundated, however, there is an opportunity for people to retreat to higher ground above the PMF and therefore the direct risk to life is limited. The area may require resupply by boat or air if not evacuated before the road is cut. If it will not be possible to provide adequate support (such as community and medical facilities) during the period of isolation, evacuation will have to take place before isolation occurs. Isolation without these services is more likely to result in fatal decisions to cross floodwaters.

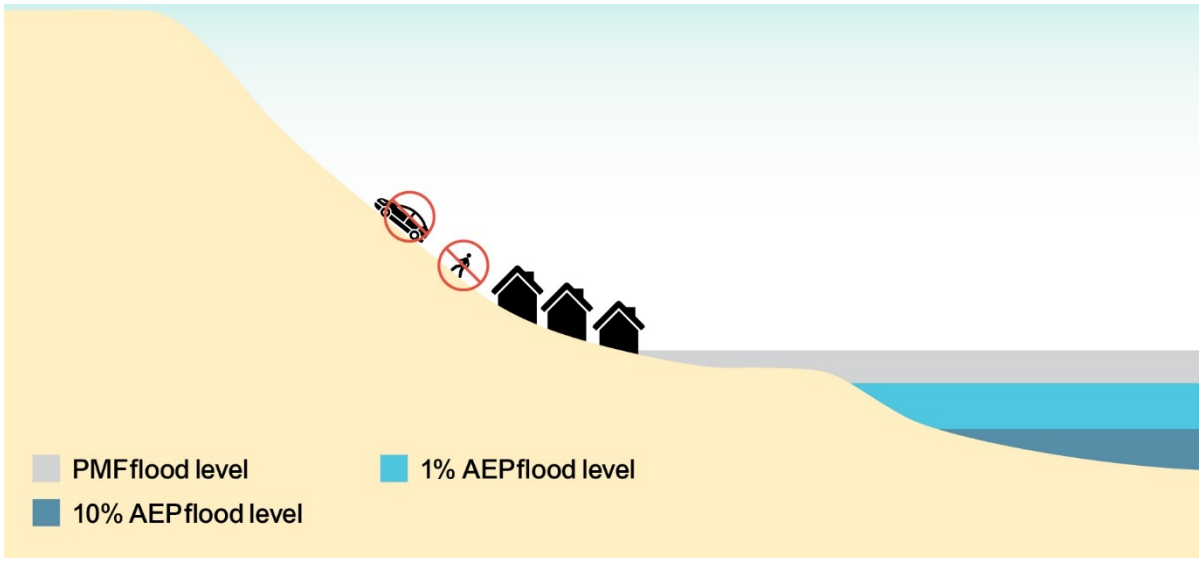


Figure 10 **High trapped perimeter area**

Low trapped perimeter area. The inhabited or potentially inhabited area is lower than the limit of flooding in the event (Figure 11 shows a low trapped perimeter area for the PMF). During a flood event the area becomes isolated by floodwater and land/property will be inundated. If floodwater continues to rise after it is isolated, the area will eventually be completely covered. People trapped in the area may drown.

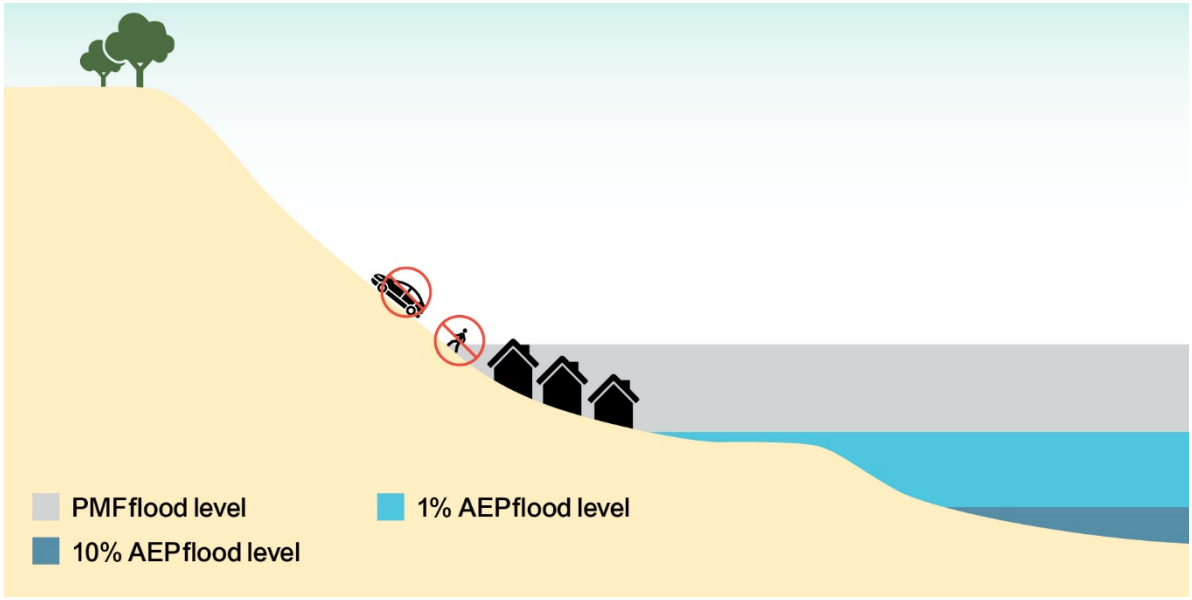


Figure 11 Low trapped perimeter area

C2.2 Areas with rising access out of the floodplain

These are inhabited areas on flood prone ridges jutting into the floodplain or on the valley side that are able to be evacuated, however, their categorisation depends on the type of evacuation access that is available to an area of safety with adequate services and accommodation available, as follows.

Areas with rising road access are those areas where access roads rise steadily uphill and away from the rising floodwaters (Figure 12 and Figure 13). The community will not be completely isolated before inundation reaches its maximum extent, even in the PMF. Evacuation can take place by vehicle or on foot along the road as floodwater advances. People should not be trapped unless they delay their evacuation from their homes, for example, people living in 2-storey homes may initially decide to stay but reconsider after water surrounds them.

These communities contain low-lying areas from which people will be progressively evacuated to higher ground as the level of inundation increases. This inundation could be caused either by direct flooding from the river system or by localised flooding from creeks.

