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## 1 INTRODUCTION

- a) This chapter of the DCP provides Council’s requirements for development upon flood prone land and land below the flood planning level within the City of Wollongong Local Government Area (LGA).
- b) This chapter of the DCP has been developed as an outcome of Floodplain Risk Management Plans (FRMPs) prepared in accordance with the process outlined by the NSW Government Flood Prone Lands Policy and the NSW Floodplain Development Manual (FDM) 2005. In areas where FRMPs have not yet been adopted the planning controls reflect Council Policy and are considered to be consistent with the principles of the State Government Flood Prone Lands Policy and FDM.
- c) The Department of Planning and the Department of Environment and Climate Change (Now Department of Planning Industry and Environment, DPIE) confirmed that there were exceptional circumstances that allowed Wollongong Council to apply flood related controls to residential development above the 1% Annual Exceedance Probability (AEP) flood level (plus freeboard) in accordance with Ministerial Directions outlined in Planning Circular PS-07-003.
- d) Other Chapters of this DCP include flood risk management provisions, which relate to the specific development requirements for specific land uses.

## 2 LAND TO WHICH THE PLAN APPLIES

1. The Plan applies to all floodplains and land below the flood planning level area within the City of Wollongong LGA. Figure 1 shows catchment boundaries within the Wollongong LGA.
2. The extents of adopted catchment wide flood studies and floodplain risk management studies and plans can be viewed at:

<https://www.wollongong.nsw.gov.au/development/maps>

>planning and environment map>*Constraints and Planning DCPs* layer

Please note the flood information is only viewable at a scale of 1:15000.

### 3 OBJECTIVES

1. The key objectives of this chapter are to:
  - a) Maintain the existing flood regime and flow conveyance capacity;
  - b) Maintain the function of floodway and flood storage areas;
  - c) Reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone land;
  - d) Reduce private and public losses from flooding;
  - e) Improve public safety with respect to flooding;
  - f) Minimise the potential impact of development and other activity upon the aesthetic, recreational and environmental value of the waterway corridors;
  - g) Increase public awareness of the hazard and extent of land affected by the full range of potential floods;
  - h) Ensure new development must, as far as practical, reduce the existing flood risk, and in no circumstances should the flood risk be worsened;
  - i) Ensure new development (with the exception of waterway crossings) does not encroach within areas susceptible to channel erosion, migration, bank failure and slumping; and
  - j) Deal equitably and consistently with all matters requiring Council approval on flood affected land, in accordance with the principles within the latest version of the NSW Floodplain Development Manual or its update.



**Figure 1 Catchments within the Wollongong Local Government Area. DEFINITIONS**

For the purposes of this chapter of the DCP, the following definitions and technical terms apply:

<b>Annual exceedance probability (AEP)</b>	The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. Example, if a peak flood discharge of 500 m <sup>3</sup> /s has an AEP of 1%, it means that there is a 1% chance (that is one-in-100 chance) of a 500 m <sup>3</sup> /s or larger event occurring in any one year.
<b>Australian Height Datum (AHD)</b>	Australian Height Datum: National reference datum for level.
<b>Average Recurrence Interval (ARI)</b>	the long-term average number of years between the occurrence of a flood as big as, or larger than, the selected event. For example, floods with a discharge as great as, or greater than, the 20-year ARI flood event will occur on average once every 20 years. ARI is another way of expressing the likelihood of occurrence of a flood event.
<b>ARR1987</b>	Australian Rainfall and Runoff: 1987 published by the Institute of Engineers, Australia
<b>ARR2019</b>	Australian Rainfall and Runoff 2019, published by the Commonwealth of Australia (Geoscience Australia).
<b>Basement Car Parking</b>	Refers to a car parking area wholly or partly accommodated underground, below a building. The roof of this space, including any solid walls on the podium, must not exceed 1.2 m in height above natural ground level or finished ground level, whichever is the greatest distance.
<b>DPIE</b>	Department of Planning Industry and Environment
<b>Deck</b>	An outdoor living area attached to a dwelling, which may be covered or uncovered, and is not capable of being used or adapted for use as habitable floor area.
<b>Enclosed car parking</b>	<p>Car parking that is potentially subject to rapid inundation, which consequently increases danger to human life and property damage (such as basement or bunded car parking areas). The following criteria apply for the purposes of determining what is enclosed car parking:</p> <p>(a) Flooding of surrounding areas may raise water levels above the perimeter which encloses the car park (normally the entrance), resulting in rapid inundation of the car park to depths greater than 0.8m, and</p> <p>(b) Drainage of accumulated water in the car park has an outflow discharge capacity significantly less than the potential inflow capacity</p>
<b>Filling</b>	Depositing of soil, rock or other material. Filling does not include the depositing of topsoil, or feature rock imported to the lot, that is intended for use in garden landscaping, turf or garden bed establishment or topdressing of lawns.
<b>Flood</b>	A relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with major drainage as defined by the Floodplain Development Manual before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding tsunamis.
<b>Flood awareness</b>	An appreciation of the likely effects of flooding and a knowledge of the relevant flood warning and evacuation procedures.

<b>Flood compatible building components</b>	A combination of measures incorporated in the design and/or construction and alteration of individual buildings or structures subject to flooding, and the use of flood compatible materials for the reduction or elimination of flood damage.
<b>Flood compatible materials</b>	Those materials used in building which are resistant to damage when inundated. A list of flood compatible materials is attached in Schedule
<b>Flood evacuation strategy</b>	The proposed strategy for the evacuation of areas within effective warning time during periods of flood as specified within any policy of Council, the FRMP, the relevant State Government disaster plan, by advices received from the State Emergency Services (SES) or as determined in the assessment of individual proposals.
<b>Flood Planning Area</b>	The area where flood related development controls apply. It includes land below the flood planning level (FPL) and may extend to include other areas of land where the high consequences in low probability events require additional flood related controls to reduce damages or to not alter the floodway in rarer flood events.
<b>Flood planning levels (FPLs)</b>	<b><i>flood planning level</i></b> In the Wollongong LGA, the FPL is the level of a 1 % AEP flood event plus 0.5 metres freeboard, unless otherwise stated in an adopted Floodplain Risk Management Study and/or Floodplain Risk Management Plan
<b>Flood Prone Land</b>	Land susceptible to flooding by the PMF event. Flood Prone Land is synonymous with flood liable land.
<b>Flood Refuge Area</b>	An onsite refuge above the PMF that provides reasonable shelter for the likely occupants of the development commensurate with the period of time that refuge is likely to be required in floods up to the PMF.  Note: In general, it is not acceptable to rely on a refuge provided by or on other development sites. In all cases where an onsite refuge is provided, it is to be both intrinsically accessible to all people on the site, sheltered and an integrated part of the development (i.e. a second storey with internal stair access). The route to the refuge is to be fail safe, plainly evident and self-directing.
<b>Flood Fringe Areas</b>	The remaining areas of flood prone land after floodway and flood storage areas have been identified
<b>Floodway Areas</b>	Areas of the floodplain where a significant discharge of water occurs during floods. They are often aligned with naturally defined channels. Floodways are areas that, even if only partially blocked would cause a significant redistribution of flow or a significant increase in flood levels.  Where not mapped in an adopted Flood Study or FRMS, floodway areas may be defined using DPIE Floodway Definition Guidance (in Prep 2020), or using a velocity x depth product greater than 0.4m <sup>2</sup> /s.  While the DPIE Floodway Definition Guidance is finalised, floodway areas may also be defined using the guidance provided in Appendix D.
<b>Flood Storage Areas</b>	those parts of the floodplain that are important for the temporary storage of floodwaters during the passage of a flood. The extent and behaviour of flood storage areas may change with flood severity, and loss of flood storage can increase the severity of flood impacts by reducing natural flood attenuation.

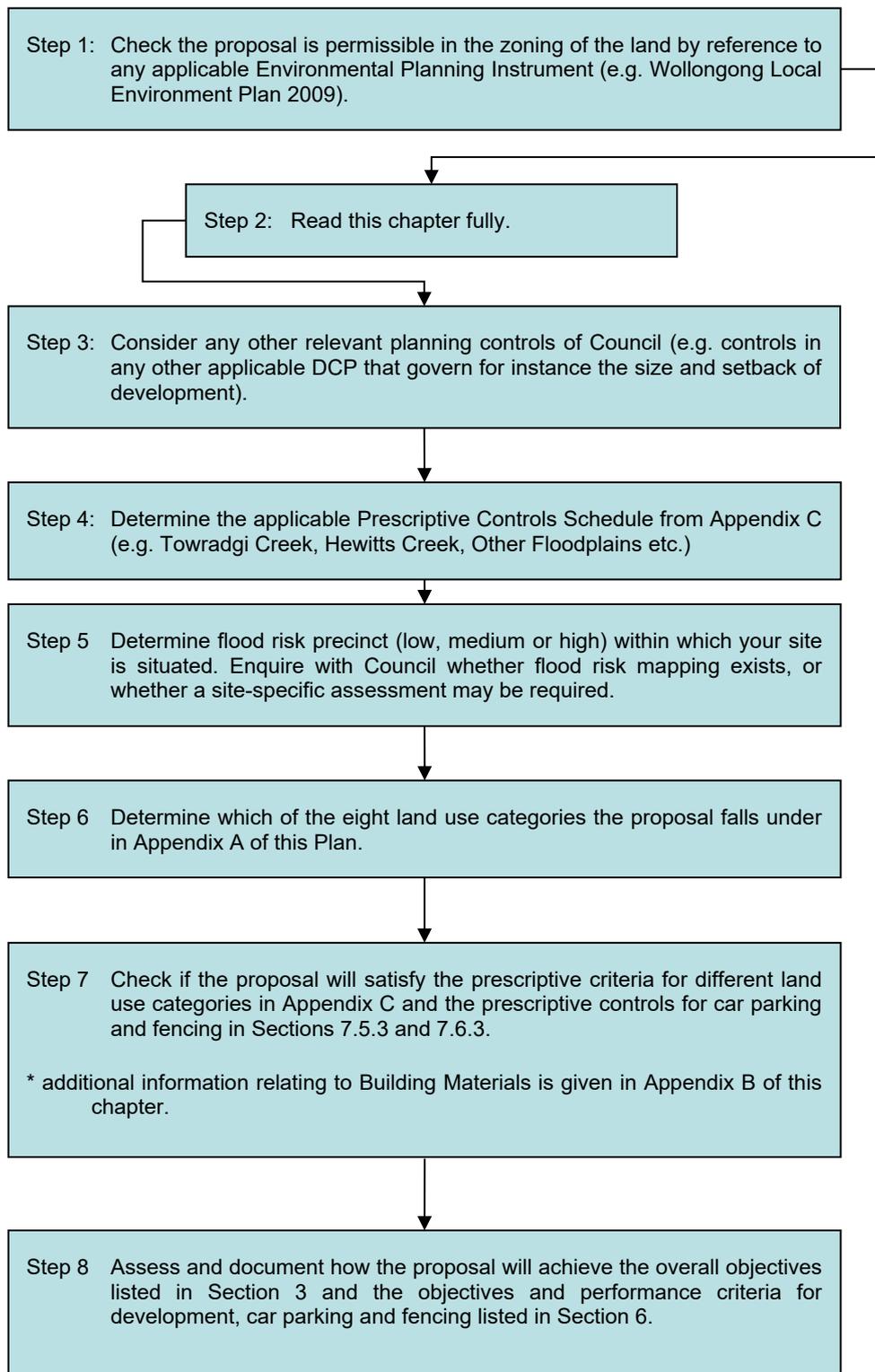
Hence, it is necessary to investigate a range of flood sizes before defining flood storage areas.

<b>Floodplain</b>	Synonymous with <b><i>flood liable</i></b> and <b><i>flood prone land</i></b> is the area of land that is subject to inundation by the probable maximum flood (PMF).
<b>Floodplain Development Manual (FDM)</b>	Floodplain Development Manual (2005) or the latest version.
<b>Floodplain Risk Management Plan (FRMP)</b>	A plan prepared for one or more floodplains in accordance with the requirements of the FDM.
<b>Floodplain Risk Management Study (FRMS)</b>	A study prepared for one or more floodplains in accordance with the requirements of the FDM.
<b>Freeboard</b>	<p>The height above the design flood used, in consideration of local and design factors, to provide reasonable certainty that the risk exposure selected in deciding on a particular design flood is actually provided. It is a factor of safety typically used in relation to the setting of flood levels, levee crest levels and so on. Freeboard compensates for a range of factors including wave action, localised hydraulic behaviour and levee settlement, all of which increase water levels or reduce the level of protection provided. Freeboard should not be relied upon to provide protection for flood events larger than the relevant defined flood event of a design flood.</p> <p>Freeboard is included in the design flood planning level and therefore used in the derivation of the flood planning area.</p>
<b>Government Infrastructure Projects</b>	Infrastructure projects undertaken by public authorities.
<b>Habitable Floor Area</b>	<ul style="list-style-type: none"> <li>• In a <b>residential situation</b>: a living or working area, such as a lounge room, dining room, rumpus room, kitchen, bedroom or workroom;</li> <li>• In an <b>industrial or commercial situation</b>: an area used for offices or to store valuable possessions susceptible to flood damage in the event of a flood.</li> </ul>
<b>Hazard</b>	A source of potential harm or a situation with a potential to cause loss. In relation to this plan, the hazard is flooding which has the potential to cause harm or loss to the community.
<b>Overland Flow</b>	Runoff from rainfall that flows over the land before entering a watercourse, creek, river, lake or dam. Overland flow can flow down roads, driveways and through homes and buildings. It is typically shallow and fast flowing.
<b>Merit Approach</b>	An approach, the principles of which are embodied in the Floodplain Development Manual that weighs social, economic, ecological and cultural impacts of land use options for different flood prone areas together with flood damage, hazard and behaviour implications, and environmental protection and wellbeing of the State's rivers and floodplains.

<b>Outbuilding</b>	A building which is ancillary to a principal residential building and includes sheds, garages, car ports and similar buildings.
<b>Practical</b>	That which in the opinion of Council can be achieved within the design of the development, while not necessitating: <ul style="list-style-type: none"> <li>(a) floor levels to be raised in a way that would unreasonably hinder access to and from existing floor levels or ground levels on the same site or adjacent public areas; and</li> <li>(b) the raising of a structure to a height that would result in unacceptable impacts on the amenity of adjacent residential properties; and</li> <li>(c) the height or presentation of a building that would be inconsistent with the existing or planned streetscape.</li> </ul>
<b>Probable maximum flood (PMF)</b>	The largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation.
<b>Probable maximum precipitation (PMP)</b>	The greatest depth of precipitation for a given duration meteorologically possible over a given size storm area at a particular location at a particular time of the year, with no allowance made for long-term climatic trends (World Meteorological Organisation, 1986). It is the primary input to the estimation of the probable maximum flood.
<b>Probability</b>	A statistical measure of the expected chance of flooding (see ARI).
<b>Reliable access</b>	during a flood means the ability for people to safely evacuate an area subject to imminent flooding within effective warning time, having regard to the depth and velocity of flood waters, the suitability of the evacuation route, and without a need to travel through areas where water depths increase.
<b>Risk</b>	The chance of something happening that will have an impact. It is measured in terms of consequences and probability (likelihood). In the context of this chapter, it is the likelihood of consequences arising from the interaction of floods, communities and the environment.
<b>Survey plan</b>	is a plan prepared by a registered surveyor which shows the information required for the assessment of an application in accordance with the provisions of this Policy.
<b>Suitably Qualified Civil Engineer</b>	A civil engineer who is included in the National Professional Engineers Register, administered by the Institution of Engineers Australia or is eligible for membership of Engineers Australia.

