

# Shelter-in-place guideline for flash flooding

This guideline aims to assist consent authorities to undertake site specific, risk-based assessment to assess if shelter-in-place is a suitable emergency management strategy for development proposed in flash flood environments. This is achieved by balancing the merits, risks, and impacts of a proposal. The guideline also aims to inform considerations about whether appropriate measures are in place to limit potential flash flood related impacts on affected proposals and public safety.

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## Introduction

Keeping people safe during floods requires understanding an area's flood risk. Good planning, awareness, preparedness and the adoption of appropriate risk management and mitigation strategies will help achieve this objective. Infrastructure, how development is designed and whether the proposal provides for safe occupation and efficient and effective evacuation during flood events are important considerations.

The NSW Independent Flood Inquiry, led by Professor Mary O'Kane AC and Michael Fuller APM reviewed the preparation for, causes of, response to, and recovery from the significant flooding experienced across NSW in early 2022. The Inquiry identified the need for a consistent framework for consent authorities when considering whether shelter-in-place could form part of the emergency response for a site.

## What is shelter-in-place?

Shelter-in-place is the internal movement of a building's occupants to an area within the building above the probable maximum flood (PMF) level before their property becomes inundated by flood waters.

Shelter-in-place is not a design or safety solution free from risk. When considering shelter-in-place, secondary risks such as the impact of a flood on people's access to water and electricity, the availability of food, management of medical emergencies, building fire and their health and well-being should also be addressed.

## What is flash flooding?

Flash flooding is “flooding that occurs within 6 hours of the precipitating weather event, and often involves rapid water level changes and flood water velocity”.<sup>1</sup> This includes overland, creek and riverine flooding sources.

Flash flooding can be more dangerous than long duration flooding. This is largely due to the rapid changes in velocities and depths of water, and very short or minimal warning time providing limited opportunity for communities to respond to a flood threat in an appropriate and timely manner.

There may be minimal time between the start of rainfall that causes flood and the flooding of roads, property and potentially buildings. Warnings to the community are often limited to severe weather warnings or flood watches for the general area, often with no specific forecasts or advice available on the local impacts of flash flooding. Flash flooding locations often do not have water level gauges that can provide information to the public about the potential scale of the flood’s impacts.

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## Intent of guideline

This guideline considers shelter-in-place where flash flooding is the only flood risk present at the site and where people can safely shelter above the PMF level.

The intent of the guideline is to:

- guide proponents on where shelter-in-place may be considered in land use planning
- provide consent authorities guidance on matters that may be considered in assessing planning proposals and development applications where shelter-in-place is proposed
- assist councils when considering the role of shelter-in-place within their own local guidelines, policies, and development control plans.

## Evacuation is the primary emergency management strategy for flooding in NSW

Evacuation off-site is the primary emergency management strategy for flooding in NSW. Flooding may displace individuals, require people to relocate or disrupt essential services to communities for hours, days or weeks. Before a flood, getting people to evacuate off-

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<sup>1</sup> Flash flooding as defined in *Emergency Planning and Response to Protect Life in Flash Flood Events* (2018) AFAC (Australasian Fire and Emergency Service Authorities Council).

site to an area not affected by flooding is considered the best way to keep people safe and reduce the impacts of an emergency on a community. Evacuation involves moving people threatened by a flood to a safer location and, typically, their eventual safe and timely return.

The NSW State Emergency Service (SES) is the lead agency for flooding and determines the emergency management strategy for flood events. Generally, the most appropriate primary emergency management strategy is self-evacuation of people off-site to an area not affected by flooding, as detailed in the NSW State Flood Plan and Local Flood Plans.

## Constraints to evacuation

Evacuation off-site may not always be possible. This is amplified in high-density urban areas where a significant number of people would need to evacuate, and where the capacity of evacuation routes may be constrained.

There may be little to no warning time in locations that experience flash flooding, meaning evacuation may pose a higher risk than sheltering-in-place for a short period of time. In this circumstance, the incorporation of suitable refuge facilities in a proposed development may be considered to reduce the potential risks.

Understanding the full range of flood behaviour at a site can help identify evacuation constraints. This should be considered through the Floodplain Risk Management process. This process can also assist councils to identify appropriate flood risk management strategies including emergency management strategies for specific areas which may include shelter-in-place.

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## Considerations for shelter-in-place

### Understanding flood behaviour

Understanding the full range of flood behaviour up to, and including the PMF, accounting for climate change scenarios and secondary risks, is essential for planning for flood emergencies.

An understanding of flood behaviour can be informed by the following documents:

- Flood studies (consistent with the Flood Risk Management Manual 2023)
- Floodplain Risk Management Studies (consistent with the Flood Risk Management Manual 2023)
- Flood plans (NSW SES)

- Flood Impact and Risk Assessment (FIRA) (consistent with Flood Impact and Risk Assessment Guideline (LU01)) if insufficient flood behaviour information is unavailable.

## Strategic decision-making about shelter-in-place

For councils considering emergency management strategies (such as shelter-in-place) in strategic decision-making, the following guidelines may assist:

- Support for Emergency Management Guideline (EM01) which provides advice on the application of emergency management considerations to minimise residual risks to occupants and sets out recommended emergency management issues for councils to consider in strategic decision-making
- Understanding and Managing Flood Risk Guideline (FB01) provides advice to councils on considering flood behaviour when preparing flood risk management studies and plans, including considering land use planning responses to flooding.