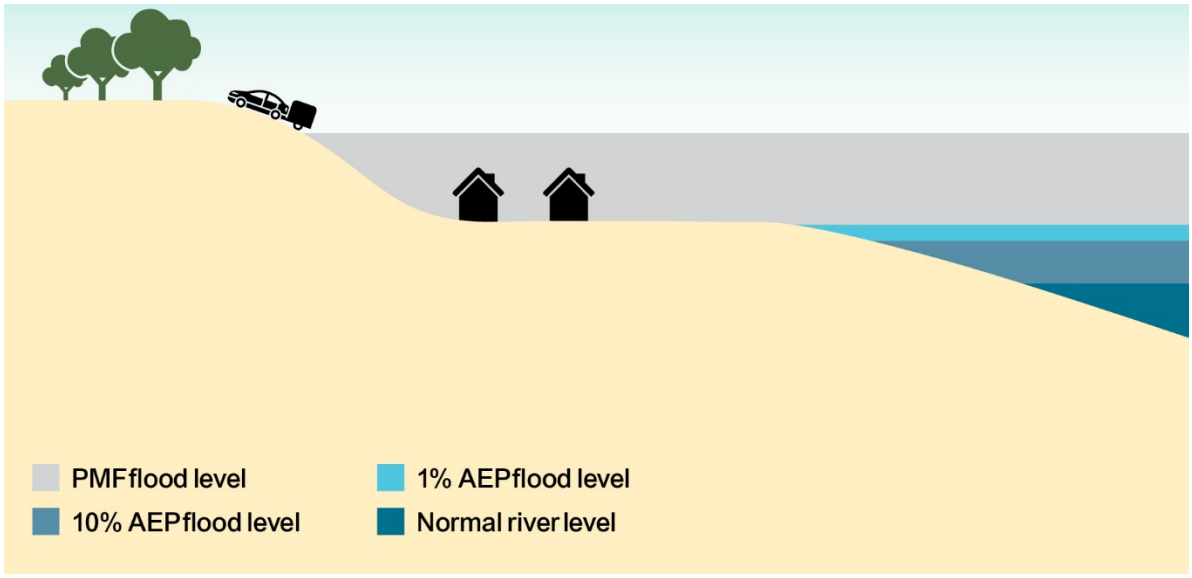


Figure 12 **Area with rising road access**

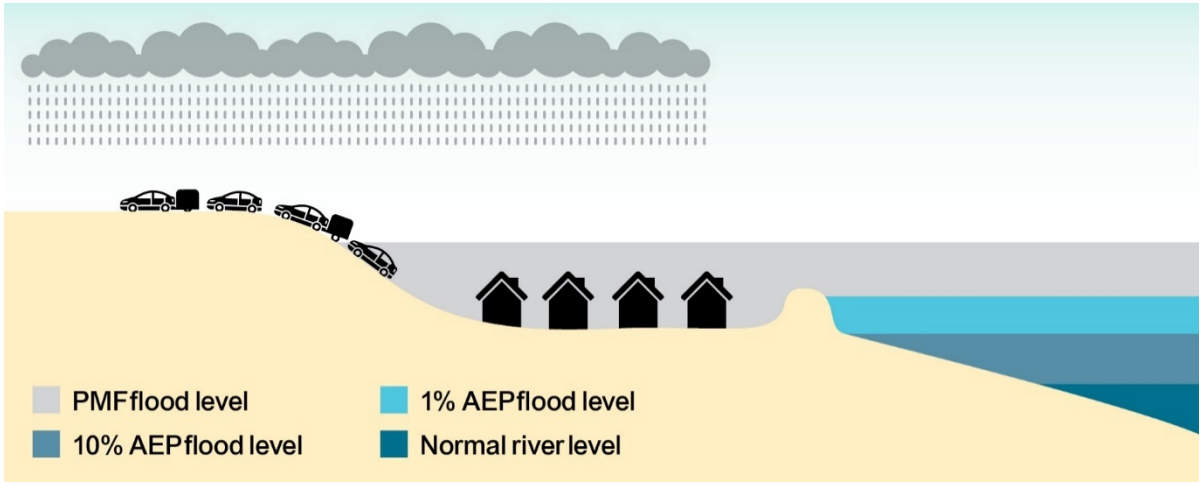


Figure 13 **Area protected by a levee with rising road access**

Areas with overland escape route are those areas where escape from rising floodwater is possible by traversing overland to higher ground (Figure 14). The area may also have access roads to flood-free land that cross lower-lying flood prone land. Evacuation can take place by road only until access roads are closed by floodwater. Escape from rising floodwater after roads are cut is possible but involves traversing overland to higher ground. Anyone not able to walk out before access roads are cut must be reached by using boats and aircraft. If people cannot get out before inundation, rescue will most likely be from rooftops.

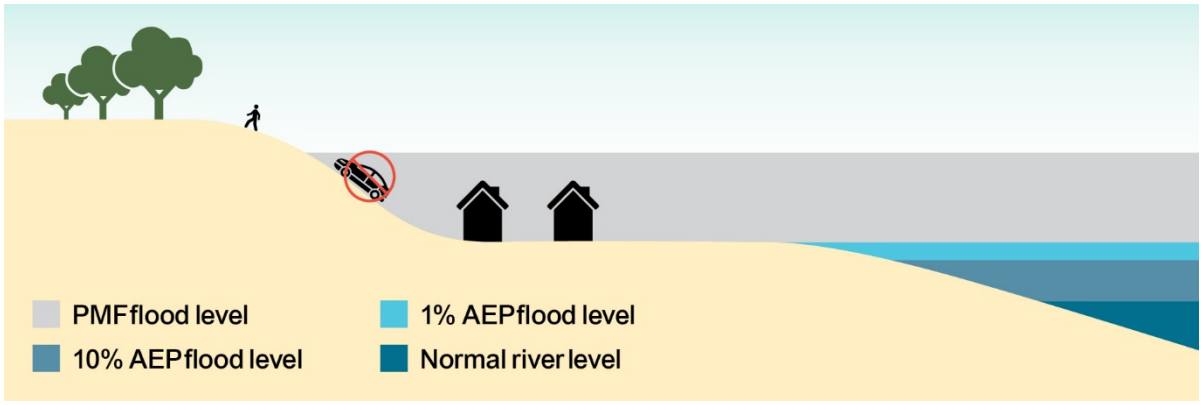


Figure 14 **Area with overland escape route**

C2.3 Indirectly affected areas

These are areas that are outside the limit of flooding and therefore will not be inundated nor will they lose road access, however, they may be indirectly affected as a result of flood damaged infrastructure or due to the loss of transport links, electricity supply, water supply, sewage or telecommunications services (Figure 15). These areas may therefore require resupply or, in the worst case, evacuation.

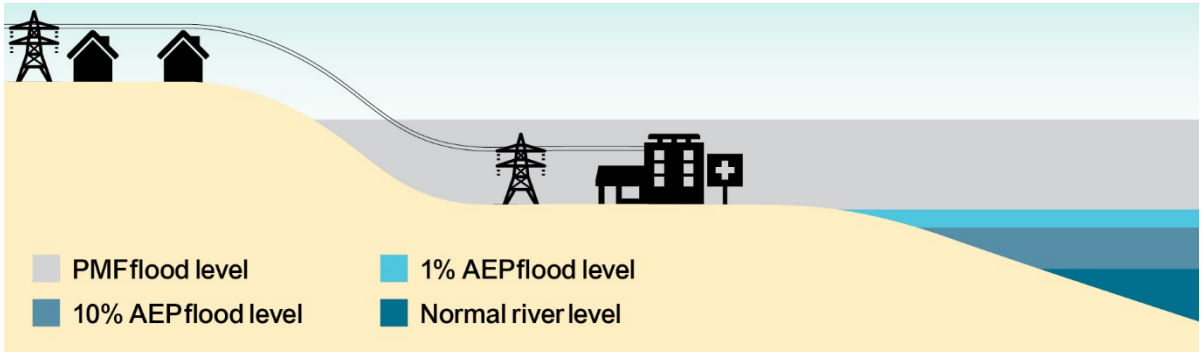


Figure 15 **Indirectly affected areas**

C2.4 Overland refuge areas

These are areas that the community in other areas of the floodplain may be evacuated to temporarily where there is adequate warning and response time, but which are isolated from the edge of the floodplain by floodwaters. These areas are effectively high flood islands or trapped perimeter areas in more frequent events and may be low islands or trapped perimeter areas in larger events. They should be categorised accordingly, and these categories used to determine their vulnerability and the associated risks.

Figure 16 provides an example of a rural area that is evacuated to a town as a refuge that may subsequently need to be evacuated due to the potential for levee overtopping.

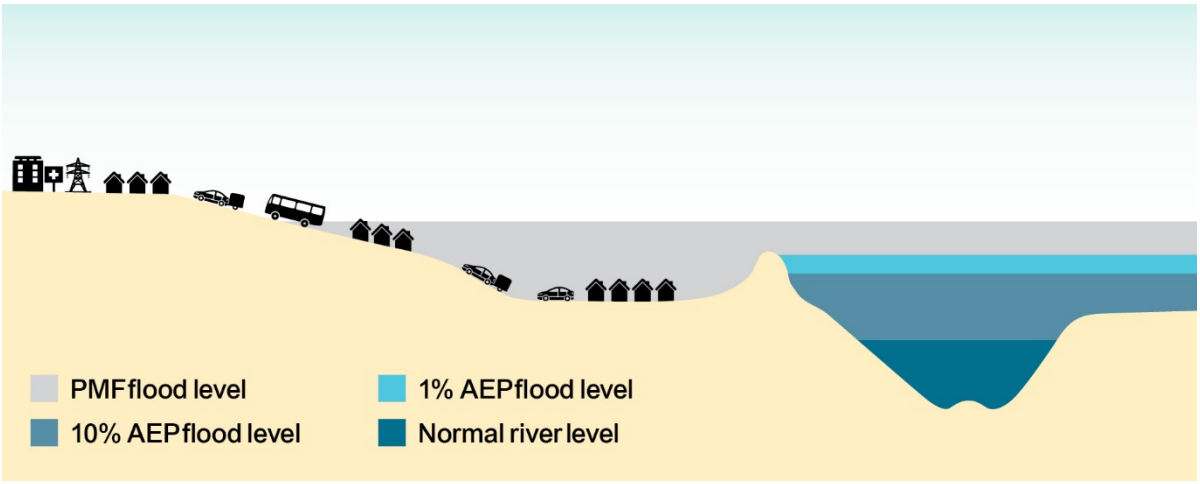


Figure 16 Overland refuge areas

C3 Deriving flood emergency response classifications in studies

When deriving flood emergency response classifications, it is important to assess them at a broad scale to allow their use for the identification of logical EM sectors and subsectors within the at-risk community. It should not be done at an individual property scale as this is below the practical scale for community EM planning. Flood warnings and associated response actions issued to communities in response to a flood threat occur at a larger scale.

The flood emergency response classification of different areas provides an understanding of the varying degrees of inundation, isolation of land and the flood impacts in isolated areas. The information that is generally required to support this is outlined in Section C3.4.

The process for classification can vary. Classification in flood studies and FRM studies is discussed in Section C3.1 and shown in Figure 17. Detailed classification for more complex EM response situations is discussed in Section C3.2 and shown in Figure 18. Classification based on Figure 17 may also be derived from existing results of studies, as discussed in Section C3.3. In all cases, clear identification of the approach, assumptions and level of detail utilised to develop FERCCs needs to be provided.

Ultimate classifications should be conducted for the PMF. Assessment should also involve identifying tipping points for changes in classifications to support EM planning for different scales of flood events (Section C3.1 has examples). Classifying FERCCs for a range of different AEP floods is an alternative.