## 4 KEY STEPS IN THE PROCESS

1. Please read this document carefully and seek assistance from Council officers as required.
2. Figure 2 is a summary of the major steps in the Development Application process for any development within a floodplain.
3. If the proposal does not comply with the prescriptive controls, determine whether the performance criteria and objectives are nonetheless achieved.
4. The assistance of Council staff or an experienced floodplain consultant may be required at various steps in the process to ensure that the requirements of this Plan are fully and satisfactorily addressed.



**Figure 2: Summary of the major steps in the Development Application process for any development within a floodplain**

## 5 FLOOD STUDIES

- a) Flood studies must be prepared by a suitably qualified engineer. The flood study must be prepared in accordance with the relevant sections of this Chapter. The 20% AEP, 1% AEP and PMF flood events must be modelled to assess the flooding impact of a proposed development to property, infrastructure and the environment.
- b) An investigation of the effects on the proposed development of upstream diversions caused by blockages and inappropriate development needs to be undertaken as part of the overall flood study.

Council will request a flood study to determine the effects of a proposed development on flooding and the effect of flooding on a proposed development. Flood studies will be required for any type of development where the development occurs in the floodplain or in areas where overland flow is suspected. Section 5.1 details the requirements for hydraulic design; Section 5.2 details requirements for conduit blockage.

Flood studies shall be prepared using a fully dynamic 1- or 2- dimensional computer model unless it can be demonstrated such modelling is not required. The model chosen shall be calibrated against a recorded storm event or Councils adopted flood study of management study if available. All input parameters and assumptions made must be clearly described and justified. A hard copy of the report, including all results, results summary table, and all the relevant information must be submitted with the application.

### 5.1 Hydraulic Design and Analysis

- a) An appropriate computer model must be used for hydraulic design and analysis.
- b) The data required for the hydraulic modelling including channel cross sections, hydraulic properties (e.g. roughness), survey and digital elevation models shall be obtained by the developer. This data shall be documented clearly and reflect both the existing and proposed hydraulic characteristics of the creek channel and floodplain. The developer must document any assumptions made.
- c) A sufficient number of cross-sections selected at appropriate locations both within the site and extending sufficiently upstream and downstream of the site shall be analysed in order to reflect flood behaviour. This would normally require that the model extend to a boundary condition at the hydraulic control downstream of the site. Alternatively, where a 2-dimensional hydraulic model is used, a suitable grid size shall be adopted to accurately determine flood behaviour and flood impacts for the development at a development specific level
- d) If modifications are required to the creek channel or floodplain or if the proposal involves activities within 40 m of the top of the creek bank. A controlled Activity Approval under the Water Management Act 2000 may be required.
- e) Council is transitioning to ARR2019 through the completion of Floodplain Risk Management Studies and Plans. During this transition, flow estimates are to use ARR1987 IFDs and hydrologic procedures. The hydrologic techniques used in adopted Council Flood Studies and Floodplain Risk Management Studies will be used for and development-related flood study.

## 5.2 Conduit Blockage

Blockage of bridges, culverts and other stormwater conduits is a key consideration for Wollongong City Council.

a) Applicability of this section:

- i) Blockage applies to all watercourses including creeks, floodways and other trunk drainage systems within the City of Wollongong with the exception of the minor system as defined in Chapter E14 of this DCP. It does not apply to pit blockage. Pit blockage considerations are set out in Section 6.2 of Chapter E14. It does not apply to pipes where the only upstream entry points are from kerb/gutter stormwater inlets (e.g. the minor system).

b) Conduit Blockage Factors

- i) The blockage factors in Table 1 are to be applied to structures across all watercourses and overland flow paths for all flood-modelling purposes.

These applications include:

- Estimation of design flood levels, velocities, and depths for flood studies;
- Determining flood hazard and hydraulic categories, including the delineation of Flood Risk Precincts, Floodways and Flood Storage Areas;
- Infrastructure design;
- Structural design of proposed development;
- Impact assessment of proposed development;
- Assessing the benefit of proposed flood mitigation works;
- Estimating flood damages;
- Assessment of risk to life and evacuation considerations; and
- Setting Flood Planning Levels (FPLs), such as floor levels for new development.

c) Peak Flood Envelopes

- i) Flooding and impacts are to be assessed using the following two scenarios :
- No Blockage; and
  - Blockage factors.
- i) Scenarios requiring various combinations of blockage (e.g. no blockage at some culverts, partial blockage at others) are generally not required.

d) Overtopping and Cross-Catchment Flow Diversion Investigation

- i) Where flows exceed the capacity of the structure (applying the relevant blockage factor), flood modelling or other calculations should be undertaken to identify the overtopping flow behaviour. The modelling or calculations must be sufficient to identify where flows will return into the watercourse downstream of the structure, and whether flow will be diverted along other flow paths.
- ii) Modelling or other calculations must be sufficient to identify whether cross catchment flows from other watercourses need to be considered at the site of interest.

## e) Design of New Structures

- i) The structure is to be designed using the relevant blockage factor at every stage in the calculations;
- ii) Impacts of the structure on existing flood behaviour (levels, velocity and hazard) are to be quantified for a range of flood events, including larger and smaller events than the design AEP;
- iii) Impacts are to be mitigated in accordance with the guidance specified in Chapter E13: Floodplain Management of this DCP; and
- iv) All aspects of the proposed design with the potential to affect flow behaviour, including ancillary structures such as headwalls, handrails, safety barriers, noise walls, etc., are to be appropriately considered in the flood calculations.

## f) Design of detention basins

- i) Basins volumes, weirs and low flow outlets to be sized assuming no blockage;
- ii) Basin spillway sized assuming relevant blockage factors of the outlet;
- iii) Outlets to have debris management structure where blockage affects performance and where there is an identified source of debris upstream.

## g) Blockage Factors

- i) Culvert and bridge classifications are defined as follows:
  - **Class 1.** Pipes 1.2 m internal diameter or smaller. Box culverts or bridges with a diagonal opening less than 1.5 m, and a width or height less than 0.9 m.
  - **Class 2.** Pipes greater than 1.2 m internal diameter. Box culverts or bridges with a diagonal opening of more than or equal to 1.5 m, less than 3 m and minimum dimension of 0.9 m for both width and height.
  - **Class 3.** Box culverts or bridges with a diagonal opening of more than or equal to 3 m, less than 6 m, and a minimum dimension of 1.2 m for both width and height.
  - **Class 4.** Box culverts or bridges with a diagonal opening greater than or equal to 6 m, and a minimum dimension of 2.5 m for both width and height.
- ii) For bridges, the dimension refer to the waterway opening between piers, not the total bridge dimensions. When determining the clearance of bridges above a natural channel, a reasonable level representing the long term channel bottom level should be used, using an averaged profile slope. For instance, it is not appropriate to propose localised excavation of the normal channel bed to increase the clearance above 3 m and satisfy the Class 4 requirements.
- iii) The blockage factors are to be applied as a reduction in the effective flow area of the unblocked waterway of the structure. The blockage is to be a consistent effective reduction of the total flow area across the entire cross-section (that is, not bottom-up, top-down, or other selective partial blockage of the waterway area). This will typically involve a consistent reduction of the cross-section width (1D hydraulic models) or computational cell width (2D or 3D hydraulic models) representing the structure. For software packages which

implement a blockage factor as a parameter for bridges or culverts, this parameter should be used.

- iv) The blockage factors are to be applied to all bridges, culverts and other conduits in the catchment that have the potential to influence the flow behaviour at the point of interest.
- v) The blockage factors are to be applied for all locations within the Wollongong LGA, regardless of current land use or other considerations such as creek slope.
- vi) Fences, rails and barriers which are within the overtopping flow path of a structure are to be modelled with appropriate energy losses (i.e. using the parameter K which represents the energy losses as a factor of dynamic head ( $V^2/2g$ ), to reflect the influence of the rails on upstream flow. Energy losses resulting from the drag and turbulence induced by the form of the embankment between the culvert soffit (top) and the overtopping crest level are to be included where appropriate.

**Table 1 Blockage Factors**

Design AEP	Bridge/Culvert Classification				Debris Blockage of Overtopping Flows
	Class 1	Class 2	Class 3	Class 4	
20% AEP	60%	50%	35%	5%	Must appropriately represent obstructions to flow such as bridge decks, fences, handrails, buildings noise barriers etc. Modelling of pervious structures such as fences and railings above the structure should assume a 75% debris blockage of the unblocked flow area through the obstruction, plus associated energy losses.
Rarer than 20% and more frequent than 2% AEP (e.g. 10%, 5% AEP)	75%	65%	50%	10%	
2% AEP or Greater (e.g. 2%, 1% AEP, PMF)	95%	75%	60%	15%	

### 5.3 Modelling of Buildings

Modelling of proposed and existing buildings will be consistent with the method used in the adopted flood study or FRMS. If the site is not within the extent of an adopted flood study or FRMS, buildings must be represented using a method consistent with those recommended in:

*Australian Rainfall and Runoff Revision Project 15: Two-dimensional simulations in urban areas – Representation of buildings in 2D numerical flood models.*

Representing proposed or existing buildings on piers or suspended slabs using Layered Flow Constrictions in TUFLOW is permitted if the opening is modelled as both open and 50% blocked for flood impact assessment. A restriction will be placed on the title to ensure the opening is maintained.

## 5.4 Ocean Levels

- a) The downstream boundary condition must be modelled using the same conditions used in the relevant flood study or floodplain risk management study and plan. For unstudied catchments, apply the downstream boundary condition used in the nearest studied catchment. E.g. for catchments in the northern suburbs, use the ocean boundary condition from the latest Hewitts Creek Flood Study or Floodplain Risk Management Study.

## 5.5 Modifications to Watercourses

- a) Modifications to natural watercourses are generally not permitted, as they adversely impact on a number of issues including:
  - Hydraulic function
  - Channel pattern and form
  - Long-term channel stability
  - Aesthetic appearance
  - Aquatic and bankside habitat diversity
  - Water quality
- b) Any proposals involving modifications to watercourses will require the submission of a detailed hydraulic assessment as well as a thorough environmental impact assessment of the prepared watercourse modification. Modifications to watercourses will only be considered where no other alternative exists, such as when scour within the watercourse threatens the stability of a dwelling or other high value asset. The reduction of development potential is not be considered justification for waterway modification.

Note: lodgement of an Integrated Development Application will be required for any involving modified to a watercourse since the concurrence of the NSW Department Water and Energy will be required pursuant to the requirements of the Water management Act 2000.

- i) Buildings including decks will not be permitted over watercourses.

## 5.6 Overland Flow

Overland flow is runoff from rainfall which flows over the land before entering a watercourse, creek, river or lake or dam. Overland flow is typically shallow and fast flowing. Where a watercourse has been filled or piped, flooding resulting from overflows from the filled/piped watercourse is considered mainstream flooding and not overland flow.

The flood planning level for overland flow is the 1% AEP plus 0.3m. In an overland flow path, where the difference between the PMF and 1% flood level is greater than 0.3m, freeboard of 0.5m to the 1% flood applies. All other development controls of this chapter and E14 – Stormwater management also apply to overland flow.

In locations where there is uncertainty whether flooding is mainstream or overland flow, Council will decide.

## 6 WHAT ARE THE KEY CRITERIA FOR DETERMINING APPLICATIONS?

### 6.1 General

1. The criteria for determining applications for proposals potentially affected by flooding are structured in recognition that different controls are applicable to different land uses and levels of potential flood inundation and hazard.
2. The procedure to determine what controls apply to proposed development are:
  - a) Identify the land use category of the development (Appendix: A);
  - b) Determine which floodplain and which part of that floodplain the land is located within (Section 6.3) and relevant flood risk mapping; and
  - c) Applying the controls outlined under Clause 6.4.
3. Sections 6.4, 6.5 and 6.6 provide objectives, performance criteria and prescriptive controls for development, car parking and fencing within the floodplain and flood planning area.
  - **The objectives** represent the outcomes that the Council wishes to achieve from each control.
  - **The performance criteria** represent a means of assessing whether the desired outcomes will be achieved.
  - **The prescriptive controls** are preferred ways of achieving the outcome. While adherence to the prescriptive controls may be important, it is paramount that the objectives and the performance criteria are clearly satisfied.

### 6.2 Land Use Categories

1. Eight major land use categories are defined for floodplain management. The specific uses, as defined by the applicable Environmental Planning Instruments, and other specially defined uses, have been grouped within each of these 8 categories.

### 6.3 Flood Risk Precincts

1. Each of the floodplains within the Wollongong LGA area can be classified based on different levels of potential flood risk. This classification of floodplains into flood risk precincts (FRPs) is achieved by considering the probabilities and consequences of all floods that could potentially occur. The full range of flood events are considered including frequent flooding (e.g. 20% AEP), rare flooding (e.g. the 1% AEP) and extreme flooding (E.g. the PMF).
2. The mapping of FRPs has been undertaken for some floodplains in the Wollongong LGA and some catchments are being reviewed. Studied catchments can be viewed at <https://www.wollongong.nsw.gov.au/development/maps> within the planning and environment map. Note – flood information is within the Constraints and Planning DCPs layer and viewable at a scale of 1:15000.
3. Council has adopted a three tier FRP classification as follows:

- a) **High Flood Risk Precinct** - The High FRP is where high flood damages, potential risk to life and/or evacuation problems would be anticipated or where development would significantly or adversely alter flood behaviour. This area includes floodways. In this precinct, there would be a significant likelihood of flood damages and/or danger to life. The High FRP includes:
    - i) Areas greater than H3 hazard conditions during a 1% AEP flood from Figure 3;
    - ii) Land within 10m from the top of a watercourse bank; and
    - iii) Floodways.
  - b) **Medium Flood Risk Precinct** - In this precinct there would be a significant likelihood of flood damage and/or danger to life, but these damages or danger to life can be minimised by the application of appropriate development controls. The Medium FRP includes:
    - i) Includes land below the 1% AEP level plus 0.5 m that is not within the High FRP area inundated in a 1% AEP plus freeboard and not classified as High FRP.
  - c) **Low Flood Risk Precinct** - This precinct is where the likelihood of damages is low for most land uses. The Low FRP.
    - i) All areas within the floodplain (i.e. within the extent of the PMF) but not identified within either the High FRP or the Medium FRP; and
    - ii) All areas within the 2100 Coastal Zone Inundation Extent not classified Medium Flood Risk or High Flood Risk Precinct.
3. Where the FRP mapping has not been undertaken as part of the FRMS process it may be required as part of a flood study prepared for an individual development application. Such FRP mapping is to be undertaken by a suitably qualified engineer.
  4. The NSW FDM (2005) is currently being reviewed (October 2019). The Australian Institute for Disaster Resilience (ADR, 2017) recommends the use of Flood Planning Constraint Categories (FPCCs) as an alternative to Flood Risk Precincts. Should the future versions of the NSW FDM also recommend the use of FPCC, Council may review how it considers flood risk in land use planning.