## Shelter-in-place considerations

When considering shelter-in-place, consent authorities should take a risk-based approach that is informed by the proposal's scale and establishes controls and mitigation measures that reflect the duration and depth of modelled flooding up to the PMF. The Support for Emergency Management Guideline (EM01) (table 12) provides advice on the application of emergency management considerations to minimise residual risks to occupants. In addition to this, the following will help guide consent authority when initially assessing if shelter-in-place is an appropriate emergency management strategy for the site:

1. does shelter-in-place align with existing emergency management strategies for the area, as determined through the flood risk management process and by the NSW SES
2. has evacuation off-site (the primary emergency management strategy) been investigated and determined to be unachievable
3. does the development include medical centres, emergency service and community facilities, and sensitive and hazardous land uses, some of which may not be suitable for shelter-in-place
4. shelter-in-place for greenfield development is not supported

5. whether there is existing government developed flood warning systems that give advanced detailed forecasts of flash flooding to allow sufficient time to evacuate to the proposed refuge locations<sup>2</sup>
6. can the community effectively be informed of the risks associated with the emergency management strategy

Following satisfactory consideration of the above issues, the Flood Impact and Risk Assessment (FIRA) being undertaken for the site must provide advice for the consent authority to consider the suitability of the site for shelter-in-place. The FIRA should include:

7. detailed assessment of evacuation off-site (the primary emergency management strategy) to determine that evacuation off-site is not achievable.
8. the flood behaviour at the site, with consideration of climate change and assessment of the potential maximum duration of isolation up to and including the PMF to identify that:
  - a. flash flooding is the only flood risk present at the site, whether it be from overland flooding, local creek or riverine flooding, and
  - b. the flooding occurs within less than 6 hours from the commencement of causative rain and the duration of shelter-in-place due to isolation by floodwaters is less than 12 hours from the commencement of rainfall, and
  - c. the development is not subject to high hazard flooding (e.g. floodways, high hazard H5 or H6 areas) or surrounding roadways are not subject to high hazard flooding.<sup>3</sup>

Following consideration of items 1 to 7, and if items 8a, b and c are met, and the consent authority considers shelter-in-place is an appropriate emergency response strategy the following items must also be considered through a FIRA:

9. how shelter-in-place will be:
  - a. used as part of the site's emergency management response, including actions before, during and after sheltering-in-place, and
  - b. communicated to occupants and visitors of the building and how this communication will be maintained for the life of the development.

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<sup>2</sup> Flash flood warning systems are not failsafe and should not be the only mechanism to get people to shelter-in-place.

<sup>3</sup> Flood Risk Management Guideline FB03 Flood Hazard, DCCEEW, 2023.

10. an understanding of the secondary risks and how the proponent proposes they will be managed is outlined in the FIRA. Secondary risks include medical emergencies, building fire, health and wellbeing.

- a. Table 12 of EM01 should be used to consider whether the risks could be effectively managed.

The consent authority should reflect the following design criteria (I to III) in relevant conditions of consent:

- I. the floor level of the shelter-in-place part of the development be above the PMF, and
- II. structural soundness for conditions in a PMF event, considering flood and debris forces, be verified by a suitably qualified structural engineer, and
- III. area and access to the area does not rely on access to electricity, is self-directing, and have clearly marked internal access for all people on site, including consideration of access for potential occupants and/or visitors.

The consent authority may also consider the following design criteria (IV to X) when setting relevant conditions of consent depending on the scale and type of development:

- IV. protection from weather and appropriate heating and cooling
- V. access to personal hygiene facilities such as a toilet
- VI. a minimum floor space of 2 m<sup>2</sup> per person
- VII. items for self-sufficiency that are stored, maintained and are regularly updated in an accessible location above the PMF, including sufficient drinking water and food for occupants, fire extinguishers, radios and torches with spare batteries, and a first aid kit with an automated external defibrillator (AED)
- VIII. centralised communal shelters may be considered but must be freely accessible internally at all times and externally accessible during events
- IX. access is provided to onsite systems that generate power of the shelter-in-place location during and after the event for a full range of flood events up to the PMF
- X. detail how these requirements will be maintained and enforced for the life of the development.

## **Additional considerations for councils**

It is suggested that councils establish a register for development approvals and occupation certificates that rely on shelter-in-place as part of their emergency management response.

Councils should include any additional information on flood risk including emergency response strategies such as sites or dwellings approved to shelter-in-place on the relevant planning certificate under section 10.7(5) of the *Environmental Planning and Assessment Act 1979*.

## Community engagement to support shelter-in-place implementation

Ongoing community engagement is important to ensure that the community is aware of actions they must take before, during and after sheltering-in-place and the key triggers that require shelter-in-place. If shelter-in-place is proposed there should be ongoing community engagement campaigns for the areas and/or developments utilising shelter-in-place. NSW SES should be involved in the development of these campaigns as the lead agency for emergency management of floods in NSW. However, NSW SES is not responsible for developing Flood Emergency Response Plans for individual developments.

Shelter-in-place like other flood risk management strategies requires clear, consistent and regular communication, strong community awareness and acceptance of what may be required to allow individuals to understand their level of risk and the triggers for associated actions, including for vulnerable populations.

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## Glossary

**Evacuation off-site** is evacuation of people to an area outside of the effects of flooding that has adequate facilities to maintain the safety of the community (NSW SES).

**Flash flooding** is flooding that occurs within 6 hours of the precipitating weather event, and often involves rapid water level changes and flood water velocity (AFAC, 2018).

**Flood Risk Management process** as defined in Figure 2 of the Floodplain Risk Management Manual (2023).

**Full range of flooding** is all flooding up to and including the PMF.

**Sensitive and hazardous uses** as defined in Standard Instrument – Principal Local Environmental Plan, clause 5.22(5).

**Shelter-in-place** is the movement of occupants of a building to an area within the building above the PMF, before their property becomes inundated by flood waters.

**Probable Maximum Flood (PMF)** is the largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation (PMP), and where applicable snow melt, coupled with the worst flood-producing catchment conditions (Flood Risk Management Manual, 2023).