In some complex cases, there will be multiple and varied tipping points, perhaps due to the cutting of evacuation routes from different sectors. Where this is the case, a pragmatic approach may be taken to examining tipping points.

The type of classification to be undertaken for the study area, either general or detailed, as outlined in Sections C3.1 or C3.2, should be identified in the study brief.

C3.1 General classifications in a flood study or FRM study

FERCCs should be developed in flood studies. This ensures that information is available to inform a range of decisions (Section C1.1) while FRM studies and plans are undertaken.

As a minimum FERCCs should be based on the changes that occur as waterways go from non-flood flows up to flooding by the PMF. This can involve tipping points such as when:

- areas go from being able to access community evacuation facilities to being isolated from these facilities. The isolation of areas as flood islands and trapped perimeter areas should be based on when the key evacuation routes out of a community, EM sector, subsector or precinct are cut
- isolated areas go from having land above the current flood level to the whole area being inundated.

The definition of a tipping point relates primarily to a flood level relative to the relevant datum (often the relevant water level gauge height). However, for short duration flooding (hours to days rather than weeks) where timing is critical to emergency response, it is also important to include the time to reach tipping point (generally derived from the relevant PMF event).

Where FERCCs are available from a flood study, they may be refined if more information is available in the subsequent FRM study. In cases where FERCCs are not available from a flood study, they should be developed in the FRM study.

LFPs may already include sectors and subsectors for an area that considers inundation, isolation and its consequences. Where this is the case, a study provides an opportunity to review sectorisation considering the behaviour identified in the study to support a review of the LFP.

Classification to support LUP and EM planning will generally follow Figure 17. This provides a flow chart of the general process for determining the FERCCs of different areas within the study area to provide an understanding of the varying degrees of inundation and isolation of land and the flood impacts in isolated areas.

The information needed to support this assessment is discussed in Section C3.4.

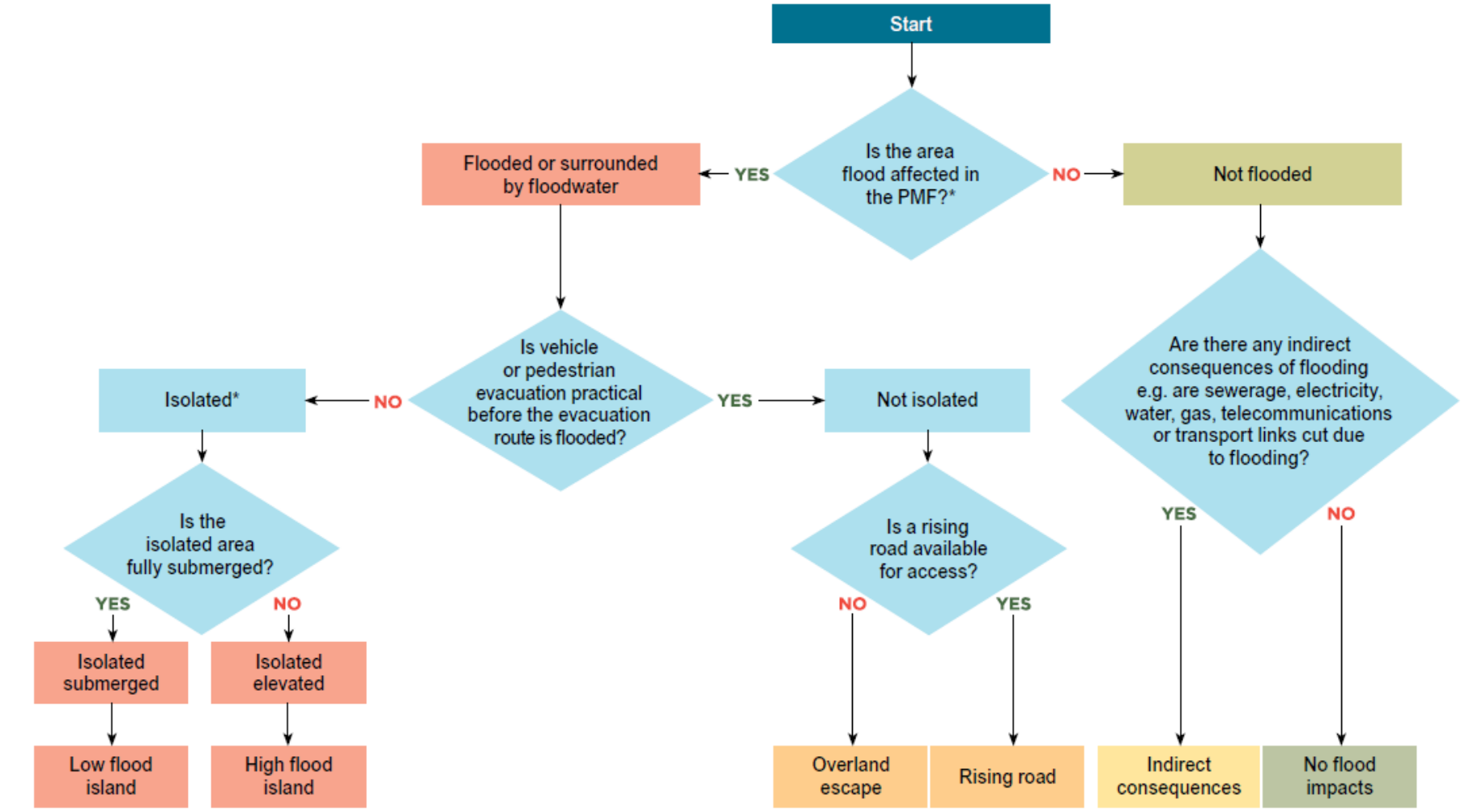
C3.2 Detailed classifications in a flood study or FRM study

In some cases, further delineation may assist in prioritising emergency response between sectors. Detailed classification will typically be required when one or more of the following applies:

- a study location has existing detailed classification and/or sectorisation as described in an LFP or emergency response arrangements
- the additional classification is necessary to assist emergency managers to derive prioritised emergency response arrangements for the study area.

Detailed classification typically provides similar information to that required for general classification in studies discussed in Section C3.1, however, it includes additional classifications, including the identification of trapped perimeter areas.

Figure 18 outlines the process for detailed classification, which extends the process outlined in Figure 17 by incorporating the additional classification.



Note:

*This is either the PMF, equivalent or the event being used to determine the Flood Emergency Response Classification

Figure 17 Flow chart for determining flood emergency response classifications for flood and flood risk management studies