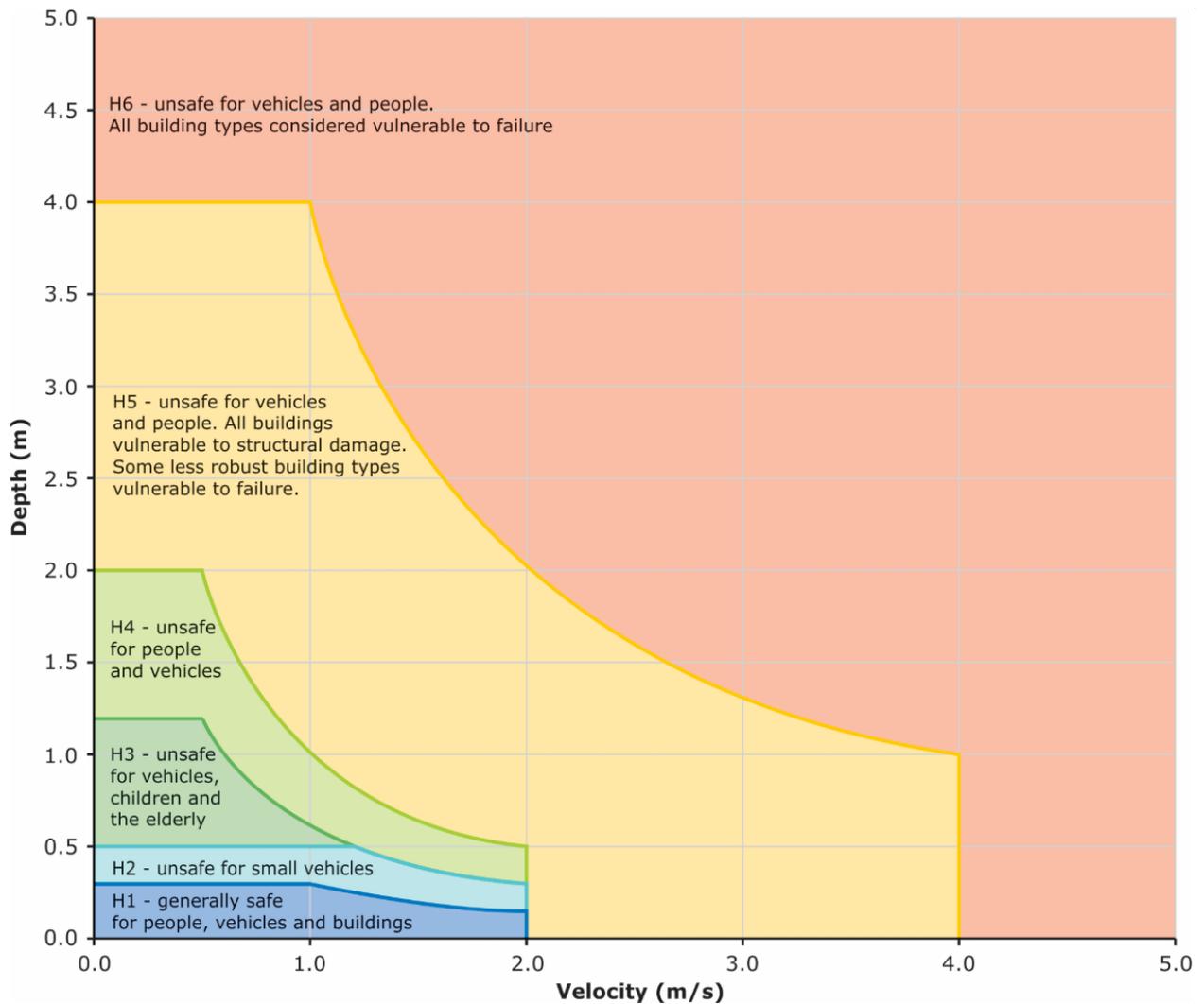


Figure 3: Combined Flood Hazard Curves (Smith et al., 2014)

## 6.4 Which controls apply to proposed developments?

1. The development controls apply to all land within a Flood Risk Precinct. The controls are graded relative to the severity and frequency of potential floods.
2. If no such study or plan exists, a site specific flood study may be required in accordance with Chapters E13 and E14 of this DCP.
3. The categories applicable to each floodplain are depicted on the planning matrices contained in the following schedules at Appendix C:

**Note:** Council is to insert controls for other floodplains as FRMPs are prepared and become adopted. Numbering of schedules takes into account studies yet to be completed. Schedule numbers shown relate to those which have been adopted by Council and included in Appendix C.

- Schedule 1 –Towradgi Creek Floodplain;
- Schedule 2 – Hewitts/Slacky/Woodlands/Tramway/ Thomas Gibson Creeks Floodplain;

- Schedule 3 – Minnegang Creek Floodplain;
- Schedule 4 – Allans Creek Floodplain;
- Schedule 5 – Fairy and Cabbage Tree Creeks Floodplain;
- Schedule 6 – Mullet/Brooks Creeks Floodplain;
- Schedule 7 – Wollongong City Floodplain;
- Schedule 8 - Whartons, Collins, Farrahars Creeks, Bellambi Gully and Bellambi Lake Floodplains ;
- Schedule 9 – Lake Illawarra Floodplain;
- Schedule 9a – Lake Illawarra - Windang Peninsula; and
- Schedule 10 – All other floodplains.

#### 6.4.1 Objectives

- a) To ensure the proponents of development and the community in general are fully aware of the potential flood hazard and consequent risk associated with the use and development of land within the floodplain;
- b) To require developments with high sensitivity to flood risk (e.g. critical public utilities) be sited and designed such that they are subject to no or minimal risk from flooding and have reliable access;
- c) Allow development with a lower sensitivity to the flood hazard to be located within the floodplain, subject to appropriate design and siting controls, provided that the potential consequences that could still arise from flooding remain acceptable having regard to the State Government's Flood Policy and the likely expectations of the community in general;
- d) To prevent any intensification of the use of High Flood Risk Precinct or floodways, and wherever appropriate and possible, allow for their conversion to natural waterway corridors;
- e) To ensure that design and siting controls required to address the flood hazard do not result in unreasonable impacts upon the amenity or ecology of an area; and
- f) To minimise the risk to life during flooding.

#### 6.4.2 Performance Criteria

- a) The proposed development should not result in any increased risk to life;
- b) Development should not detrimentally increase the potential flood affectation on other development or properties either individually or in combination with the cumulative impact of development that is likely to occur in the same floodplain;
- c) Development should not result in impacts upon the amenity of an area by way of unacceptable overshadowing of adjoining properties, privacy impacts (e.g. by unsympathetic house-raising) or by being incompatible with the streetscape or character of the locality;
- d) The proposal must not have an adverse impact upon the ecological value of the waterway corridors, and where possible, should provide for their enhancement. Proposed development must be consistent with ESD principles; and

- e) The geomorphic stability of a waterway corridor does not impose additional risk to human life or property.

### 6.4.3 Prescriptive Controls

- a) Appendix C (Schedules 1 – 10) outlines the prescriptive controls that apply to each of the floodplains to which this Plan applies;
- b) Table 2 provides permissible impacts for various development types for flood events up to the 1% AEP flood;
- c) Flood impacts in the PMF will be assessed on merit and will consider:
  - i) Impacts to evacuation routes and onsite refuge service levels;
  - ii) Additional flood affected allotments;
  - iii) Flood warning times; and
  - iv) Changes to above yard and above floor flooding.

**Table 2. Permissible Flood Impacts**

Development/ Project Type	Allowable Impact (mm)					
	Critical Uses and Facilities	Sensitive Uses and Facilities	Residential	Commercial or Industrial	Tourist Related Development	Recreation or Non-urban Uses
Individual Property	10	10	20	20	20	20
Multi Lot Subdivision	10	10	20	50	50	50
Government Infrastructure Projects	20	20	100	150	150	150

New development must not increase the frequency of over floor flooding for residential, commercial or industrial buildings in a 20%, 1% or PMF event. Additionally, new development must not cause additional lots to be impacted by the 1% or PMF event.

## 6.5 Car Parking – Flood Related Requirements

### 6.5.1 Objectives

- a) To minimise the damage to motor vehicles from flooding;
- b) To ensure that motor vehicles do not become moving debris during floods;
- c) To minimize damage to garages and their contents from flooding; and
- d) To minimise the risk to human life resulting from the inundation of car parking, or driveway areas.

### 6.5.2 Performance Criteria

- a) The proposed car parking should not result in any increased risk to vehicle damage;
- b) The proposed garage should not detrimentally increase the potential flood affectation on other development;
- c) The parking should be designed considering the hazard curves in Figure 3;
- d) The proposed parking or driveway area must not increase the risk to life from flooding; and
- e) The parking should be designed to ensure that vehicles will not be transported by floodwaters.

### 6.5.3 Prescriptive Standards

- a) Open car parking – open car parking subject to inundation should be designed giving regard to vehicle stability in terms of depths and velocity during inundation by floodwaters, ensuring that each car parking space is within hydraulic hazard category H1 in Figure 3 during a 1 % AEP flood.
- b) Garage addition or open car parking to an existing house – the minimum floor level should be as high as practical but shall be no lower than 300mm above adjacent finished ground levels. Refer to Schedule 1 for the maximum floor areas within the various FRPs.
- c) Garage as part of new development and redevelopment;
  - i) Not permitted within a floodway;
- d) Basement car parks – are to be protected from inundation during a 1 % AEP flood, ensuring all vehicular access, doors and ventilation points are a minimum of 0.2 metres above the 1 % AEP flood level.

## 6.6 Fencing – Flood Related Requirements

### 6.6.1 Objectives

- a) To ensure that fencing does not result in the undesirable obstruction of the free flow of floodwaters;
- b) To ensure that fencing does not become unsafe during floods and potentially become moving debris which threatens the integrity of structures or the safety of people; and
- c) To ensure that fencing does not obstruct connectivity and the movement of fauna along riparian corridors.

### 6.6.2 Performance Criteria

- a) Fencing is to be constructed in a manner which does not affect the flow of floods so as to detrimentally increase flood affectation on surrounding land;
- b) Ability to be certified by a suitably qualified engineer, that the proposed fencing is adequately constructed so as to withstand the forces of floodwaters, or collapse in a controlled manner to prevent impediment to flood waters; and
- c) Where fencing is required across riparian corridors, the fencing is to be of the type that will not harm or obstruct the movement of native fauna.

### 6.6.3 Prescriptive Standards

- a) Fencing within a floodway or High FRP will not be permissible except for security/ permeable/ open type/safety fences of a type approved by Council.
- b) Council requires a Development Application for all new solid (non-porous) and continuous fences above 0.6m high, in the High and Medium FRP's.
- c) An applicant must demonstrate that the fence would not impede flow or flood water. Appropriate fences must satisfy the following:
  - i) An open collapsible hinged fence structure of pool fence type;
  - ii) Brick or other masonry type fence (which will generally not be permitted) or:
  - iii) A fence type and citing criteria prescribed by Council.

Council will consider other forms of fencing subject to compliance with the performance criteria.

## 7 FILLING OF THE FLOODPLAIN

1. Filling in flood prone areas is not permitted unless:
  - A FRMP for the catchment has been adopted which allows filling to occur; or
  - a report from a suitably qualified engineer is submitted to Council that satisfies the requirements of items 2 and 3 below and certifies that the development, in combination with similar filling of developable sites in the area, will not increase flood affectation elsewhere.
2. Filling of individual sites in isolation without consideration of the cumulative effects is not permitted. A case by case decision making approach cannot take into account the cumulative impact on flooding behaviour and associated risks caused by individual developments. Any proposal to fill a site must be accompanied by an analysis of the effect on flood levels of similar filling of developable sites in the area.
3. This analysis would form part of a flood study prepared in accordance with Chapters E13 and E14 of this DCP.
4. Generally, there is to be no net increase in fill in the floodplain. Compensatory excavation may be used to offset fill, however the compensatory excavation must be taken from an adjacent area of similar flood function that is lower in the floodplain (i.e. at a lower AEP inundation extent) than the proposed fill areas. Cut and fill drawings and volume calculations must be supplied to Council.
5. Filling above the 1% event may be permitted if can be demonstrated there are no adverse impacts in rare events (e.g. 0.2%, 0.5%, PMF).

## 8 OTHER CONSIDERATIONS

1. When assessing proposals for development or other activity within the area to which this Policy applies, Council will take into consideration the following specific matters.
  - a) The proposal does not have a significant direct or cumulative detrimental impact on:
    - i) Water quality;

- ii) Native bushland vegetation;
  - iii) Riparian vegetation;
  - iv) Estuaries, wetlands, lakes or other water bodies;
  - v) Aquatic and terrestrial ecosystems;
  - vi) Indigenous flora and fauna; and
  - vii) Fluvial geomorphology.
- b) Development pursued to mitigate the potential impact of flooding (e.g. house raising) must be undertaken in a manner which minimises the impact upon the amenity and character of the locality.
  - c) The proposal must not constrain the orderly and efficient utilisation of the waterways for multiple purposes.
  - d) Proposals for house raising must provide appropriate documentation including a report from a suitably qualified engineer to demonstrate the raised structure will not be at risk of failure from the forces of floodwaters and the provision of details such as landscaping and architectural enhancements which ensure that the resultant structure will not result in significant adverse impacts upon the amenity and character of an area.
  - e) Requirements for Concessional Development as listed in Appendix A.

## **9 WHAT INFORMATION IS REQUIRED WITH AN APPLICATION TO ADDRESS THIS CHAPTER?**

1. Applications must include information which addresses all relevant controls listed above, and the following matters as applicable.
2. Applications for Concessional Development (see Appendix A) to an existing dwelling on Flood Prone Land shall be accompanied by documentation from a registered surveyor confirming existing floor levels to AHD.
3. Development Applications affected by this plan shall be accompanied by a survey plan showing:
  - a) The position of the existing building/s or proposed building/s
  - b) The existing ground levels to Australian Height Datum around the perimeter of the building and contours of the site; and
  - c) The existing or proposed floor levels to Australian Height Datum.
4. Applications for earthworks, filling of land and subdivision shall be accompanied by a survey plan (with a contour interval of 0.25m) showing levels in AHD and design plan showing design surface levels (also in AHD with 0.25m contour intervals).
5. For large scale developments, or developments in critical situations, particularly where an existing catchment based flood study is not available, a flood study using a fully dynamic one or two dimensional computer model is required. For smaller developments consideration may be given to the use of the existing flood study if available and suitable (e.g. it contains sufficient local detail), or otherwise a flood study prepared in a manner consistent with the Australian Rainfall and Runoff

1987 publication, Chapters E13 and E14 of this DCP and the Floodplain Development Manual (FDM), will be required. From this study, the following information shall be submitted in plan form for the pre-developed and post-developed scenarios:

- a) Catchment plan;
  - b) Hydrologic calculations/analysis including model input and results files;
  - c) 2D model domain, grid size, boundary conditions, roughness layers;
  - d) Hydraulic structures and blockage factors applied
  - e) Survey data
  - f) Results (including depths, levels, FRP, hydraulic categories, velocity and hazard)
  - g) Impact maps
  - h) Water surface contours;
  - i) Velocity vectors;
  - j) Velocity and depth product contours;
  - k) Delineation of flood risk precincts relevant to individual floodplains; and
  - l) Flood profiles for the full range of events for total development including all structures and works (such as revegetation /enhancements).
6. Where the controls for a particular development proposal require an assessment of structural soundness during potential floods, the following impacts must be addressed:
- a) Hydrostatic pressure;
  - b) Hydrodynamic pressure;
  - c) Impact of debris; and
  - d) Buoyancy forces.
7. Foundations need to be included in the structural analysis.