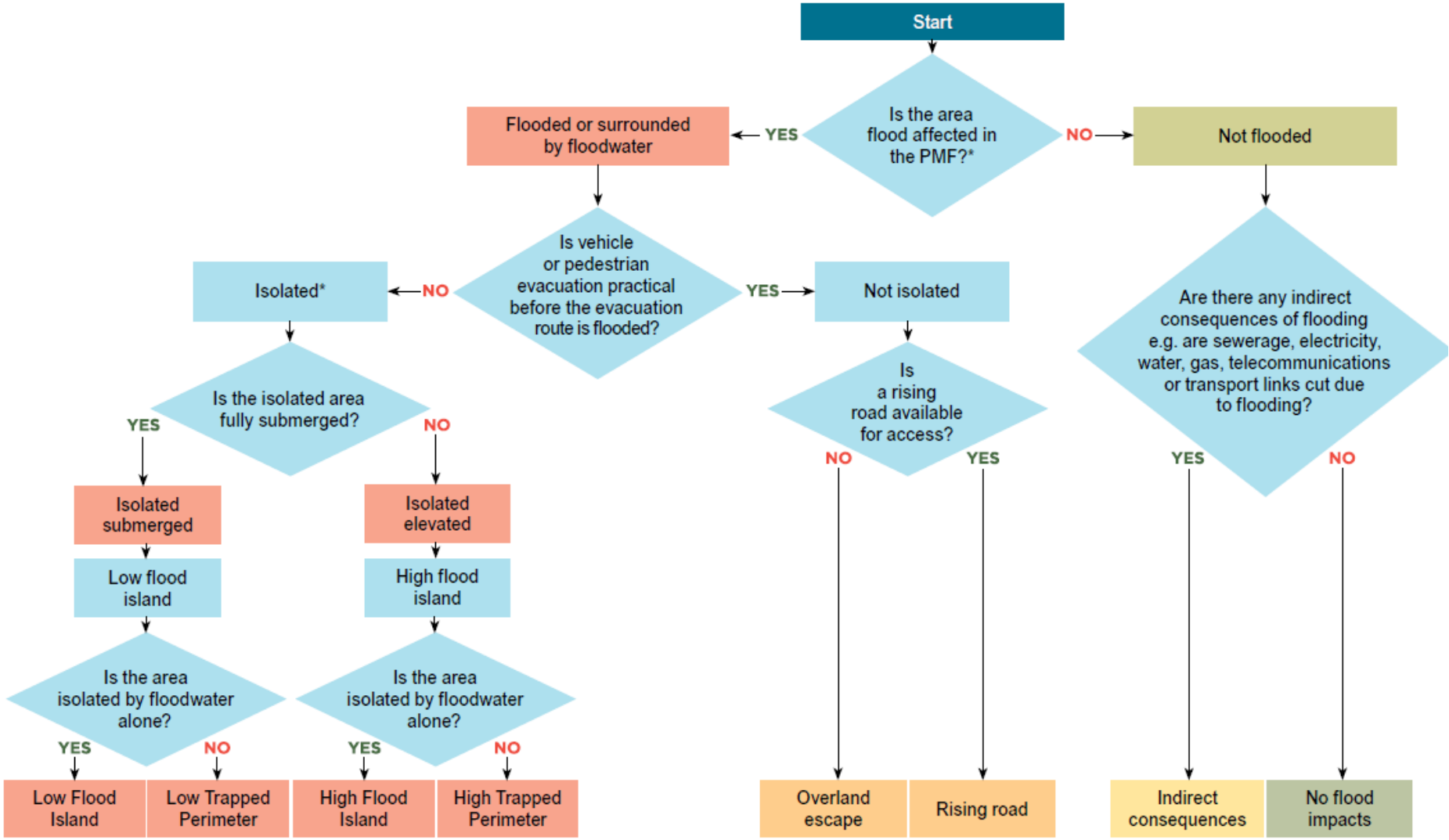


Figure 18 **Flow chart for determining detailed flood emergency response classifications**

C3.3 Retrofitting classifications using existing information

Where studies have already been completed without completing FERCCs, all the necessary information identified in Section C3.4 may not be available, and additional data may need to be sourced. To retrofit a classification, it is assumed the necessary information on topography, cadastre and transport links is available.

When retrofitting classifications to existing studies where the PMF is not available, the following approaches can be adopted:

- A specialist flood practitioner may approximate the PMF or an equivalent extreme flood, and this may be mapped to use with other available information to establish classifications.
- The classification may be based on the largest flood in the existing information. The limitations of this approach need to be clearly identified. For example, the classification could be described as 'preliminary classification – isolated area with residual land above the 1% AEP design flood, the largest flood event where information is available'. This approach requires caution, as larger floods may introduce tipping points such as isolation and full inundation of areas. EM planning may need to consider the need to evacuate all isolated areas, rather than assume there will be elevated areas above all potential future floods.

C3.4 Information to support assessment

Classification generally requires information describing the spatial extents of flooding for the full range of flood events up to and including the PMF, and how this interacts with the landscape, transport links and key infrastructure facilities.

The information needed from investigations to determine the classifications typically includes the following:

- local topography to sufficient detail across the floodplain. This may be a digital elevation model covering the floodplain
- local cadastre data
- flood extents for different scales of floods up to and including the PMF. It may be supported by an animation of the PMF in a format that allows the animation to be stopped and started at key points in the modelling and allows flood extents to be extracted at different levels
- for areas inundated or isolated in the PMF, information on evacuation routes, whether by road or overland, including factors that may limit the serviceability of the route. This may include whether the route is cut by floodwaters and, if so, where this occurs and the level at which the evacuation route is cut
- whether isolated areas include any elevated areas of land above the PMF
- the level of service provided by protection works, such as levees (event works are expected to provide protection for, for example, a design event)
- information on the location of key community infrastructure.

It is unlikely all this information will be available in all cases. This should not prohibit classification but may highlight the need for the collection of additional information to inform, in particular, key tipping points such as isolation in future. For example, unless the flood study brief has identified evacuation routes and the need for a survey of these, and this information is not already available, consideration could be given to collecting this information separate to the study or as part of the survey for the FRM study.

C3.5 Key deliverables

For studies conducted under the NSW Floodplain Management Program, the tipping points that influence emergency response need to be determined. To support EM, classifications undertaken in a flood study should be for a minimum of the design events of 20% AEP, 1% AEP and PMF. The classification should be refined to better capture key tipping points in the FRM study using the process described in Section C3.1 and Figure 17 unless otherwise specified in the study brief. An example is shown in Figure 19. In some cases, this may also include a range of events such as the 5% AEP where there is a significant range between the 20% and 1% AEP flood levels. This information is a key component of understanding the consequences of flooding so this can be considered in decision-making (Section C1.1) before moving into a FRM study and developing a draft FRM plan. If required, the classifications may be verified in the FRM study where more information may be available and where management options, including those that may influence classification or trigger levels, may be assessed. The FRM plan is to identify adopted FRM measures that may impact on classifications.

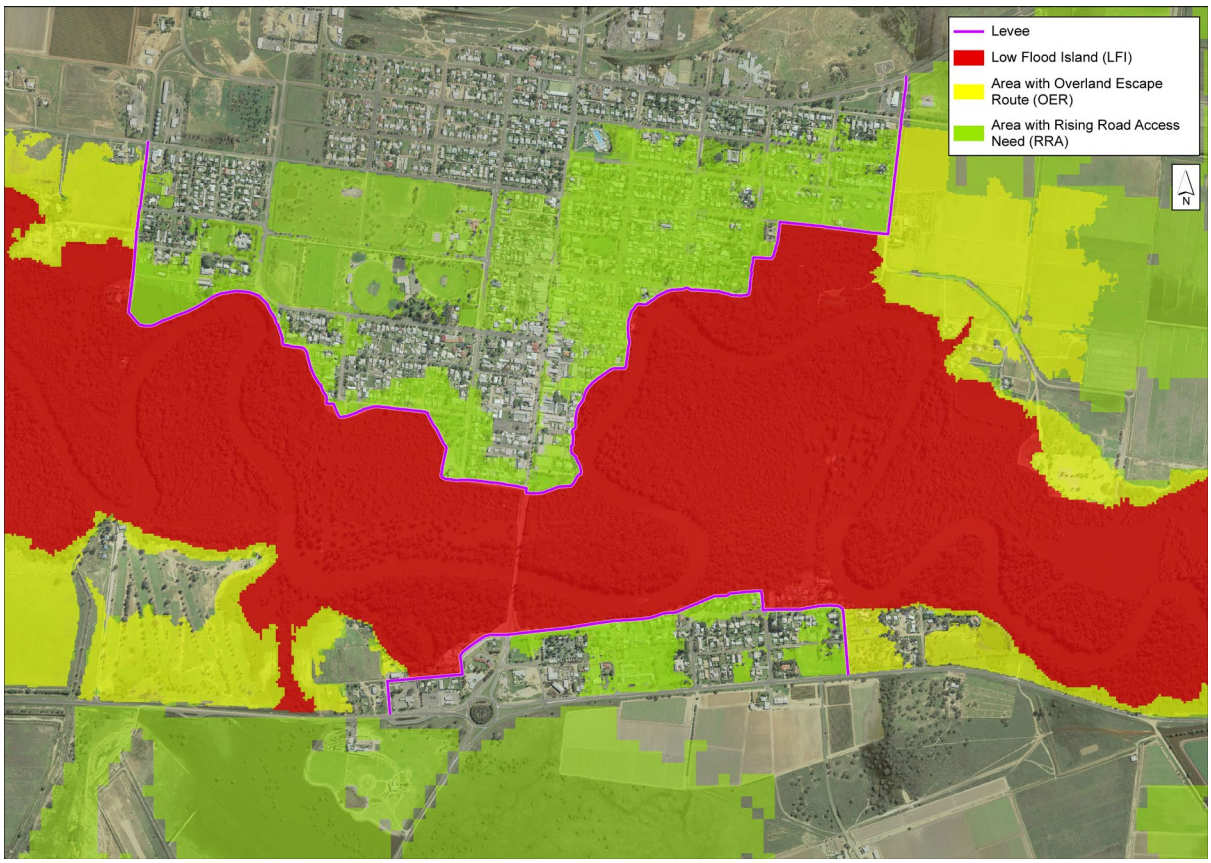


Figure 19 **Example of flood emergency response classification of communities**

Emergency response classification within a study should typically include the following with outputs related to gauge height where available:

- a clear description of the process used to determine the classification and any relevant information such as the comparison to existing sector boundaries. This description may also include relevant recommendations for further work to be investigated. For example, a flood study may identify future work to provide information for more detailed classifications in the FRM study. This may include the need for a survey of key road closure locations or infrastructure that will assist in the understanding of consequences and potential actions for EM relating to these

levels. Similarly, an FRM study and plan may identify additional requirements that may need to be undertaken as part of its implementation

- PMF or extreme flood extent
- emergency response classification for the PMF
- mapping of EM sector boundaries or classification where these already exist. These should be shown relative to the classifications determined in the study
- information on key tipping points for changes in classification. These tipping points may include key road closure locations that result in the isolation of parts of, or all of the community. The level of these tipping points is important to understand, as is the timing of levels being reached so this can be considered in EM planning. Other examples of tipping points may include the typical time and level when floor levels begin to be inundated in an area or key infrastructure or utilities are impacted. The key considerations and tipping points for each of the classifications are shown in Table 10
- an animation (.avi) of the flood progression of the PMF overlaid over cadastre as a minimum to assist in identification or clarification of tipping points of isolation/inundation for a range of PMF events at appropriate time steps, including that deriving peak flood level and shortest time to key tipping points
- where specified in the project brief (generally in the FRM study) any survey information collected on key road closure points on evacuation routes
- in FRM studies and plans, any information on how classifications or tipping points may be altered by the implementation of adopted FRM measures.

All spatial data is to be provided to NSW SES and Department of Planning and Environment's Environment Heritage Group as part of the study finalisation in accordance with the requirements of the study brief.

Table 10 **Key considerations/tipping points for areas with different flood emergency response classifications**

Key tipping points	High flood island	Low flood island	High trapped perimeter	Low trapped perimeter	Area with overland escape	Area with rising road	Indirectly affected area
External access cut, area becomes isolated	✓	✓	✓	✓	✓		
Key internal roads cut		✓		✓	✓	✓	
Overground flooding of land		✓		✓			
Over floor flooding of houses		✓		✓			
Over floor flooding of facilities with special evacuation needs, e.g. aged care, schools		✓		✓			
Transport infrastructure shutdown, e.g. railways, airports	✓	✓	✓	✓	✓	✓	✓
Flooding of key response infrastructure, e.g. hospitals / evac. centres		✓		✓	✓	✓	
Risk of flooding of key public utilities, e.g. sewage / gas / power	✓	✓	✓	✓	✓	✓	✓
Whole area flooded		✓		✓	✓	✓	

Part D – Considering flood emergency management constraints in decision-making

D1 Introduction

EM planning forms the basis for community response to flooding and the EM response strategy of the local community.

The NSW SES undertakes EM planning for flood affected communities at a strategic or community scale where their EM risks can be collectively addressed in an efficient manner to achieve the best outcomes for community safety. EM planning is informed by a range of data sources (Figure 2) including that produced during the FRM process.

This part of the guideline is intended to assist councils to better understand flood EM constraints (see Table 11) beyond the FERCCs (see Part C), including consideration of EM strategies to inform their strategic decision-making.

This information can inform the consideration of EM in addressing risks to the existing community and future development. It can inform the development and implementation of recommendations that consider EM in FRM studies and plans under the FRM process (Section D2).

The consideration of EM planning in the development and implementation of local environment plans (LEPs) and development control plans (DCPs) is discussed in Section D3. It considers the EM strategy of the community and the limitations of flood EM strategies, flood EM planning principles (Section A2.7) and cumulative impacts of development on existing EM strategies.

Section D4 outlines considerations in testing the EM strategy proposed for an area relative to existing community EM strategies including those in LFPs. The application of EM considerations to address continuing risk and reduce residual risk to new development are discussed in Section D5.

D2 Considering emergency management in the flood risk management process

The FRM process provides the opportunity to consider EM for the existing community and future development at a community scale. Having NSW SES EM input into the FRM process (as discussed in Part A) provides the opportunity to raise EM issues and have these considered in investigations and recommendations under the FRM process.

The FRM process can provide the opportunity to:

- gain an up-to-date understanding of flooding, the existing EM constraints and the EM response strategy and consider its suitability for the flood threat faced by the community (see Part A)
- update flood and other relevant information to support EM planning (discussed in Parts B and C)
- examine future scenarios (see FRM guideline FB01) to provide advice on the impacts of climate change and the cumulative impact of future development and additional population on EM constraints (including EM resources and logistics) and the

existing community EM response strategy, and the implications for the residual risks to the community

- develop information to support more effective consideration of EM issues in the development and implementation of LEPs and DCPs (see Section D3 and FRM guideline FB01). This includes the information identified in Parts B and C of this guideline
- identify the need for and assess additional FRM measures (see *Flood risk management measures FRM guideline MM01*) to address risks to the existing and future community. This may include advice on whether EM issues related to new development and its impacts can be effectively managed through permissible land-use zonings and development controls. It may also include consideration of the implications of proposed FRM measures, such as flood warning systems and detention basins on EM strategies for the community
- provide information and advice for emergency managers to input into strategic LUP activities to manage the growth in EM risk from flooding due to development and redevelopment.

The FRM process can result in new information and recommendations to:

- the NSW SES to update flood intelligence and the LFP as discussed in Section A2
- implement FRM measures, including those that may improve the flood EM outcomes for the community. These may include:
  - works that influence community response, such as new or upgraded flood warning systems and improved capacity or reliability of evacuation routes
  - improvements to EM planning and the LFP considering updated flood information
  - additional community awareness activities by council and the NSW SES
  - considering EM strategies in flood EM constrained areas and advising how these can be considered as part of the development, update and implementation of LEPs and DCPs (see Sections D3 and D4).

D3 Considering emergency management in land-use planning

New development and redevelopment can impact on EM planning for the community. It can increase the population in the floodplain, including those who are serviced by constrained evacuation routes and may impact on the ability of the existing community to effectively evacuate during floods. This can increase risks to the existing community. It may also create a situation where a community will need to be evacuated or will be isolated for periods of time during floods.

Decisions to place new development or to redevelop in the floodplain need to consider the EM constraints. They should also consider the current EM response strategy of the existing community and a range of other factors to ensure the realities of flooding and evacuation are adequately considered. This includes considering the inherent risks to the population needing evacuation, including the possibility of evacuees being trapped and overwhelmed by floodwaters while evacuating. There can also be risks due to the exposure of the community and emergency service personnel to floodwater and adverse weather conditions and in using equipment in these conditions. Events occur that are larger than the defined flood event (DFE) used for most development conditions. As such flood related EM and public safety risks for the full range of flooding should be assessed and managed.

Strategic LUP that effectively considers flood and associated EM risks and constraints can assist in minimising the increase in flood risk to a community as it grows. It can encourage development in less flood constrained areas where it does not impact on the flood risks to the existing community and where the flood risks to the new development can be effectively managed.

A key part of these considerations is supporting community safety and limiting any increases in the EM risks to the existing community and any additional burden placed on the NSW SES by new development and redevelopment.

To achieve this aim, EM constraints, including the FERCCs (Part C), should be considered in a fit-for-purpose way within councils' strategic LUP when considering community growth. This involves informing decisions on development through update of LEPs and DCPs or during broad precinct-scale planning such as rezonings. Direction 4.3 made under section 9.1 of the *Environmental Planning and Assessment Act 1997* identifies the need to consider flood related EM risks (including public safety) 'when a planning proposal authority prepares a planning proposal that creates, removes or alters a zone or a provision that affects flood prone land'. This allows councils to consider these risks in informing LUP decisions.

The FRM process with NSW SES involvement and input can provide information to support consideration of EM in LUP and may result in recommendations that councils can consider in their LUP decisions. This can include recommendations that inform strategic LUP in flood constrained areas as part of LEPs and DCPs. This enables recommendations within these documents in consideration of:

- existing EM constraints and the existing EM response strategy. These should be clearly documented throughout the FRM process and available to inform the management of flood risk
- the cumulative impact of future development and additional population on these constraints as well as the associated implications for the residual risks to the existing and growing community. This includes consideration of the cumulative impacts of development and their impacts on the existing EM response strategy. This may include the implications for EM resources and logistics and whether EM issues related to new development can be effectively managed
- the need for and viability of further reducing residual risk to the community through additional management measures. It may identify EM measures to facilitate effective risk reduction as part of the chosen strategy.

Input into the strategic direction of the community by influencing land-use and development controls through LEPs and DCPs is ideal, however, there are many existing situations where land is already zoned for more intensive development where EM risks have not been considered. This may result in more intensive development being proposed in highly flood constrained areas. In these instances, there may still be opportunities to consider flood EM constraints more effectively in development and redevelopment decisions.

Depending on the stage of planning or inclusion of recommendations within the FRM plan, some options for managing the growth in risk due to future development may include:

- identification of areas with less flood related constraints that are more suitable for more intensive development and for the location of developments with more vulnerable occupants (see FRM guideline FB01)
- understanding the existing EM response strategy in consultation with the NSW SES and its assumptions and considering limitations in setting strategic directions and requirements to support future development

- identification of suitable development types and typical development controls commensurate with the flood risk to occupants and property
- recommending linkage to capital works programs or developer contributions to support the implementation of works or measures associated with the strategy
- provision of upgraded or additional flood warning services for the community
- ongoing community education and awareness to ensure the community is aware of the flood risks, warnings and response actions during flooding.

The options available will vary depending on:

- flood characteristics
- existing EM response strategy and arrangements
- whether redevelopment of existing areas or new development in large-scale 'greenfield' areas identified for rezoning is being considered.

Having an understanding of new development and redevelopment directions can also assist the update of community EM planning as the community grows.

D4 Testing an emergency management response strategy

Decision-making to minimise risk to the community is often not straightforward given the complexities in assessing EM risks, however, community safety during flooding is dependent on making informed decisions based on knowledge of these risks.