## Appendix: A LAND USE CATEGORIES – WLEP(2009)

Essential Community Facilities	Critical Utilities	Subdivision	Residential
Emergency services facilities; public administration building that may provide an important contribution to the notification or evacuation of the community during flood events (e.g. SES Headquarters and Police Stations); Hospitals.	Community facility; telecommunications facility; institutions; educational establishments; child care centre; liquid fuel depot; public utility undertaking (including electricity generating works; sewerage treatment plant; sewerage system; telecommunications facility; utility installations and water treatment facility) which are essential to evacuation during periods of flood or if affected would unreasonably affect the ability of the community to return to normal activities after flood events; residential care facility; group home; school and seniors housing.	Earthworks; excavation; subdivision of land which involves the creation of new allotments with potential for further development.	Affordable housing; attached dwelling; backpackers' accommodation; caravan park (with permanent occupants i.e. other than short term sites)(1); dual occupancy; dwelling; dwelling house; exhibition home; farm stay accommodation; home business; home industry; home occupancy; home occupation (sex services); hostel; hotel or motel accommodation; moveable dwelling; multi dwelling housing; neighbourhood shop; permanent group home; residential accommodation; residential flat building; rural worker's dwelling; secondary dwelling; semi-detached dwelling; serviced apartments; tourist and visitor accommodation and transitional group home.

- (1) As defined by the Local Government (Manufactured Home Estates, Caravan Parks, Camping Grounds and Moveable Dwellings) Regulation 2005

Note: Where the Environmental Planning Instrument (EPI) land use definition is not used, the bracketed text refers to the EPI land use definition.

## Appendix: A LAND USE CATEGORIES (cont.)

Commercial or Industrial	Tourist Related Development	Recreation or Non-urban Uses	Concessional Development
<p>Agricultural produce industry; air transport facility; airport; amusement centre; brothel; bulky goods premises; business premises; car park; cellar door premises; community facility (other than critical and sensitive uses and facilities); correctional centre; crematorium; depot; entertainment facility; exhibition village; feed lot, food and drink premises; freight transport facility; function centre; funeral chapel; funeral home; hazardous industry; hazardous storage establishment; health care professional; health consulting rooms; health services facility; heavy industry; heliport; highway service centre; industrial retail outlet; industry; light industry; liquid fuel depot; livestock processing industry; market; medical centre; mixed use development; mortuary; offensive industry; offensive storage establishment; office premises; passenger transport facility; place of public worship; pub; public administration building (other than critical uses and facilities); recreation facility (major); registered club; restaurant; restricted dairy; restricted premises; retail premises; rural industry; rural supplies; sawmill or log processing works; self-storage units; service station; sex services premises; shop; shop top housing; storage premises; take away food or drink premises; timber and building supplies; transport depot; truck depot; vehicle body repair workshop; vehicle repair station; vehicle sales or hire premises; veterinary hospital; warehouse or distribution centre; waste disposal facility; waste management facility; waste or resource management facility; waste or resource transfer stations; and wholesale supplies.</p>	<p>Camp site and caravan site – short term sites (1) only.</p>	<p>Agriculture; airstrip; animal boarding or training establishment; aquaculture; biosolid waste application; biosolids treatment facility; boat launching ramp; boat repair facility; boat shed; caravan park (with non-permanent occupants); charter and tourism boating facility; dairy (pasture based), environmental facility; environmental protection works; extensive agriculture; extractive industry; farm building; horticulture; helipad: information and education facility; intensive livestock agriculture; intensive plant agriculture; kiosk; jetty; landscape and garden supplies; marina; mine; mining; natural water-based aquaculture; port facilities; pond-based aquaculture; public utility undertaking (other than critical uses or facilities); recreation area; recreation facility (indoor); recreational facility (outdoor); research station; resource recovery facility; restriction facilities; roadside stall; stock and sale yard; tank-based aquaculture; turf farming; utility installations (other than critical uses and facilities); viticulture; water recreation structure; water recycling facility; and water storage facility.</p>	<p>(a) Redevelopment for the purposes of substantially reducing the flood risk to the existing building and its occupants;</p> <p>(b) Redevelopment within the existing footprint of approved structures. Existing elevated footings or crawl space must be maintained to allow floodwaters to flow beneath the structure.</p> <p>(c) Council may consider the construction of a single dwelling up to 250m<sup>2</sup> (external) within the high flood risk precinct on vacant land. Vacant land refers to residential allotments which was zoned residential and vacant prior to 2009.</p> <p>(d) In relation to an existing dwelling:</p> <ul style="list-style-type: none"> <li>(i) additions or alterations to the dwelling; and/or</li> <li>(ii) garages or outbuildings; and/or</li> <li>(iii) decks;</li> </ul> <p>provided that the total of:</p> <ul style="list-style-type: none"> <li>• the gross floor area from (i); and</li> <li>• the area of garages from (ii); and</li> <li>• the area of decks from (iii),</li> </ul> <p>approved since 7 February 2005, does not exceed:</p> <ul style="list-style-type: none"> <li>• 40m<sup>2</sup> in the Medium Flood Risk Precinct; or</li> </ul>

			<ul style="list-style-type: none"> <li>• 20m<sup>2</sup> in the High Flood Risk Precinct.</li> </ul> <p>(Note that for the purposes of this clause, the area of garages and the area of decks referred to above means the plan area measured to the external edge of the structure).</p>
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- (1) As defined by the Local Government (Caravan Park and Camping Grounds) Transitional Regulation 1993.

Note: Where the Environmental Planning Instrument (EPI) land use definition is not used, the bracketed text refers to the EPI land use definition.

## APPENDIX: A LAND USE CATEGORIES - TEMPORARY EVENTS

Temporary public events include markets, circuses music festivals, outdoor cinema's etc. When such events include temporary structures, public congregation areas or car parking areas within the 1% AEP flood extent, an event specific flood risk assessment and management plan is required. The risk assessment and management plan must be prepared by a suitably qualified engineer with relevant experience in floodplain management.

The risk assessment must include the depth, velocity and timing of inundation in a 20% and 1% event. The management plan must demonstrate how the flood risk will be managed.

In areas of flash flooding, which includes the majority of the Wollongong LGA (except Lake Illawarra floodplain), it is often not possible to provide an appropriate flood response during an event due to the fast rate of rise of floodwaters and limited response time. Therefore, the only way to mitigate the flood risk in flash flood areas is to include provisions in the event management plan that require monitoring of weather forecasts in the days leading up to the event, and a requirement that the event be cancelled if there is a risk of flooding and/or a forecast for heavy or prolonged rainfall.

## Appendix: B FLOOD COMPATIBLE MATERIALS

BUILDING COMPONENT	FLOOD COMPATIBLE MATERIAL
<b>Flooring and Sub-floor Structure</b>	<ul style="list-style-type: none"> <li>Concrete slab-on-ground monolith construction.</li> <li>Suspended reinforced concrete slab.</li> </ul>
<b>Floor Covering</b>	<ul style="list-style-type: none"> <li>Clay tiles.</li> <li>Concrete, precast or in situ.</li> <li>Concrete tiles.</li> <li>Epoxy, formed-in-place.</li> <li>Mastic flooring, formed-in-place.</li> <li>Rubber sheets or tiles with chemical-set adhesives.</li> <li>Silicone floors formed-in-place.</li> <li>Vinyl sheets or tiles with chemical-set adhesive.</li> <li>Ceramic tiles, fixed with mortar or chemical-set adhesive.</li> <li>Asphalt tiles, fixed with water resistant adhesive.</li> </ul>
<b>Wall Structure</b>	<ul style="list-style-type: none"> <li>Solid brickwork, blockwork, reinforced, concrete or mass concrete.</li> </ul>
<b>Roofing Structure</b> (for Situations Where the Relevant Flood Level is Above the Ceiling)	<ul style="list-style-type: none"> <li>Reinforced concrete construction.</li> <li>Galvanised metal construction.</li> </ul>
<b>Doors</b>	<ul style="list-style-type: none"> <li>Solid panel with water proof adhesives.</li> <li>Flush door with marine ply filled with closed cell foam.</li> <li>Painted metal construction.</li> <li>Aluminium or galvanised steel frame.</li> </ul>
<b>Wall and Ceiling Linings</b>	<ul style="list-style-type: none"> <li>Fibro-cement board.</li> <li>Brick, face or glazed.</li> <li>Clay tile glazed in waterproof mortar.</li> <li>Concrete.</li> </ul>

BUILDING COMPONENT	FLOOD COMPATIBLE MATERIAL
	<ul style="list-style-type: none"> <li>• Concrete block.</li> <li>• Steel with waterproof applications.</li> <li>• Stone, natural solid or veneer, waterproof grout.</li> <li>• Glass blocks.</li> <li>• Glass.</li> <li>• Plastic sheeting or wall with waterproof adhesive.</li> </ul>
<b>Insulation</b>	<ul style="list-style-type: none"> <li>• Foam (closed cell types).</li> </ul>
<b>Windows</b>	<ul style="list-style-type: none"> <li>• Aluminium frame with stainless steel rollers or similar corrosion and water resistant material.</li> </ul>
<b>Nails, Bolts, Hinges and Fittings</b>	<ul style="list-style-type: none"> <li>• Brass, nylon or stainless steel.</li> <li>• Removable pin hinges.</li> <li>• Hot dipped galvanised steel wire nails or similar.</li> </ul>
<b>Electrical and Mechanical Equipment</b>	<p>For dwellings constructed on land to which this chapter applies, the electrical and mechanical materials, equipment and installation should conform to the following requirements.</p> <ul style="list-style-type: none"> <li>• Main power supply</li> </ul> <p>Subject to the approval of the relevant authority the incoming main commercial power service equipment, including all metering equipment, shall be located above the relevant flood level. Means shall be available to easily disconnect the dwelling from the main power supply.</p> <ul style="list-style-type: none"> <li>• Wiring</li> </ul> <p>All wiring, power outlets, switches, etc., should, to the maximum extent possible, be located above the relevant flood level. All electrical wiring installed below the relevant flood level should be suitable for continuous submergence in water and should contain no fibrous components. Earth core leakage systems (or safety switches) are to be installed. Only submersible-type splices should be used below the relevant flood level. All conduits located below the relevant designated flood level should be so installed that they will be self-draining if subjected to flooding.</p> <ul style="list-style-type: none"> <li>• Equipment</li> </ul> <p>All equipment installed below or partially below the relevant flood level should be capable of disconnection by a single plug and socket assembly.</p> <ul style="list-style-type: none"> <li>• Reconnection</li> </ul>



BUILDING	FLOOD COMPATIBLE
COMPONENT	MATERIAL
	<ul style="list-style-type: none"><li>• Should any electrical device and/or part of the wiring be flooded it should be thoroughly cleaned or replaced and checked by an approved electrical contractor before reconnection.</li></ul>

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## Appendix: C PRESCRIPTIVE STANDARDS - SPECIFIC FLOODPLAINS

- Schedule 1 –Towradgi Creek Floodplain;
- Schedule 2 – Hewitts/Slacky/Woodlands/Tramway/ Thomas Gibson Creeks Floodplain;
- Schedule 3 – Minnegang Creek Floodplain;
- Schedule 4 – Allans Creek Floodplain;
- Schedule 5 – Fairy and Cabbage Tree Creeks Floodplain;
- Schedule 6 – Mullet/Brooks Creeks Floodplain;
- Schedule 7 – Wollongong City Floodplain;
- Schedule 8 - Whartons, Collins, Farrahars Creeks, Bellambi Gully and Bellambi Lake Floodplains ;
- Schedule 9 – Lake Illawarra Floodplain;
- Schedule 9a – Lake Illawarra - Windang Peninsula; and
- Schedule 10 – All other floodplains.

**SCHEDULE 1: PRESCRIPTIVE CONTROLS – TOWRADGI CREEK FLOODPLAIN**

		Flood Risk Precincts (FRP's)																									
		Low Flood Risk						Medium Flood Risk						High Flood Risk ( & Interim Riverine Corridor)													
Planning Consideration		Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development		
		Floor Level			3										2,7	2 or 5	2	1	2,4 or 6								1
Building Components			2										1	1	1	1	1									1	1
Structural Soundness			3		2		3						2	2	3	2	2									1	1
Flood Affection			2	2		2	2					1	1 or 2	1	1	1	2									1	1
Evacuation			2, 4	5	3, 4	4	3, 4					5	3,4	1,4	3,4	1										1	
Management & Design			4, 5	1								1		2,3 or 5	2,3 or 5	2,3 or 5	2,3 or 5									2,3 or 5	2,3 or 5
	Not Relevant		Unsuitable Land Use																								

**Note:**

- a. Filling of the site, where acceptable to Council, may change the FRP considered to determine the controls applied in the circumstances of individual applications.
- b. Terms in *italics* are defined in the glossary of this plan and Schedule 2 specifies development types included in each land use category. These development types are generally as defined within Environmental Planning Instruments applying to the local government area.
- c. **Freeboard** equals an additional height of 500mm.

## Floor Level

- 1 All Floor Levels to be equal to or greater than the 5% AEP flood level plus freeboard unless justified by site specific assessment.
- 2 *Habitable floor* levels to be equal to or greater than the 1% AEP flood level plus freeboard.
- 3 All Floor Levels to be equal to or greater than the *PMF flood* level plus *freeboard*.
- 4 Floor levels to be as close to the flood planning level as practical & no lower than the existing floor level when undertaking alterations or additions.
- 5 Floor levels of shops to be as close to the flood planning level as practical. Where below the flood planning level, more than 30% of the floor area to be above the flood planning level or premises to be flood proofed below the flood planning level.
- 6 Garage floor level to be no lower than 300mm above finished adjacent ground.
- 7 Garage and all other non-habitable internal floor levels to be no lower than the 1% AEP flood level minus 300mm or 300mm above finished adjacent ground (whichever is the greater).

## Building Components & Method

- 1 All structures to have *flood compatible building components* below or at the 100 year *flood* level plus *freeboard*.
- 2 All structures to have *flood compatible building components* below or at the *PMF* level plus *freeboard*.

## Structural Soundness

- 1 Engineers report to certify that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a 1% AEP flood level plus freeboard.
- 2 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a 1% AEP flood level plus freeboard , *PMF* plus *freeboard* if required to satisfy evacuation criteria (see below).
- 3 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a *PMF flood* plus *freeboard*.