From an EM perspective, minimising the risks during flooding to both the existing and future community, as well as the potential risks to rescuers, is paramount. This relies on the effective consideration of EM risks when making decisions on FRM for the existing community and for the future community as it grows through development and redevelopment. Fundamentally, the community and occupants of new development need to be safe during floods. This involves understanding the key EM constraints that influence LUP so these can be considered and managed on a strategic basis. These constraints include:

- FERCCs, for example, to determine whether the future development area or existing community will be isolated and potentially also inundated in particular events (Part C)
- availability of warning for the location – this includes the time to onset of flooding and available warning time (Section A2.6)
- period of isolation and/or inundation at the location (Section A2.5)
- evacuation capability (Section A2.5.1)
- compatibility with the existing EM response strategy (Section A2.7)
- whether occupants are safe and self-sufficient in the event of a flood
- ability to self-evacuate to a place of safety.

Understanding these constraints can provide a starting point for considering an EM response strategy and its effectiveness in managing the growth in EM risks to the community due to new development.

Section D4.1 discusses a general process for considering feasibility of an assumed EM response strategy in LUP. Section D4.2 discusses how this can inform decision-making based on the limitations of the EM response strategy.

Figure 20 and Figure 21 provide processes for consideration of EM principles (Section A2.7) and EM constraints in decision-making. They both link to considerations outlined in Table 11. Figure 20 provides EM considerations for strategic decisions such as

community EM planning and consideration of future development to inform LEPs, DCPs and precinct planning. Figure 21 provides EM considerations for redevelopment or development in existing zoned areas.

The processes described in these figures and the considerations in this section of the guideline are a guiding set of EM constraints for consideration in risk-based strategic LUP decisions and should not be considered in isolation. Each situation will have different EM constraints and pose its own unique challenges that need to be considered in the broader strategic planning context by the NSW SES and decision-making authorities.

D4.1 Considering the context of LUP

The various stages of LUP allow consideration of flood and associated EM constraints in either a strategic or individual development site focus. This includes consideration of the scale of redevelopment, other potential development, the risks posed to the users of the development and potential increase in risks posed to the existing community when adopting a particular EM response strategy for new development or redevelopment within existing zoned areas.

The FRM process provides the opportunity to improve knowledge and inform decision-making on EM constraints where evacuation difficulties have been identified.

The FRM process may also inform decisions on strategic LUP considerations, such as:

- **Future community growth directions** – This includes identifying areas where new development does not adversely impact on existing development and where flood risks to the new development and its users can be effectively managed. This may inform the making of an LEP by rezoning areas to support greenfield development or redevelopment and the inclusion of development controls required to manage the flood and EM risk to development within these zonings in a DCP. This forms the basis of Figure 20.
- **Development consistent with current zonings** – This relates to the strategic application of development controls in the DCP in existing zoned and developed areas. For example, controls may be tailored to minimise risk to infill development and 'one off' single dwelling redevelopment and their occupants within an area. This forms the basis of Figure 21.

Whether or not an area can be evacuated, the process for testing an EM response strategy should be based on:

- the full range of flood behaviour
- the EM principles (Section A2.7)
- the key considerations within the steps in the decision-making process and context as shown in Figure 20 and Figure 21 and outlined in Table 11
- the remainder of Section D4.

D4.2 Decision-making considering an emergency response strategy

The processes and considerations described in Section D4.1 aid the strategic decision-making in an EM response strategy, however, the factors shown in Figure 20 and Figure 21 and described in Table 11 and the remainder of this section need to be further considered in the context of existing EM strategies, evacuation capability and options to minimise any intolerable flood risks to the existing and or future community.

This may involve modification of the proposed development or identifying additional controls to manage future risk to the community in the context of both:

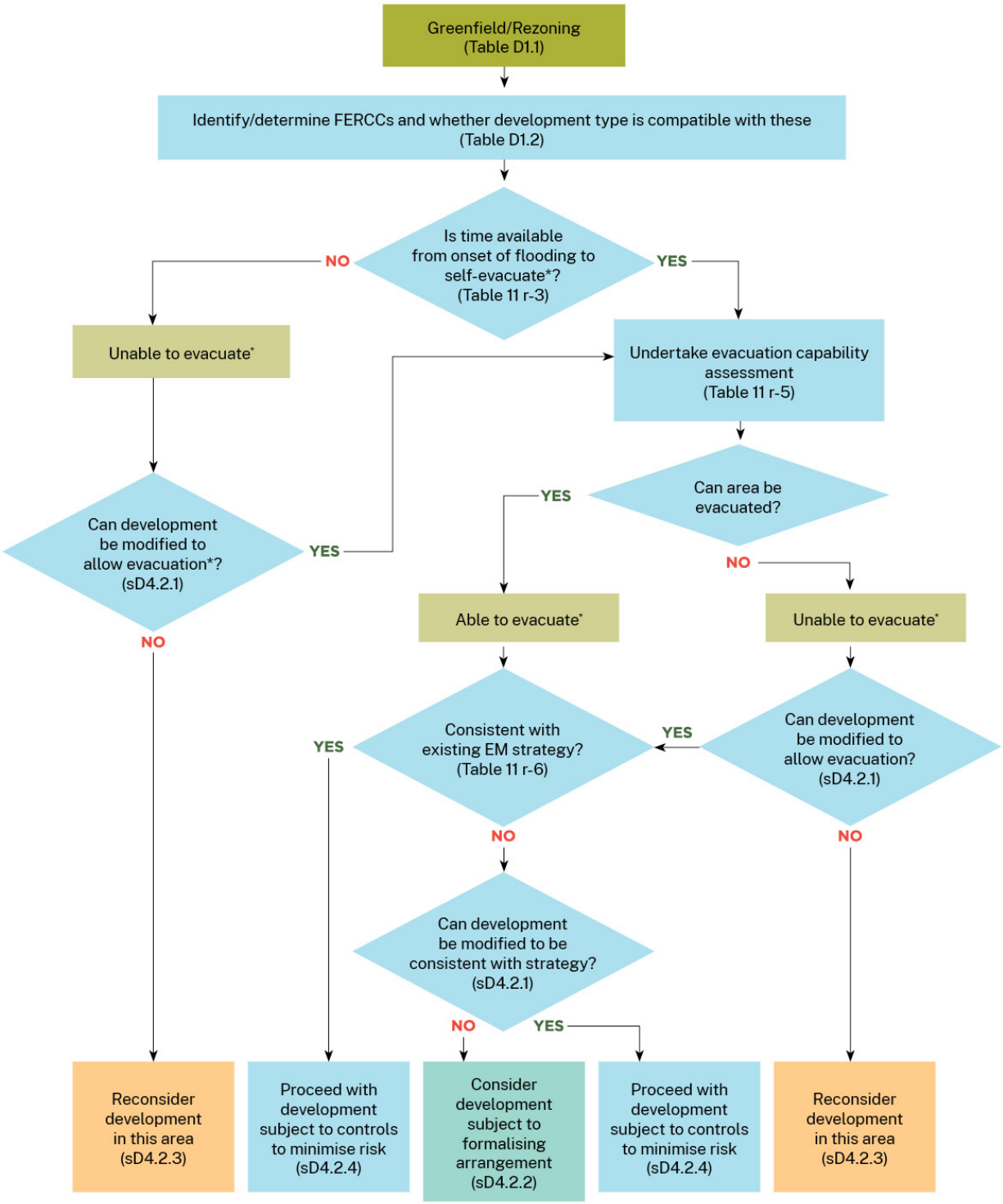
- proposed new greenfield developments, which can consider EM constraints to inform development location and type (Figure 20)
- infill or redevelopment consistent with existing zonings (Figure 21). This may primarily involve property modification measures to manage changes in risk.

Part of this process is to ensure that if development is considered feasible and is implemented, its EM response strategy is documented and available to inform the LFP.