## Flood Affection

- 1 Engineers report required to certify that the development will not increase *flood* affection elsewhere, includes medium & high density residential proposals.
- 2 The impact of the development on flooding elsewhere to be considered, includes low density residential.

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**Note:** When assessing *flood* affection the following must be considered:

1. Loss of storage in the *floodplain*.
  2. Changes in *flood* levels & velocities caused by alteration of conveyance of *flood* waters.
- 

## Evacuation

- 1 *Reliable access or refuge* required during a 100 year *flood*.

- 
- 2 *Reliable access* for pedestrians and vehicles required during a *PMF flood*.
  - 3 Reliable access for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest *habitable floor* level to an area of refuge above the *PMF level*, or a minimum of 20 m<sup>2</sup> of the dwelling to be above the *PMF level*.
  - 4 The development is to be consistent with any relevant *flood evacuation strategy* or similar plan.
  - 5 Applicant to demonstrate that evacuation of potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.

### Management and Design

- 1 Applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.
- 2 *Site Emergency Response Flood plan* required (except for single dwelling-houses) where floor levels are below the *flood planning level*.
- 3 Applicant to demonstrate that area is available to store goods above the 1% AEP *flood level* plus *freeboard*.
- 4 Applicant to demonstrate that area is available to store goods above the *PMF level* plus *freeboard*.
- 5 No external storage of materials below the *flood planning level* which may cause pollution or be potentially hazardous during any *flood*.

**SCHEDULE 2: PRESCRIPTIVE CONTROLS – HEWITTS CREEK FLOODPLAIN**

	Flood Risk Precincts (FRP's)																										
	Low Flood Risk						Medium Flood Risk						High Flood Risk (& Interim Riverine Corridor)														
Planning Consideration	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development			
Floor Level		3										2, 7	2 or 5	2	1	2, 4, 6									1	2, 4, 6	
Building Components		2										1	1	1	1	1										1	1
Structural Soundness		3		3		3						3	2	3	2	2										1	1
Flood Affectation		2	2		2	2					1	1 or 2	2	2	2	2										1	1
Evacuation		2, 4	5	3, 4	4	3, 4					5	3, 4	1, 4	3, 4	1											1	
Management & Design		4, 5	1								1		2, 3, 5	2, 3, 5	2, 3, 5	2, 3, 5										2, 3, 5	2, 3, 5
	Not Relevant	Unsuitable Land Use																									

**Note:**

- a. Filling of the site, where acceptable to Council, may change the FRP considered to determine the controls applied in the circumstances of individual applications.
- b. For the Hewitts Catchments it is recommended that filling in floodplain areas east of the South Coast Railway Line embankment be permitted, if the applicant can demonstrate there are no local hydraulic impacts on adjoining property as a result of this filling. Filling in floodplain areas west of the Main South Coast Railway is not to be permitted unless an Engineer's report is provided that certifies that the development will not increase flood affectation elsewhere.
- c. Terms in italics are defined in the glossary of this plan and Schedule 2 specifies development types included in each land use category. These development types are generally as defined within Environmental Planning Instruments applying to the local government area.
- d. **Freeboard** equals an additional height of 500 mm.

## Floor Level

- 1 All Floor Levels to be equal to or greater than the 5% AEP *flood level* plus *freeboard* unless justified by site specific assessment.
- 2 *Habitable floor* levels to be equal to or greater than the 100 year *flood level* plus *freeboard*.
- 3 All Floor Levels to be equal to or greater than the *PMF flood level* plus *freeboard*.
- 4 Floor levels to be as close to the flood planning level as practical & no lower than the existing floor level when undertaking alterations or additions.
- 5 Floor levels of shops to be as close to the flood planning level as practical. Where below the *flood planning level*, more than 30% of the floor area to be above the *flood planning level* or premises to be flood proofed below the *flood planning level*.
- 6 Garage floor level to be no lower than 300mm above finished adjacent ground.
- 7 Garage and all other non-habitable internal floor levels to be no lower than the 1% AEP flood level minus 300mm or 300mm above finished adjacent ground (whichever is the greater).

## Building Components & Method

- 1 All structures to have *flood compatible building components* below or at the 1% AEP *flood level* plus *freeboard*.
- 2 All structures to have *flood compatible building components* below or at the *PMF level* plus *freeboard*.

## Structural Soundness

- 1 Engineer's report to certify that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a 1% AEP *flood* plus *freeboard*.
- 2 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a 1% AEP *flood* plus *freeboard*.
- 3 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a *PMF flood* plus *freeboard*.

## Flood Affection

- 1 Engineer's report required to certify that the development will not increase *flood* affection elsewhere, includes medium & high-density residential proposals.
- 2 The impact of the development on flooding elsewhere to be considered, includes low density residential.

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**Note:** When assessing *flood* affection the following must be considered:

1. Loss of storage in the *floodplain*.
2. Changes in *flood* levels & velocities caused by alteration of conveyance of *flood* waters.

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## Evacuation

- 1 *Reliable access or refuge* required during a 1% AEP *flood*.
- 2 *Reliable access* for pedestrians and vehicles required during a *PMF flood*.

- 3 Reliable access for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest *habitable floor* level to an area of refuge above the *PMF level*, or a minimum of 20sqm of the dwelling to be above the *PMF level*.
- 4 The development is to be consistent with any relevant *flood evacuation strategy* or similar plan.
- 5 Applicant to demonstrate that evacuation of potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.

### Management and Design

- 1 Applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.
- 2 *Site Emergency Response Flood plan* required (except for single dwelling-houses) where floor levels are below the *flood planning level*.
- 3 Applicant to demonstrate that area is available to store goods above the 1% AEP *flood level* plus *freeboard*.
- 4 Applicant to demonstrate that area is available to store goods above the *PMF level* plus *freeboard*.
- 5 No external storage of materials below the *flood planning level* which may cause pollution or be potentially hazardous during any *flood*.

### SCHEDULE 3: PRESCRIPTIVE CONTROLS – MINNEGANG CREEK FLOODPLAIN

		Flood Risk Precincts (FRP's)																									
		Low Flood Risk						Medium Flood Risk						High Flood Risk (and Interim Riverine Corridor)													
Planning Consideration		Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development		
	Floor Level		3										2,6	2 or 5	2,6	1	2,4									1	2,4
Building Components		2										1	1	1	1	1									1	1	
Structural Soundness		3		2		3						2	2	2	2	2									1	1	
Flood Affection		2	2		2	2						1	2	2	2	2									1	1	
Evacuation		2, 4	*	3, 4	4	3, 4					*	3, 4	1,4	3,4	1										1		
Management & Design		4, 5	1								1		2,3 5	2,3 5	2,3 5,	2,3 5									2,3 5	2,3 5	
	Not Relevant	Unsuitable Land Use							*	Refer to 'Management & Design' planning consideration for subdivision																	

**Notes:**

1. Filling of the site, where acceptable to Council, may change the FRP considered to determine the controls applied in the circumstances of individual applications.
2. Terms in italics are defined in the glossary of this Plan and Schedule 2 specifies development types included in each land use category. These development types are generally as defined within Environmental Planning Instruments applying to the local government area.

## Floor Level

- 1 All floor levels to be equal to or greater than the 5% AEP *flood* level plus *freeboard* unless justified by site specific assessment.
- 2 *Habitable floor* levels to be equal to or greater than the 1% AEP *flood* level plus *freeboard*.
- 3 All floor levels to be equal to or greater than the *PMF flood* level plus *freeboard*.
- 4 Floor levels to be as close to the flood planning level as practical and no lower than the existing floor level when undertaking alterations or additions.
- 5 Floor levels of shops to be as close to the flood planning level as practical. Where below the *flood planning level*, more than 30% of the floor area is to be above the *flood planning level* or premises to be flood-proofed below the *flood planning level*.
- 6 Garage and all other non-habitable internal floor levels to be no lower than the 1% AEP flood level minus 300mm or 300mm above finished adjacent ground (whichever is the greater).

## Building Components and Method

- 1 All structures to have *flood compatible building components* below or at the 1% AEP *flood* level plus *freeboard*.
- 2 All structures to have *flood compatible building components* below or at the *PMF flood* level plus *freeboard*.

## Structural Soundness

- 1 Engineer's report to certify that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a 1% AEP *flood* plus *freeboard*.
- 2 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a 1% AEP *flood* plus *freeboard*.
- 3 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a *PMF flood* plus *freeboard*.

## Flood Affection

- 1 Engineer's report required to certify that the development would not increase *flood* affection elsewhere.
- 2 The impact of the development on flooding elsewhere to be considered.

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**Note:** When assessing *flood* affection the following must be considered:

1. Loss of storage in the *floodplain*.
  2. Changes in *flood* levels and velocities caused by alteration of conveyance of *flood* waters.
- 

## Evacuation

- 1 *Reliable access or refuge* required during a 1% AEP *flood*.
- 2 *Reliable access* for pedestrians and vehicles required during a *PMF flood*.

- 
- 3 *Reliable access* for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest *habitable floor* level to an area of refuge above the *PMF flood* level, or a minimum of 40% of the gross floor area of the dwelling to be above the *PMF flood* level.
  - 4 The development is to be consistent with any relevant *flood evacuation strategy* or similar plan.

### Management and Design

- 1 Applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accordance with this Plan.
- 2 Site Emergency Response Flood plan required (except for single- dwelling houses) where floor levels are below the *flood planning level*.
- 3 Applicant to demonstrate that area is available to store goods above the 1% AEP *flood* level plus *freeboard*.
- 4 Applicant to demonstrate that area is available to store goods above the *PMF flood* level plus *freeboard*.
- 5 No external storage of materials below the *flood planning level* which may cause pollution or be potentially hazardous during any *flood*.

**SCHEDULE 4: PRESCRIPTIVE CONTROLS – ALLANS CREEK FLOODPLAIN**

	Flood Risk Precincts (FRP's)																							
	Low Flood Risk^						Medium Flood Risk^						High Flood Risk^ ( & Interim Riverine Corridor)											
Planning Consideration	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development
Floor Level		3										2, 6	1, 2 or 5	2,6	1	2,4					1		1	2,4 or 6
Building Components		2										1	1	1	1	1					1		1	1
Structural Soundness		3		3		3						3	2	3	2	2					1		1	1
Flood Affection		2	2		2	2					1	1	1	1	1	2					1		1	1
Evacuation		2, 4	*	3, 4	4	3, 4					*	3, 4	1,4	3,4	1						*		1	
Management & Design		4, 5	1								1		2,3 5	2,3 5	2,3 5,6	2,3 5					2,3 5		2,3 5	2,3 5

	Not Relevant		Unsuitable Land Use		*	Refer to 'Management & Design' planning consideration for subdivision		Industrial Only, Commercial Not Permitted
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## Floor Level

- 1 For industrial land use only – All Floor Levels to be equal to or greater than the 1% AEP flood unless justified by site specific assessment.
- 2 Habitable floor levels to be equal to or greater than the 1% AEP flood level plus 0.5m (freeboard).
- 3 All Floor Levels to be equal to or greater than the PMF flood level plus 0.5m (freeboard).
- 4 Floor levels to be as close to the flood planning level as practical & no lower than the existing floor level when undertaking alterations or additions.
- 5 Floor levels of shops to be as close to the flood planning level as practical. Where below the *flood planning level*, more than 30% of the floor area to be above the *flood planning level* or premises to be flood proofed below the *flood planning level*.
- 6 Garage and all other non-habitable internal floor levels to be no lower than the 1% AEP flood level minus 300mm or 300mm above finished adjacent ground (whichever is the greater).

## Building Components & Method

- 1 All structures to have flood compatible building components below or at the 1% AEP flood level plus 0.5m (freeboard).
- 2 All structures to have flood compatible building components below or at the PMF level plus 0.5m (freeboard).

## Structural Soundness

- 1 Engineer's report to certify that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a 1% AEP flood plus freeboard.
- 2 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a 1% AEP flood plus freeboard, or a PMF plus freeboard if required to satisfy evacuation criteria (*see below*).
- 3 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a PMF flood plus freeboard.

## Flood Affection

- 1 Engineers report required to certify that the development will not increase flood affection elsewhere, includes medium and high density residential proposals.
- 2 The impact of the development on flooding elsewhere to be considered, includes low density residential.

## Evacuation

- 1 Reliable access or refuge required during a 1% AEP flood.
- 2 Reliable access for pedestrians and vehicles required during a PMF flood.
- 3 Reliable access for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest habitable floor level to an area of refuge above the PMF level, or a minimum of 20sqm of the dwelling/premises to be above the PMF level.
- 4 The development is to be consistent with any relevant flood evacuation strategy or similar plan.

- 5 Applicant to demonstrate that evacuation of potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.

### Management and Design

- 1 Applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accordance with this chapter.
  - 2 Site Emergency Response Flood plan required (except for single dwelling-houses) where floor levels are below the PMF.
  - 3 Applicant to demonstrate that area is available to store goods above the 1% AEP flood level plus 0.5m (freeboard).
  - 4 Applicant to demonstrate that area is available to store goods above the PMF plus 0.5m (freeboard).
  - 5 No external storage of materials below the *flood planning level* which may cause pollution or be potentially hazardous during any flood.
- \* adapted from this chapter for Towradgi Creek and modified for the Allans Creek Floodplain.
- ^ Flood Risk Precinct Definitions for Allans Creek – see Section 3.

Any proposed development will also need to be consistent with other Council requirements.

**SCHEDULE 5: PRESCRIPTIVE CONTROLS – FAIRY CABBAGE TREE CREEK FLOODPLAIN**

		Flood Risk Precincts (FRP's)																									
		Low Flood Risk						Medium Flood Risk						High Flood Risk ( & Interim Riverine Corridor)													
Planning Consideration		Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development		
	Floor Level			3										2,7	2 or 5	2	1	2,4 6								1	2,4 6
Building Components			2										1	1	1	1	1									1	1
Structural Soundness			3		2		3						2	2	3	2	2									1	1
Flood Affection			2	2		2	2					1	1 or 2	1	1	1	2									1	1
Evacuation			2, 4	5	3, 4	4	3, 4					5	3,4	1,4	3,4	1										1	
Management & Design			4, 5	1								1		2,3 5	2,3 5	2,3 5	2,3 5									2,3 5	2,3 5
	Not Relevant	Unsuitable Land Use																									

**Note:**

- a. Filling of the site, where acceptable to Council, may change the FRP considered to determine the controls applied in the circumstances of individual applications.
- b. Terms in italics are defined in the glossary of this plan and Schedule 2 specifies development types included in each land use category. These development types are generally as defined within Environmental Planning Instruments applying to the local government area.
- c. *Freeboard* equals an additional height of 500mm.

## Floor Level

- 1 All Floor Levels to be equal to or greater than the 5% AEP flood level plus freeboard unless justified by site specific assessment.
- 2 Habitable floor levels to be equal to or greater than the 1% AEP flood level plus freeboard.
- 3 All Floor Levels to be equal to or greater than the PMF flood level plus freeboard.
- 4 Floor levels to be as close to the flood planning level as practical & no lower than the existing floor level when undertaking alterations or additions.
- 5 Floor levels of shops to be as close to the flood planning level as practical. Where below the *flood planning level*, more than 30% of the floor area to be above the *flood planning level* or premises to be flood proofed below the *flood planning level*.
- 6 Garage and all other non-habitable internal floor levels to be no lower than the 1% AEP flood level minus 300 mm or 300 mm above finished adjacent ground (whichever is the greater).