D4.2.1 Potential development modification measures

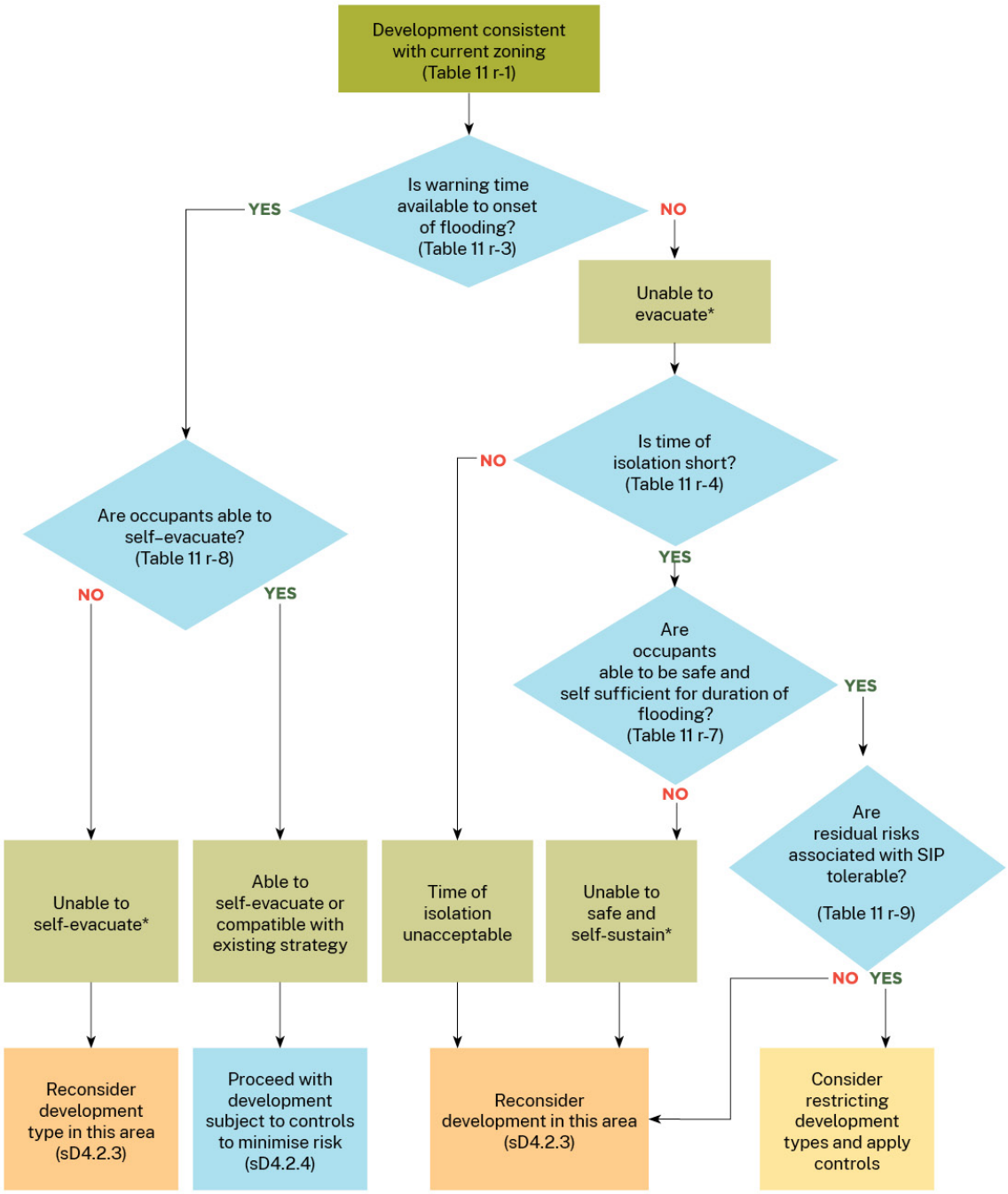
If potential future growth in the community will result in the evacuation capacity of the evacuation route being exceeded, to support community safety it may be appropriate to make modifications to elements that influence this capacity. These alterations can include:

- managing the scale of development
- changing the development type to one that is suitable for the limitations of the location. FRM guideline FB01 provides advice on relative vulnerability of different land uses and their occupants to flooding
- providing an access route that facilitates evacuation
- upgrading existing access for the community to increase capacity, for example, of the existing road network
- providing effective or improved flood warning to support effective EM response.



Note: * 'Evacuate' or 'Evacuation' means self-evacuation based on flood triggers to an area outside of floodwaters with adequate services to sustain evacuees.

Figure 20 Considering emergency management in greenfield developments, rezoning and creating new communities



Note * 'Evacuate' or 'Evacuation' means self-evacuation based on flood triggers to an area outside of floodwaters with adequate services to sustain evacuees.

Figure 21 Considering emergency management in redevelopment or infill development compatible with existing zoning

In existing zoned areas and established communities, considering controls to minimise risks to the community and occupants due to infill development and redevelopment is typically necessary. This is particularly important in areas of flash flooding. The risks associated with assuming individuals can shelter in place safely and considerations for flood warning are discussed in Part A of this guideline. Infill and redevelopment in these areas typically requires consideration of a suite of factors to minimise the risks through redevelopment, including the application of:

- controls, including minimum floor level and structural building controls to reduce the exposure of occupants to flooding
- flood warning systems to warn the community of impending flooding
- ongoing community engagement to ensure the actions that should be undertaken during flooding are understood.

Table 11 Test categories for effectiveness of consideration of flood emergency management

Flow chart reference		Descriptor	Further information
LUP consideration/FRM recommendations			
1.	LUP context	**Strategic consideration of large-scale precinct/study areas** In this case, EM is best considered in an FRM study or in government studies to inform the amendment or making of an LEP/regional strategy. This allows consideration of broad-scale impacts on EM for the existing and future community. These would typically be considered in strategic precinct-scale investigations to inform State environmental planning policy (SEPP) and LEP requirements, and DCP controls. **Individual dwelling redevelopment consideration** Typically considered in LEPs and DCP controls for concessional development or redevelopment to reduce risk to existing development within a defined study area or development types compatible with existing zoning.	Section D4.1
Key EM constraints			
2.	FERCCs	These provide key base information on the priority of evacuation consideration due to potential implications for the community. They need to be considered in conjunction with other EM constraints and secondary considerations including those outlined below.	Part C
3.	Time from onset of flooding and available warning	The time available from the onset of rainfall to flooding and the effectiveness of flood warnings are key considerations in determining an EM response strategy for an area. Where effective warnings are not available for a community, consideration should be given to whether an improved or new system may be warranted to materially reduce EM risk.	Part A
4.	Period of isolation	There is no known safe period of isolation. The longer the isolation the greater the risk to occupants including the potential to enter floodwater or be subject to injury from fire or medical emergency.	Part A
5.	Evacuation capability	Evacuation capability of the community needs to be considered in large-scale development proposals. It involves an understanding of: • available warning time • the EM capacity to warn the community • number of people to be evacuated • time and location of evacuation route closure	Part A

Flow chart reference		Descriptor	Further information
		• time to warn people to evacuate • time people take to accept and act on a warning • time taken for people to travel along an evacuation route including time for likely convergence and traffic delays • the evacuation capability of the existing community and ensuring this is not affected where new development is being considered • availability of a safe area to evacuate to with adequate services to support evacuees. Evacuation is the primary EM response strategy. Adopting an alternative strategy in areas that do not have adequate warning time or ability to evacuate is not without significant risk. The risk to the community needs to be considered and managed before the strategy is adopted. This includes understanding the behaviour of occupants and their vulnerability to fire and medical emergency. Effectively communicating the strategy during an event requires upfront acceptance of the risks associated with the strategy and ongoing community awareness.	
6.	Compatibility with an existing EM response strategy	Any proposed strategy needs to consider its compatibility with the existing EM response strategy and any factors that may alter the application of this strategy within the decision-making process.	Part A
7.	Safety and self-sufficiency of occupants	Consideration needs to ensure the safety and self-sufficiency of occupants including considering the factors identified in Section D4.2.4. This includes the vulnerability of occupants, potential to self-sustain, availability of services and ability of the shelter to withstand the impacts of flooding and debris loading.	Part A & Section D4.2.4
8.	Self-evacuation	Consider the vulnerably of occupants based on land use and likelihood of ability to self-evacuate by car with adequate warning, to a location of safety and available services.	Part A
Shelter in place (SIP) as a strategy in fast responding catchments			
9.	Shelter in place	The risks associated with occupants remaining within the flood impacted area are identified in Part A of this guideline. Key considerations for development include those identified in Section D4.2.4. This risk management strategy is not endorsed for creation of new communities through rezoning. It should only be considered as an FRM measure for the existing community or through redevelopment in existing zoned areas.	Part A & Section D4.2.4

D4.2.2 Formalising an emergency response strategy

Any proposed emergency response strategy for a development needs to consider any existing LFP or EM response strategy for the community, the evacuation capability of any existing community, as well as the future community, and associated development

requirements to ensure the risk to future occupants due to new development is minimised and managed.

Where a proposed emergency response strategy has been determined as feasible and agreed to by the NSW SES for the community, it should be recommended for inclusion in the LFP. This can ensure it is recognised by all parties involved and links to ongoing engagement, awareness and understanding of the expectations, likely warning and actions required by the community during flooding.

D4.2.3 Reconsideration of development in an area

When considering the expansion of a future community through rezoning, the ability of the future community to self-evacuate consistent with the LFP or an existing EM strategy requires consideration. In some cases this may not be possible.

The LFP and investigations under the FRM process may provide information on existing evacuation constraints that can assist when considering the EM strategy and associated constraints. Where available and fit for purpose this information should be used to understand where these situations are likely to exist and where management measures may be required to facilitate community evacuation.

Consideration also needs to be given to the additional burden on the NSW SES to respond effectively in EM constrained areas. This may include consideration of, for example, response capability and the impact on emergency response activities in existing areas, as well as in the new development. These considerations are likely to vary with location and require an understanding of the specific issues relating to EM in the area.

If the capability to safely and effectively evacuate cannot be demonstrated or is significantly compromised, even with examination of management options, consideration should be given to other options, such as reconfiguring the development to address issues, altering the scale or type of the development, or finding an alternative location for development (in an area where EM risks can be adequately addressed).