## Building Components & Method

- 1 All structures to have flood compatible building components below or at the 1% AEP flood level plus freeboard.
- 2 All structures to have flood compatible building components below or at the PMF level plus freeboard.

## Structural Soundness

- 1 Engineer's report to certify that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a 1% AEP flood plus freeboard.
- 2 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a 1% AEP flood plus freeboard, PMF plus freeboard if required to satisfy evacuation criteria (see below).
- 3 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a PMF flood plus freeboard.

## Flood Affection

- 1 Engineer's report required to certify that the development will not increase flood affection elsewhere, includes medium & high-density residential proposals.
- 2 The impact of the development on flooding elsewhere to be considered, includes low density residential.

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**Note:** When assessing *flood* affection the following must be considered:

1. Loss of net storage of flood waters in the *floodplain*. Compensatory cut to fill earthworks in the floodplain may be a means to ensure no net loss of flood water storage.
  2. Changes in *flood* levels and velocities caused by alteration of conveyance of *flood* waters.
- 

## Evacuation

- 1 Reliable *access or refuge* required during a 1% AEP flood.
- 2 Reliable *access* for pedestrians and vehicles required during an PMF flood.

- 
- 3 Reliable access for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest habitable floor level to an area of refuge above the PMF level, or a minimum of 20 m<sup>2</sup> of the dwelling to be above the PMF level.
  - 4 The development is to be consistent with any relevant flood evacuation strategy or similar plan.
  - 5 Applicant to demonstrate that evacuation of potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.

### Management and Design

- 1 Applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.
- 2 *Site Emergency Response Flood plan* required (except for single dwelling houses) where floor levels are below the *flood planning level*.
- 3 Applicant to demonstrate that area is available to store goods above the 1% AEP flood level plus freeboard.
- 4 Applicant to demonstrate that area is available to store goods above the PMF level plus freeboard.
- 5 No external storage of materials below the *flood planning level* which may cause pollution or be potentially hazardous during any flood.

### SCHEDULE 6: PRESCRIPTIVE CONTROLS – MULLET AND BROOKS CREEK FLOODPLAIN

		Flood Risk Precincts (FRP's)																							
		Low Flood Risk						Medium Flood Risk						High Flood Risk (& Interim Riverine Corridor)											
Planning Consideration	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	
	Floor Level		3									2,7	2 or 5	2	1	2,4 6								1	2,4 6
Building Components		2									1	1	1	1	1								1	1	
Structural Soundness		3		2		3					2	2	3	2	2								1	1	
Flood Affection		2	2		2	2					1	1 or 2	1	1	1	2							1	1	
Evacuation		2, 4	5	3, 4	4	3, 4					5	3,4	1,4	3,4	1								1		
Management & Design		4, 5	1								1		2,3 5	2,3 5	2,3 5	2,3 5							2,3 5	2,3 5	
	Not Relevant	Unsuitable Land Use																							

**Note:**

- a. Filling of the site, where acceptable to Council, may change the FRP considered to determine the controls applied in the circumstances of individual applications.
- b. Terms in italics are defined in the glossary of this plan and Schedule 2 specifies development types included in each land use category. These development types are generally as defined within Environmental Planning Instruments applying to the local government area.
- c. *Freeboard* equals an additional height of 500mm.

## Floor Level

- 1 All Floor Levels to be equal to or greater than the 5% AEP *flood level plus freeboard* unless justified by site specific assessment.
- 2 *Habitable floor* levels to be equal to or greater than the 1% AEP *flood level plus freeboard*.
- 3 All Floor Levels to be equal to or greater than the *PMF flood level plus freeboard*.
- 4 Floor levels to be as close to the flood planning level as practical & no lower than the existing floor level when undertaking alterations or additions.
- 5 Floor levels of shops to be as close to the flood planning level as practical. Where below the *flood planning level*, more than 30% of the floor area to be above the *flood planning level* or premises to be flood proofed below the *flood planning level*.
- 7 Garage and all other non-habitable internal floor levels to be no lower than the 1% AEP flood level minus 300mm or 300mm above finished adjacent ground (whichever is the greater).

## Building Components & Method

- 1 All structures to have *flood compatible building components* below or at the 1% AEP *flood level plus freeboard*.
- 2 All structures to have *flood compatible building components* below or at the *PMF level plus freeboard*.

## Structural Soundness

- 1 Engineer's report to certify that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a 1% AEP *flood plus freeboard*.
- 2 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a 1% AEP *flood plus freeboard*, *PMF plus freeboard* if required to satisfy evacuation criteria (see below).
- 3 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a *PMF flood plus freeboard*.

## Flood Affection

- 1 Engineer's report required to certify that the development will not increase *flood* affection elsewhere, includes medium & high-density residential proposals.
- 2 The impact of the development on flooding elsewhere to be considered, includes low density residential.

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**Note:** When assessing *flood* affection the following must be considered:

1. Loss of storage in the *floodplain*.
2. Changes in *flood* levels & velocities caused by alteration of conveyance of *flood* waters.

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## Evacuation

- 1 *Reliable access or refuge required during a 1% AEP flood*.
- 2 *Reliable access* for pedestrians and vehicles required during a *PMF flood*.

- 3 Reliable access for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest *habitable floor* level to an area of refuge above the *PMF level*, or a minimum of 20sqm of the dwelling to be above the *PMF level*.
- 4 The development is to be consistent with any relevant *flood evacuation strategy* or similar plan.
- 5 Applicant to demonstrate that evacuation of potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.

### Management and Design

- 1 Applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.
- 2 *Site Emergency Response Flood plan* required (except for single dwelling-houses) where floor levels are below the *flood planning level*.
- 3 Applicant to demonstrate that area is available to store goods above the 1% AEP *flood level* plus *freeboard*.
- 4 Applicant to demonstrate that area is available to store goods above the *PMF level* plus *freeboard*.
- 5 No external storage of materials below the *flood planning level* which may cause pollution or be potentially hazardous during any *flood*.

**SCHEDULE 7: PRESCRIPTIVE CONTROLS – WOLLONGONG CITY FLOODPLAIN**

Planning Consideration	Flood Risk Precincts (FRP's)																								
	Low Flood Risk						Medium Flood Risk						High Flood Risk ( & Interim Riverine Corridor)												
	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	
Floor Level		3	8	8	8	8	8				2, 7	1, 2 or 5	2	1	2, 4									1	2, 4, 6
Building Components		2									1	1	1	1	1									1	1
Structural Soundness		3	3		3						3	2	3	2	2									1	1
Flood Affection		2	2		2	2					1	1	1	1	1	2								2	1, 2
Evacuation		2, 4	*	3, 4	4	3, 4					*	3, 4	1, 4	3, 4	1	4								1	4
Management & Design		4, 5	1								1		2, 3, 5	2, 3, 5	2, 3, 5, 6	2, 3, 5								2, 3, 5	2, 3, 5

	Not Relevant	Unsuitable Land Use	*	Refer to 'Management & Design' planning consideration for subdivision
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**Note:**

- a. Filling of the site, where acceptable to Council, may change the FRP considered to determine the controls applied in the circumstances of individual applications.
- b. Terms in italics are defined in the glossary of this plan and Schedule 2 specifies development types included in each land use category. These development types are generally as defined within Environmental Planning Instruments applying to the local government area.
- c. **Freeboard** equals an additional height of 500mm

## Floor Level

- 1 All Floor Levels to be equal to or greater than the 5% AEP *flood* level plus *freeboard* unless justified by site specific assessment.
- 2 *Habitable floor* levels to be equal to or greater than the 1% AEP *flood* level plus *freeboard*.
- 3 All Floor Levels to be equal to or greater than the *PMF flood* level plus *freeboard*.
- 4 Floor levels to be as close to the flood planning level as practical & no lower than the existing floor level when undertaking alterations or additions.
- 5 Floor levels of shops to be as close to the flood planning level as practical. Where below the *flood planning level*, more than 30% of the floor area to be above the *flood planning level* or premises to be flood proofed below the *flood planning level*.
- 7 Garage and all other non-habitable internal floor levels to be no lower than the 1% AEP flood level minus 300mm or 300mm above finished adjacent ground (whichever is the greater).
- 8 Habitable flood level to be a minimum of 300mm above finished adjacent ground level.

## Building Components & Method

- 1 All structures to have *flood compatible building components* below or at the 1% AEP *flood* level plus *freeboard*.
- 2 All structures to have *flood compatible building components* below or at the *PMF* level plus *freeboard*.

## Structural Soundness

- 1 Engineers report to certify that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a 1% AEP *flood* plus *freeboard*.
- 2 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a 1% AEP *flood* plus *freeboard*, *PMF* plus *freeboard* if required to satisfy evacuation criteria (see below).
- 3 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a *PMF flood* plus *freeboard*.

## Flood Affection

- 1 Engineers report required to certify that the development will not increase *flood* affection elsewhere, includes medium & high density residential proposals.
- 2 The impact of the development on flooding elsewhere to be considered, includes low density residential.

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**Note:** When assessing *flood* affection the following must be considered:

1. Loss of storage in the *floodplain*.
  2. Changes in *flood* levels & velocities caused by alteration of conveyance of *flood* waters.
- 

## Evacuation

- 1 *Reliable access or refuge* required during a 1% AEP *flood*.

- 
- 2 *Reliable access* for pedestrians and vehicles required during a *PMF flood*.
  - 3 Reliable access for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest *habitable floor* level to an area of refuge above the *PMF level*, or a minimum of 20sqm of the dwelling to be above the *PMF level*.
  - 4 The development is to be consistent with any relevant *flood evacuation strategy* or similar plan.

### Management and Design

- 1 Applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.
- 2 *Site Emergency Response Flood plan* required (except for single dwelling-houses) where floor levels are below the *flood planning level*.
- 3 Applicant to demonstrate that area is available to store goods above the 1% AEP *flood level* plus *freeboard*.
- 4 Applicant to demonstrate that area is available to store goods above the *PMF level* plus *freeboard*.
- 5 No external storage of materials below the *flood planning level* which may cause pollution or be potentially hazardous during any *flood*.

### SCHEDULE 8: PRESCRIPTIVE CONTROLS – COMBINED CATCHMENTS OF WHARTONS, COLLINS AND FARRAHARS CREEKS, BELLAMBI GULLY AND BELLAMBI LAKE FLOODPLAINS

	Flood Risk Precincts (FRP's)																								
	Low Flood Risk						Medium Flood Risk						High Flood Risk (& Interim Riverine Corridor)												
Planning Consideration	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	
Floor Level		3									2, 7	2 or 5	2	1	2, 4, 6									1	2, 4, 6
Building Components		2									1	1	1	1	1									1	1
Structural Soundness		3		3		3						2	2	3	2	2								1	1
Flood Affection		2	2		2	2					1	1 or 2	1	1	1	2								1	1
Evacuation		2, 4	*	3, 4	4	3, 4					*	3, 4	1, 4	3, 4	1									1	
Management & Design		4, 5	1								1		2, 3, 5	2, 3, 5	2, 3, 5	2, 3, 5								2, 3, 5	2, 3, 5

Not Relevant	Unsuitable Land Use	*	Refer to 'Management & Design' planning consideration for subdivision
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**Notes:**

- \*
  - a. Filling of the site, where acceptable to Council, may change the FRP considered to determine the controls applied in the circumstances of individual applications..
  - b. Terms in italics are defined in the glossary of this plan and Schedule 2 specifies development types included in each land use category. These development types are generally as defined within Environmental Planning Instruments applying to the local government area.
  - c. Freeboard equals an additional height of 500mm.

## Floor Level

- 1 All Floor Levels to be equal to or greater than the 5% AEP *flood level plus freeboard* unless justified by site specific assessment.
- 2 *Habitable floor* levels to be equal to or greater than the 1% AEP *flood level plus freeboard*.
- 3 All Floor Levels to be equal to or greater than the *PMF flood level plus freeboard*.
- 4 Floor levels to be as close to the flood planning level as practical & no lower than the existing floor level when undertaking alterations or additions.
- 5 Floor levels of shops to be as close to the flood planning level as practical. Where below the *flood planning level*, more than 30% of the floor area to be above the *flood planning level* or premises to be flood proofed below the *flood planning level*.
- 7 Garage and all other non-habitable internal floor levels to be no lower than the 1% AEP flood level minus 300mm or 300mm above finished adjacent ground (whichever is the greater).

## Building Components & Method

- 1 All structures to have *flood compatible building components* below or at the 1% AEP *flood level plus freeboard*.
- 2 All structures to have *flood compatible building components* below or at the *PMF level plus freeboard*.

## Structural Soundness

- 1 Engineers report to certify that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a 1% AEP *flood plus freeboard*.
- 2 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a 1% AEP *flood plus freeboard*, *PMF plus freeboard* if required to satisfy evacuation criteria (see below).
- 3 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a *PMF flood plus freeboard*.

## Flood Affection

- 1 Engineers report required to certify that the development will not increase *flood* affection elsewhere, includes medium & high density residential proposals.
- 2 The impact of the development on flooding elsewhere to be considered, includes low density residential.

---

**Note:** When assessing *flood* affection the following must be considered:

1. Loss of storage in the floodplain.
  2. Changes in *flood* levels & velocities caused by alteration of conveyance of flood waters.
- 

## Evacuation

- 1 *Reliable access or refuge required during a 1% AEP flood*.
- 2 *Reliable access* for pedestrians and vehicles required during a *PMF flood*.

- 3 Reliable access for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest *habitable floor* level to an area of refuge above the *PMF level*, or a minimum of 20sqm of the dwelling to be above the *PMF level*.
- 4 The development is to be consistent with any relevant *flood evacuation strategy* or similar plan.

### Management and Design

- 1 Applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.
- 2 *Site Emergency Response Flood plan* required (except for single dwelling-houses) where floor levels are below the *flood planning level*.
- 3 Applicant to demonstrate that area is available to store goods above the 1% AEP *flood level* plus *freeboard*.
- 4 Applicant to demonstrate that area is available to store goods above the *PMF level* plus *freeboard*.
- 5 No external storage of materials below the *flood planning level* which may cause pollution or be potentially hazardous during any *flood*.

**SCHEDULE 9: PRESCRIPTIVE CONTROLS – LAKE ILLAWARRA FLOODPLAIN**

		Flood Risk Precincts (FRP's)																							
		Low Flood Risk						Medium Flood Risk						High Flood Risk ( & Interim Riverine Corridor)											
Planning Consideration	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	
	Floor Level		3										2,6 or 7	2 or 5	2	1	2,4 6								1
Building Components		2		2								2	1	2	1	1								1	1
Structural Soundness		3		3		3						3	2	3	2	2								1	1
Flood Affection		2,3			2,3	2,3						2,3	2,3	2,3	2,3	2								1,3	1,3
Evacuation		2,4		3,4	4	3,4						3,4	1,4	3,4	3,4									1	
Management & Design		4,5											2,3 5	2,3 5	2,3 5	2,3 5								2,3 5	2,3 5
	Not Relevant	Unsuitable Land Use						Concessional development to use the 1% AEP including Medium Sea Level Rise (0.4m - 2050), all other development to use the 1% AEP including High Sea Level Rise (0.91m - 2100).																	