D4.2.4 Considering land uses, development types and controls

Where a rezoning, infill or redevelopment of individual dwellings or buildings is being considered, decision-making should consider the ability of development controls to manage the associated risk. Controls should be aimed at managing risk based on the flood related constraints and likely impacts during flooding.

Consideration of these factors may vary depending on the primary EM response strategy. For example, when considering an existing flash flood situation where occupants are likely to be advised to remain in their dwellings during flooding, development conditions should aim to ensure the building can withstand flood and debris forces, that people have a flood-free location to shelter during the event, and that services are available during and beyond the event for the full range of flooding. These controls are important to allow safe occupation and return.

Rezoning provides the opportunity to consider and aim for compatibility of the location of the potential future land use and occupants with the flood constraints on the land given the development controls suitable to address these constraints. It may provide the opportunity to avoid or limit development in areas that are the most highly constrained by EM issues.

Some of the key considerations that inform decision-making of the types of developments and controls to minimise EM risk include:

- **Vulnerability of occupants** – The consequences associated with failed evacuation of developments with vulnerable occupants (e.g. hospitals, aged care, childcare or private residences of elderly residents, those with disability or impaired mobility) need to be considered and inform suitability of land use and permissible development types to minimise the EM risks to occupants and staff.
- **Flood-free location for sheltering** – Sufficient flood-free area should be available and accessible to services during an event.
- **Availability of services** – Access to ablutions, water, power and basic first aid equipment and availability of onsite systems to provide for power, water and sewage services for the likely flood duration (plus a further period of back-up to allow for restoration of external services), needs to be considered for the community. The need for access during a flood or ability to quickly recover these services afterwards must be considered depending on the strategy.
- **Structural adequacy and building requirements** – Flow velocities, flow depths and associated debris loads can affect the structural soundness of buildings in several ways. Structural soundness of buildings needs to cater for these forces, including buoyancy, the impacts of local hydraulic conditions and debris loads. Structural adequacy is a key consideration for individuals remaining in place during flooding and recovery post event. Building requirements may therefore vary depending on the primary EM response strategy.

Further advice to inform consideration of the types of controls in either a redevelopment context or future rezoning with an opportunity to consider land use, and based on their evacuation capability, is provided in Section D4.

D5 Application of emergency management related considerations to minimise residual risk

The development of flood related LEP and DCP controls should include consultation with the NSW SES about any existing EM strategies and known flood and EM constraints, so they can be considered strategically to inform decisions on community redevelopment and growth. FRM guideline FB01 provides additional advice on considerations for LEPs and DCPs.

Section D4.2.4 of this guideline provides the context for considering EM and the ability for risk to be managed through applying controls in EM constrained areas. Table 12 provides advice on the application of EM related considerations to minimise residual risks to occupants. It should be used in conjunction with advice in FRM guideline FB01 and in this guideline. It provides typical considerations based on the EM strategy considering the development stage, typical land uses, the role of management measures such as warning systems and community awareness, and other considerations relating to EM strategies.

This advice has been provided for strategic consideration of development controls that may be recommended through the FRM process to minimise EM risks based on typical land-use categories and EM strategies. Additional considerations and management may be needed to manage the flood EM risks to the community depending on the flood situation.

Table 12 Recommended emergency management issues for councils to consider in strategic decision-making

Key consideration	EM response strategy	
	Evacuation	**Shelter in place**
Greenfield development – all land uses in EM constrained areas		
Proposed future community or rezoning in EM constrained areas	Self-evacuation required. Any evacuation strategy proposed in areas where evacuation may be feasible on a community scale without detriment to the existing community. Needs to have supporting evidence of an evacuation capability assessment, consider vulnerability of proposed development types and land uses and consider manageable controls described in Part A and Section D4 of this guideline.	Generally not supported by the NSW SES given the potential increase in risk, particularly to potential rescuers and residual risks to occupants that are unlikely to be able to be managed. Requires comprehensive consideration of likely risks to occupants and associated treatment measures.
Redevelopment in existing zoned EM constrained areas		
Residential development	Any evacuation strategy proposed in areas where evacuation may be feasible on a community scale without detriment to the existing community. May require supporting evidence of an evacuation capability assessment where identified by the consent authority or the NSW SES.	Make buildings as safe as possible to occupy during flood events. An area of habitable floor of any residential development should be located above the PMF with the building structurally designed for the likely flood and debris impacts. Consider provision of services to minimise risk of fire and medical emergency during flooding.
Medium and high density residential	Development requiring evacuation where this may be feasible on a community scale without detriment to the existing community. May require supporting evidence of an evacuation capability assessment where identified by emergency services.	Make buildings as safe as possible to occupy during flood events. An area of habitable floor of any residential development should be located above the PMF with the building structurally designed for the likely flood and debris impacts. To minimise the increased risk of fire and to reduce both the potential for adverse outcomes in the case of a medical emergency and the risks to those who may aid the patient, the NSW SES, Ambulance NSW, the relevant Health functional area and the fire agency servicing the area should be consulted by councils to determine appropriate risk management strategies during flooding.
Sensitive development used in emergencies	All new emergency response hospitals and emergency response headquarters should be located in areas of the floodplain that are lower risk and can be readily	All new emergency response hospitals should be located on land outside the extent of the PMF where service interruption is likely to be limited.

Key consideration	EM response strategy	
	Evacuation	**Shelter in place**
	evacuated within the available time and with the available resources.	
Commercial development (including retail)	Any evacuation strategy proposed in areas where evacuation may be feasible on a community scale without detriment to the existing community. May require supporting evidence of an evacuation capability assessment where identified by the consent authority or NSW SES.	To cater for the safety of potential occupants, clients and visitors in commercial development there should be the provision of sufficient readily accessible habitable areas above the PMF.
Childcare facilities	All new childcare facilities should be located in areas of the floodplain that are lower risk and can be readily evacuated within the available time and with the available resources.	All new childcare facilities should be located with floor levels above the PMF level.
Primary and secondary schools and day hospitals	All new day hospitals and primary and secondary school facilities should be located in areas of the floodplain that can be readily evacuated within the available time and resources. Assessment should be supported by an evacuation capability assessment where identified by the consent authority or NSW SES	Where possible, new day hospitals and primary and secondary school classrooms should also be located above the PMF level. However, at a minimum there should be access to adequate space above the PMF within a day hospital and school building for patients, school students, staff and visitors where the facility is not intended to be evacuated outside the floodplain.
Carparking	NA	Any additional parking should be above ground level and have pedestrian access to a podium level above the PMF.
Warning systems		
Warning systems	Any warning system needs to be supported by evidence that it meets the TWSF requirements including consultation with the BoM and the NSW SES.	
PA systems	NA	Consider developing a PA system to communicate evacuation directions and safety messages to the population in the lead-up to and during a flood to assist in improving the safety of the community.
Community awareness		
Increasing the flood awareness of current and future communities	Council should have community awareness strategies that include requiring the existing and future community to participate in increasing this awareness.	

Key consideration	EM response strategy	
	Evacuation	**Shelter in place**
Reducing human behaviour risks through businesses, schools and childcare centres	Where facilities, such as businesses, schools and childcare centres have site emergency plans that consider flooding these plans should by regularly exercised similar to building fire evacuation drills.	
Additional risk management considerations		
Addressing secondary risks of fire and medical emergencies during floods	NA	To minimise the increased risk of fire and to reduce both the potential for adverse outcomes in the case of a medical emergency and the risks to those who may aid the person/patient, the NSW SES, Ambulance NSW, the relevant Health functional area, and the fire agency servicing the area should be consulted by council to determine appropriate risk management measures to minimise risks during flooding.
		Where there is no CBD-wide strategy to address secondary risks during flooding, consideration needs to be given to how secondary risks will be managed for the duration of flooding and a further period of up to 48 hours to provide restoration of external services.
Limiting exposure of people to floodwaters	Needs to be considered as part of the evacuation strategy.	This can be aided by providing sufficient readily accessible habitable areas above the PMF to cater for potential occupants, clients, visitors and residents.
Provision of publicly accessible space for the itinerant population	Needs to be considered as part of the evacuation strategy.	Provision of publicly accessible space or access to space above the PMF (with adequate infrastructure to enable the physically impaired to access such space) that is easily accessible 24 hours a day, 7 days a week and is clearly identified for this purpose with associated directional signage.
Providing adequate services so people are less likely to enter floodwaters	NA	This includes access to ablutions, water, power and basic first aid equipment. Consideration must be given to the availability of onsite systems to provide for power, water and sewage services for the likely flood duration (up to 12 hours) plus a further period of up to 48 hours to allow for restoration of external services.

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More information

Flood risk management manual, guidelines and tools

See links on the following Department of Planning and Environment (DPE) webpages:

- Flood risk management manual
- Flood risk management guidelines

- ‘Administration arrangements: flood risk management guideline AG01’

Other links

- Floodplain Management Program
- NSW State Emergency Service website