**Floor Level**

- 1 All floor levels to be equal to or greater than the 5% AEP *flood* level plus freeboard unless justified by site specific assessment.
- 2 Habitable floor levels to be equal to or greater than the 1% AEP flood level plus 0.5m freeboard.
- 3 All floor levels to be equal to or greater than the PMF.
- 4 Floor levels to be as close to the flood planning level as practical and no lower than the existing floor level when undertaking alterations or additions.
- 5 Floor levels of shops to be as close to the flood planning level as practical. Where below the *flood planning level*, more than 30% of the floor area to be above the *flood planning level* or premises to be flood proofed below the *flood planning level*.
- 6 Garage floor level to be no lower than 300mm above finished adjacent ground.
- 7 Garage and all other non-habitable internal floor levels to be no lower than the 1% AEP flood level minus 300mm or 300mm above finished adjacent ground (whichever is the greater).

### Building Components and Method

- 1 All structures to have flood compatible building components below or at the 1% AEP flood level plus freeboard.
- 2 All structures to have flood compatible building components below or at the PMF.

### Structural Soundness

- 1 Engineers report to certify that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a 1% AEP flood plus 0.5m freeboard.
- 2 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a 1% AEP flood plus 0.5m freeboard.
- 3 Engineers report to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a PMF event.

### Flood Affection

- 1 Engineers report required to certify that the development will not increase flood affection elsewhere.
- 2 The impact of the development on flooding elsewhere to be considered.
- 3 No wholesale filling of sites around the foreshore of the lake is permitted, unless supported by a sensitivity analysis indicating that there is no significant impact on flood levels. Also, filling that impacts on active flow areas in the stream networks feeding Lake Illawarra will not be supported. However, filling within existing building areas is permitted. Filling of depressions outside of the existing building areas may be permitted subject to it being demonstrated that there is no loss of flood storage across the site in all events up to the PMF.

### Evacuation

- 1 Reliable access or refuge required during a 1% AEP flood.
- 2 Reliable access for pedestrians and vehicles required during a PMF event.
- 3 Reliable access for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest habitable floor level to an area of refuge above the PMF, or a minimum of 20m<sup>2</sup> of the dwelling to be above the PMF level.
- 4 The development is to be consistent with any relevant flood evacuation strategy or similar plan.
- 5 Applicant to demonstrate that evacuation of potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.

### Management and Design

- 1 Applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.
- 2 Site Emergency Response Flood plan required (except for single dwelling-houses) where floor levels are below the *flood planning level*.
- 3 Applicant to demonstrate that area is available to store goods above the 1% AEP flood level plus 0.5m freeboard.

- 
- 4 Applicant to demonstrate that area is available to store goods above the PMF.
  - 5 No external storage of materials below the *flood planning level* which may cause pollution or be potentially hazardous during any flood.

**SCHEDULE 9a: PRESCRIPTIVE CONTROLS – LAKE ILLAWARRA – WINDANG PENINSULA**

		Flood Risk Precincts (FRP's)																																
		Low Flood Risk								Medium Flood Risk								High Flood Risk ( & Interim Riverine Corridor)								Isolation Risk <small>-Applies to the entire Windang Peninsula as shown in Figure 9a. -These controls apply in addition to those applied in flood risk precincts.</small>								
Planning Consideration		Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	
	Floor Level		3											2,6 or 7	2 or 5	2	1	2,4 6									1	2,4 6						
Building Components		2		2									2	1	2	1	1									1	1							
Structural Soundness		3		3		3							3	2	3	2	2									1	1							
Flood Affection		2,3			2,3	2,3							2,3	2,3	2,3	2,3	2									1,3	1,3							
Evacuation		2,4		3,4	4	3,4							3,4	1,4	3,4	3,4										1				3,4	4	3,4		
Management & Design		4,5												2,3 5	2,3 5	2,3 5	2,3 5									2,3 5	2,3 5			1		1		
	Not Relevant	Unsuitable Land Use							Concessional development to use the 1% AEP including medium level sea level rise, all other development to use the 1% AEP including high sea level rise.																									

## Floor Level

- 1 All floor levels to be equal to or greater than the 5% AEP *flood* level plus freeboard unless justified by site specific assessment.
- 2 Habitable floor levels to be equal to or greater than the 1% AEP flood level plus 0.5m freeboard.
- 3 All floor levels to be equal to or greater than the PMF.
- 4 Floor levels to be as close to the flood planning level as practical and no lower than the existing floor level when undertaking alterations or additions.
- 5 Floor levels of shops to be as close to the flood planning level as practical. Where below the *flood planning level*, more than 30% of the floor area to be above the *flood planning level* or premises to be flood proofed below the *flood planning level*.
- 6 Garage floor level to be no lower than 300mm above finished adjacent ground.
- 7 Garage and all other non-habitable internal floor levels to be no lower than the 1% AEP flood level minus 300mm or 300mm above finished adjacent ground (whichever is the greater).

## Building Components and Method

- 1 All structures to have flood compatible building components below or at the 1% AEP flood level plus freeboard.
- 2 All structures to have flood compatible building components below or at the PMF.

## Structural Soundness

- 1 Engineers report to certify that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a 1% AEP flood plus 0.5m freeboard.
- 2 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a 1% AEP flood plus 0.5m freeboard.
- 3 Engineers report to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a PMF event.

## Flood Affection

- 1 Engineers report required to certify that the development will not increase flood affection elsewhere.
- 2 The impact of the development on flooding elsewhere to be considered.
- 3 No wholesale filling of sites around the foreshore of the lake is permitted, unless supported by a sensitivity analysis indicating that there is no significant impact on flood levels. Also, filling that impacts on active flow areas in the stream networks feeding Lake Illawarra will not be supported. However, filling within existing building areas is permitted. Filling of depressions outside of the existing building areas may be permitted subject to it being demonstrated that there is no loss of flood storage across the site in all events up to the PMF.

## Evacuation

- 1 Reliable access or refuge required during a 1% AEP flood.
- 2 Reliable access for pedestrians and vehicles required during a PMF event.

- 3 Reliable access for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest habitable floor level to an area of refuge above the PMF, or a minimum of 20m<sup>2</sup> of the dwelling to be above the PMF level.
- 4 The development is to be consistent with any relevant flood evacuation strategy or similar plan.
- 5 Applicant to demonstrate that evacuation of potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.

### Management and Design

- 1 Applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.
- 2 Site Emergency Response Flood plan required (except for single dwelling-houses) where floor levels are below the *flood planning level*.
- 3 Applicant to demonstrate that area is available to store goods above the 1% AEP flood level plus 0.5m freeboard.
- 4 Applicant to demonstrate that area is available to store goods above the PMF.
- 5 No external storage of materials below the *flood planning level* which may cause pollution or be potentially hazardous during any flood.

## SCHEDULE 10: PRESCRIPTIVE CONTROLS – OTHER FLOODPLAINS

		Flood Risk Precincts (FRP's)																										
		Low Flood Risk						Medium Flood Risk						High Flood Risk ( & Interim Riverine Corridor)														
Planning Consideration		Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development			
	Floor Level		3										2, 7	2 or 5	2	1	2, 4 6									1	2, 4 6	
Building Components		2										1	1	1	1	1										1	1	
Structural Soundness		3		2		3						2	2	3	2	2										1	1	
Flood Affection		2	2		2	2					1	1 or 2	1	1	1	2										1	1	
Evacuation		2, 4	5	3, 4	4	3, 4					5	3, 4	1, 4	3, 4	1											1		
Management & Design		4, 5	1								1		2, 3 5	2, 3 5	2, 3 5	2, 3 5										2, 3 5	2, 3 5	
	Not Relevant		Unsuitable Land Use																									

**Note:**

- a. Filling of the site, where acceptable to Council, may change the FRP considered to determine the controls applied in the circumstances of individual applications.
- b. Terms in italics are defined in the glossary of this plan and Schedule 2 specifies development types included in each land use category. These development types are generally as defined within Environmental Planning Instruments applying to the local government area.
- c. **Freeboard** equals an additional height of 500mm.

### Floor Level

- 1 All floor levels to be equal to or greater than the 5% AEP *flood level* plus freeboard unless justified by site specific assessment.
- 2 Habitable floor levels to be equal to or greater than the 100 year flood level plus freeboard.
- 3 All floor levels to be equal to or greater than the PMF flood level plus freeboard.
- 4 Floor levels to be as close to the *flood planning level* as practical and no lower than the existing floor level when undertaking alterations or additions.
- 5 Floor levels of shops to be as close to the *flood planning level* as practical. Where below the *flood planning level*, more than 30% of the floor area to be above the *flood planning level* or premises to be flood proofed below the *flood planning level*.

- 6 Garage floor level to be no lower than 300mm above finished adjacent ground.
- 7 Garage and all other non-habitable internal floor levels to be no lower than the 1% AEP flood level minus 300mm or 300mm above finished adjacent ground (whichever is the greater).

### Building Components and Method

- 1 All structures to have flood compatible building components below or at the 1% AEP flood level plus freeboard.
- 2 All structures to have flood compatible building components below or at the PMF level plus freeboard.

### Structural Soundness

- 1 Engineers report to certify that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a 100 year flood plus freeboard.
- 2 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a 100 year flood plus freeboard, or a PMF plus freeboard if required to satisfy evacuation criteria (*see below*).
- 3 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a PMF flood plus freeboard.

### Flood Affectation

- 1 Engineers report required to certify that the development will not increase flood affectation elsewhere, includes medium and high density residential proposals.
- 2 The impact of the development on flooding elsewhere to be considered, includes low density residential.

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**Note:** When assessing flood affectation the following must be considered:

1. Loss of storage in the floodplain.
2. Changes in flood levels and velocities caused by alteration of conveyance of flood waters.

### Evacuation

- 1 Reliable access for pedestrians required during a 100 year flood.
- 2 Reliable access for pedestrians and vehicles required during a PMF flood.
- 3 Reliable access for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest habitable floor level to an area of refuge above the PMF level, or a minimum of 20m<sup>2</sup> of the dwelling to be above the PMF level.
- 4 The development is to be consistent with any relevant flood evacuation strategy or similar plan.
- 5 Applicant to demonstrate that evacuation of potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.

### Management and Design

- 1 Applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accord with this plan.
- 2 Site Emergency Response Flood plan required (except for single dwelling-houses) where floor levels are below the *flood planning level*.

- 
- 3** Applicant to demonstrate that area is available to store goods above the 100 year flood level plus freeboard.
  - 4** Applicant to demonstrate that area is available to store goods above the PMF level plus freeboard.
  - 5** No external storage of materials below the *flood planning level* which may cause pollution or be potentially hazardous during any flood.

**Appendix: D McLuckie et al (2019) Improving Guidance for Councils and Committees on Floodplain Management in NSW – NSW Office of Environment and Heritage**

## Improving Guidance for Councils and Committees on Floodplain Management in NSW – NSW Office of Environment and Heritage<sup>##</sup> Session

Duncan McLuckie<sup>1</sup>, Angela Toniato<sup>2</sup> Elise Armstrong<sup>1</sup>

<sup>1</sup> NSW Office of Environment and Heritage<sup>##</sup> (Newcastle)

<sup>2</sup> NSW Office of Environment and Heritage<sup>##</sup> (Wollongong)

**Note:** <sup>##</sup> The NSW Office of Environment and Heritage is transitioning into the Department of Planning Industry and Environment on 1 July 2019.

### Abstract

The New South Wales Flood Prone Land Policy aims to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone land and reduce public and private losses from floods utilising ecologically positive methods wherever possible.

The NSW Office of Environment and Heritage is updating the NSW Floodplain Development Manual in consultation with other agencies and industry. As part of this work OEH is developing and updating a range of technical guidance that supports councils and committees in understanding and managing flood behaviour in NSW.

This session discusses progress on the Manual and guidance update in consideration of consultation to date, user needs, improving outcomes from the process, improving understanding of flooding, the need for improved access to flood information, and national best practice.

This paper provides the basis for this session which will:

- Outline the scope of the overall project
- Provide an overview of the review of the manual
- Provide an overview of the review of associated guidance and tools
- Discuss draft guidance in different areas of practice and their interaction. These include guides on the local flood risk management framework, flood emergency response classification of communities, information to support emergency management, flood hazard categorisation and flood function including floodways and flood storage.

### Introduction

The NSW Office of Environment and Heritage (OEH) is the lead agency in flood risk management in New South Wales. It manages the NSW Floodplain Management Program (the Program) which provides local councils in NSW with both technical and policy support (through a range of professionals with expertise in flood risk management and associated disciplines) and financial support through the associated grants program OEH administers. OEH works closely with a range of other relevant agencies (in NSW and beyond) and with local government councils and the floodplain risk management (FRM) industry in NSW to support the management of flood risk and the delivery of the NSW Flood Prone Land Policy (the Policy). OEH is currently reviewing the Floodplain Development Manual (2005) (the Manual) and associated guidance to improve flood risk management outcomes in NSW. This paper outlines the direction of these projects and provides an update on their progress.

### Background on Development of FRM Guidance in NSW

The Policy was first adopted in 1984 and was supported by the NSW Floodplain Development Manual (1986). The Policy and Manual were last fully updated in 2005. Although *Planning Circular 07/003, New Guideline and changes to section 117 direction and EP&A Regulation on flood prone land* amended the Manual. The Joint Department of Natural Resources (DNR, now OEH) and Department of Planning (DoP, now Department of Planning and Environment, DPE) guideline required councils to get DNR and DoP agreement to place development controls on standard residential development in low flood risk areas, i.e. areas outside the flood planning area).

The primary objective of the Policy is to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods, utilising ecologically positive methods, where possible. The Policy recognises that flood prone land is a valuable resource that should not be sterilised by unnecessarily precluding its development and that the application of rigid and prescriptive controls to address flooding can lead to inappropriate development or unreasonably restricted development.

The delivery of the Policy is supported by the Manual and FRM guidelines and the technical and financial support provided by OEH through the Program. The Manual provides an informed basis for local councils to meet their obligations for managing flood risks to their community under Section 733 of the Local Government Act (1993) and the NSW Flood Prone Land Policy. Managing flood risk consistent with the Manual provides councils, staff and councillors with limited protection from liability for decisions made and flood information provided.

The Manual (which includes the Policy) is available on OEH's website at <http://www.environment.nsw.gov.au/topics/water/floodplains/floodplain-manual> and is supported by a range of technical guidelines available on OEH's website at <http://www.environment.nsw.gov.au/topics/water/floodplains/floodplain-guidelines>. The existing guidelines provide advice on the following:

- Understanding flood behaviour
  - Modelling reports and supporting information for review
  - Modelling the interaction of catchment flooding and oceanic inundation in coastal waterways, which includes examples and templates
  - Floodway definition
  - Practical consideration of climate change
  - Considering Australian Rainfall and Runoff 2016 in Studies, which includes guidelines, examples and background documents
- Assessing residential flood damage
- Supporting emergency management including: Flood emergency response planning classification of communities and NSW State Emergency Service (NSW SES) requirements from the FRM process
- Other FRM concerns such as temporary or relocatable flood barriers, rainwater tanks: limitations as FRM devices and drainage behind and through levees
- Data handover through the NSW Flood Data Portal

The Manual and Policy are also supported by tools such as:

- The brief development tool. This tool enables the development of technical specifications that can be tailored for the project. This supports flexibility in scoping

## Consultation on Improving FRM delivery in NSW

McLuckie and Toniato (2018) provided a synopsis of consultation to improve FRM in NSW undertaken in early 2018. Consultation outcomes were considered in the structure and scope of the review project and included:

- Website: Need a single website as the go to place for NSW Government FRM advice.
- Policy: Keep the Policy in the Manual but improve its prominence and clarity.
- Manual and Guidelines
  - Maintain the FRM process as it supports comprehensive assessment and informed decisions.
  - Consider how to address State Government administrative changes
  - Clearly separate the FRM process for strategic FRM by local government from flood impacts assessments for developments.
  - Consider national best practice and link to as appropriate. National flood planning constraint categories were seen as providing a good starting point for risk based land use planning as they were not limited to a single scale of event.
  - Support approaches that are practical for different circumstances but enable consistency of outcomes and outputs.
  - Update or consider guidance in areas including freeboard, climate change, defining flood function, flood damages, flood warning, land use planning, mapping, emergency management considerations, committees, cumulative impacts, local overland flooding, consultation and community engagement, shelter in place, model use and filtering, business cases for mitigation actions, flood compatible building material, future timeframe scenarios, model planning controls and mapping.
  - Promote the importance of reports as a communication avenue to communities.
  - Improving accessibility of reports and final expertly interpreted spatial layers.
  - Identify minimum requirements for studies and plans and measures of success including evaluation process to understand the level of success.
  - Continue to link guidance into project specifications.
- Community flood resilience should incorporate FRM concepts of avoidance, minimisation and mitigation and go beyond the concepts of building it back better after an event and being prepared to recover from disasters. Focus could be on identifying key factors that support a community being more resilient to flooding.
- Other relevant issues raised include:
  - Planning circular PS07/003 was seen by local councils as limiting consideration of flood risk to residential properties in land use planning to within the FPA based upon the FPL of 1% AEP plus a typical freeboard of 0.5m. The circular and the associated guide and direction are being reviewed in parallel with the Manual.
  - The need for training for council staff and councillors on flood risk management.

## Update of the Manual, Guides and Tools

Given the timeframe since the last update of the Manual, the changes to agency responsibilities, lessons learnt from floods and reviews in NSW and other jurisdictions, the update of national best practice as outlined in the ADR Handbook 7 (ADR 2017a) and its supporting series of guides, the OEH recognised the importance of updating the Manual.

OEH is leading this review with support from an inter-agency working group and with reference to both local government and consultant groups. The review is not intending to make significant changes to the intent of the Policy, nor the fundamental roles and responsibilities of councils in understanding and managing flood risk for the benefit of their communities nor the support provided by the NSW Government. Rather, the review is focussed on updating the guidance and advice available to assist councils in undertaking this role.

The Manual and Program will continue to provide the foundation of delivery of the Policy and to outline the separation between State and Local Government responsibilities. However, there will likely be more advice included in technical guidelines which can be more responsive to change than the gazetted Manual.

Work on the Manual and associated guidance is progressing and is being undertaken in parallel with work being undertaken in relation to the update of PS07/003 and the related joint OEH/DPE guide. OEH is working closely in supporting DPE with this work. This work is outside the scope of this paper.

#### Floodplain Development Manual

Work on the Manual is currently underway. The intent is to restructure the Manual into four (4) sections, rather than separating information between the main manual chapters and the appendices (as in the 2005 version).

The four draft sections are:

- A. NSW Flood Prone Land Policy
- B. Preliminaries, Foreword, Introduction and Roles and Responsibility
- C. Strategic Management of Flood Risk including FRM principles
- D. FRM Framework and associated FRM process

The Manual is being written with roles and responsibilities for different government levels, i.e. local, State and Commonwealth. The breakdown of roles is being addressed in a separate administrative guide.

#### FRM Guidelines

A range of additional or updated FRM guides are likely to be needed to support the updated Manual. The draft list below provides an indication of the FRM guides expected to be needed to facilitate the update. The list below is expected to evolve as work continues.

- Administrative Guide – Outlines agency roles, current guides and tools.
- Local flood risk management framework
- Flood function - updates the previous floodway definition guide and replaces part of Appendix L of the Manual
- Flood hazard - replaces part of Appendix L of the Manual
- Emergency management planning for floods – replace Appendix N of the Manual
- Flood information from studies to support emergency management (update existing guide)
- Flood emergency management classification (update existing guide)
- Flood information to support land use planning activities

- Considering flood risk in land use planning
- Flood impact assessment for developments
- Rural floodplain management planning – supplement Manual
- Management options including assessment and business cases – replace Appendix J of the Manual and several existing guides
- Estimating Flood Damage – guide and tools – replace Manual guidance
- Guidance on reporting for studies

The update of the Manual and FRM Guides also mean that the Brief Development Tool and Handover Requirements will be updated. The most up to date Brief Development Tool and handover requirements will continue to be made available to registered users through the NSW Flood Data Portal. This tool should always be used in partnership with OEH FRM staff and in consideration of the aims and scope of the project being undertaken.

Other documents identified by industry for development or update but not critical to the immediate update of the 2005 Manual include:

- Climate change adaptation
- FRM Committee Handbook
- Shelter in Place
- Data to be provided for review of model calibration and validation reports
- Levee investigation, design, operation and maintenance guidance and will expand and replace guidance on drainage through levees
- Local flood warning system and gauge owner's manual
- Local overland flooding
- Post event data collection
- Brief Development Tool for investigations and designs
- Guidance for voluntary purchase and voluntary house raising projects
- Consultation and community engagement
- Flood compatible building materials

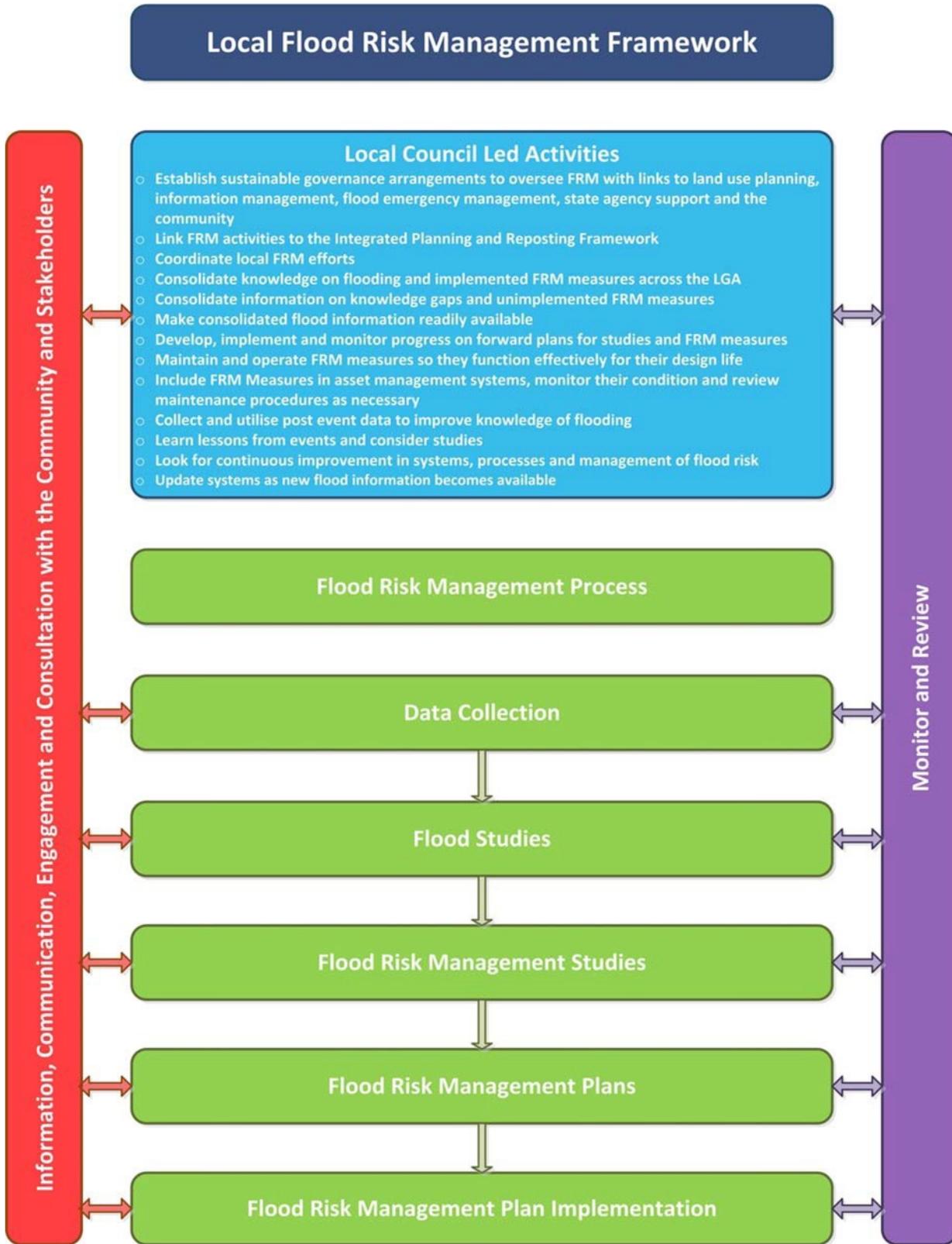
Following completion of the Manual update project consideration will be given to future priorities for additional or updated guidance.

### **Discussion of Specific Draft Guides**

Guidance on the local FRM framework, flood emergency response classification of communities, flood hazard and flood function (floodways and flood storage), and how they influence decision making are discussed below.

#### **Local Flood Risk Management Framework**

The local FRM framework has been developed from ADR Handbook 7 (ADR 2017a) to link LGA scale activities that manage or influence flood risk with the FRM process which may be undertaken at difference scales within the LGA or may span multiple LGAs. This difference in scale means that effective management at LGA scale will generally involve the range of activities shown in Figure 1. The local FRM framework guide will provide guidance to council in relation to LGA scale activities and the development of consolidated knowledge to inform these activities.



*Flood Emergency Response Classification of Communities and Flood Information to Support Emergency Management*

The Flood Emergency Response Classification of Communities (FERCCs) Guide will update the existing *NSW FRM Guide Flood Emergency Response Classification of Communities* (OEH 2007) in consideration of the changing use of this guide and *ADR FRM Guide 7.2 Flood Emergency Response Classification of the Floodplain (ADR 2017b)*. It outlines how FERCCs are to be undertaken in future studies under the Program.

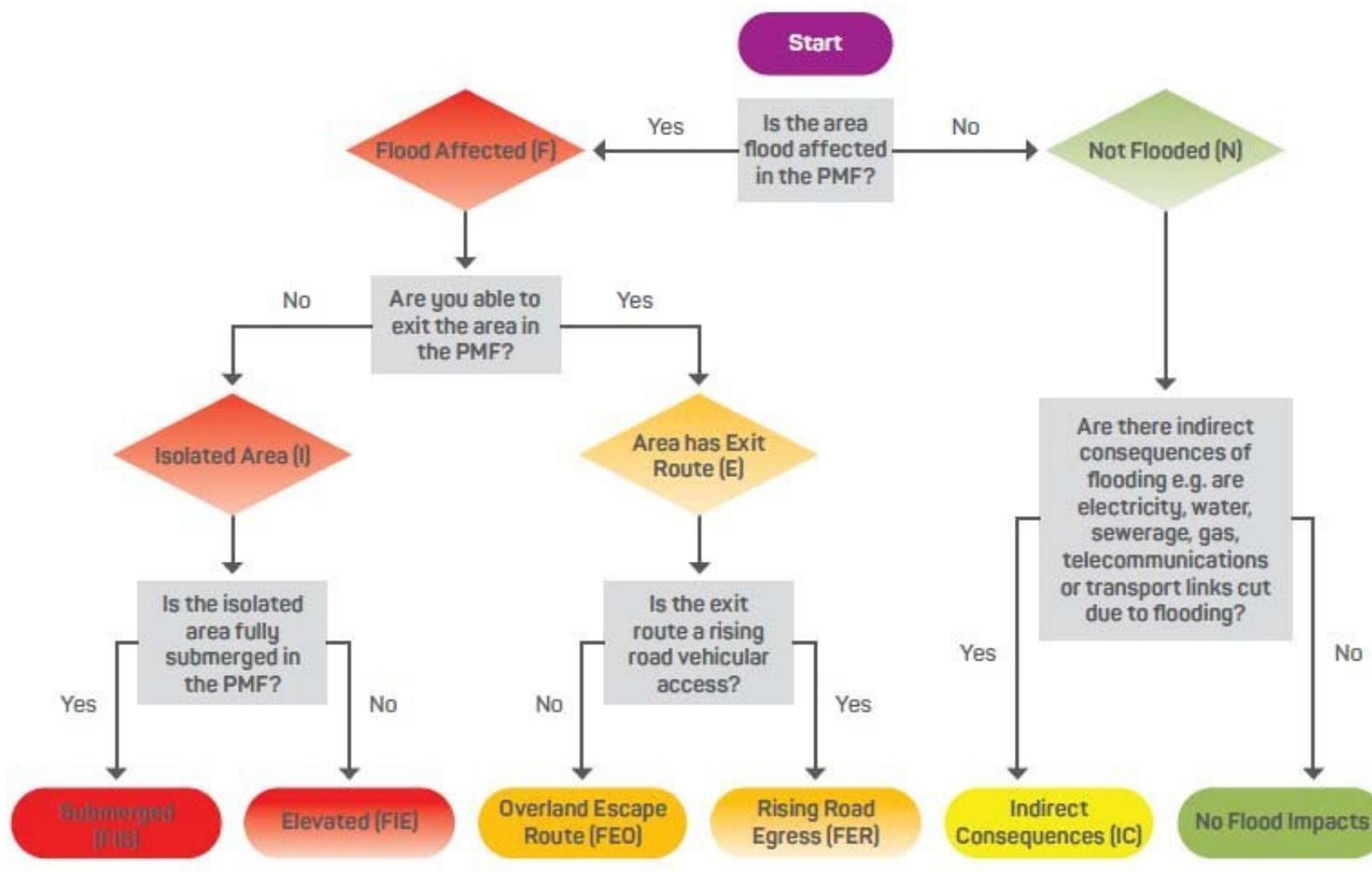
The original NSW guide focused purely on informing flood emergency management planning. The later ADR guide (ADR 2017b) took the opportunity to embed evolving NSW practice by identifying emergency management constraints earlier in the FRM process. This enables this information to be made available earlier (from flood studies) in a format suitable to inform broader decision making. For example, in land use planning, this information can inform decisions either used directly or through the development of flood planning constraint categories (FPCCs) as outlined in *ADR FRM Guide 7.5 Flood Information to Support Land Use Planning (ADR 2017c)*. An equivalent NSW guide is currently being developed.

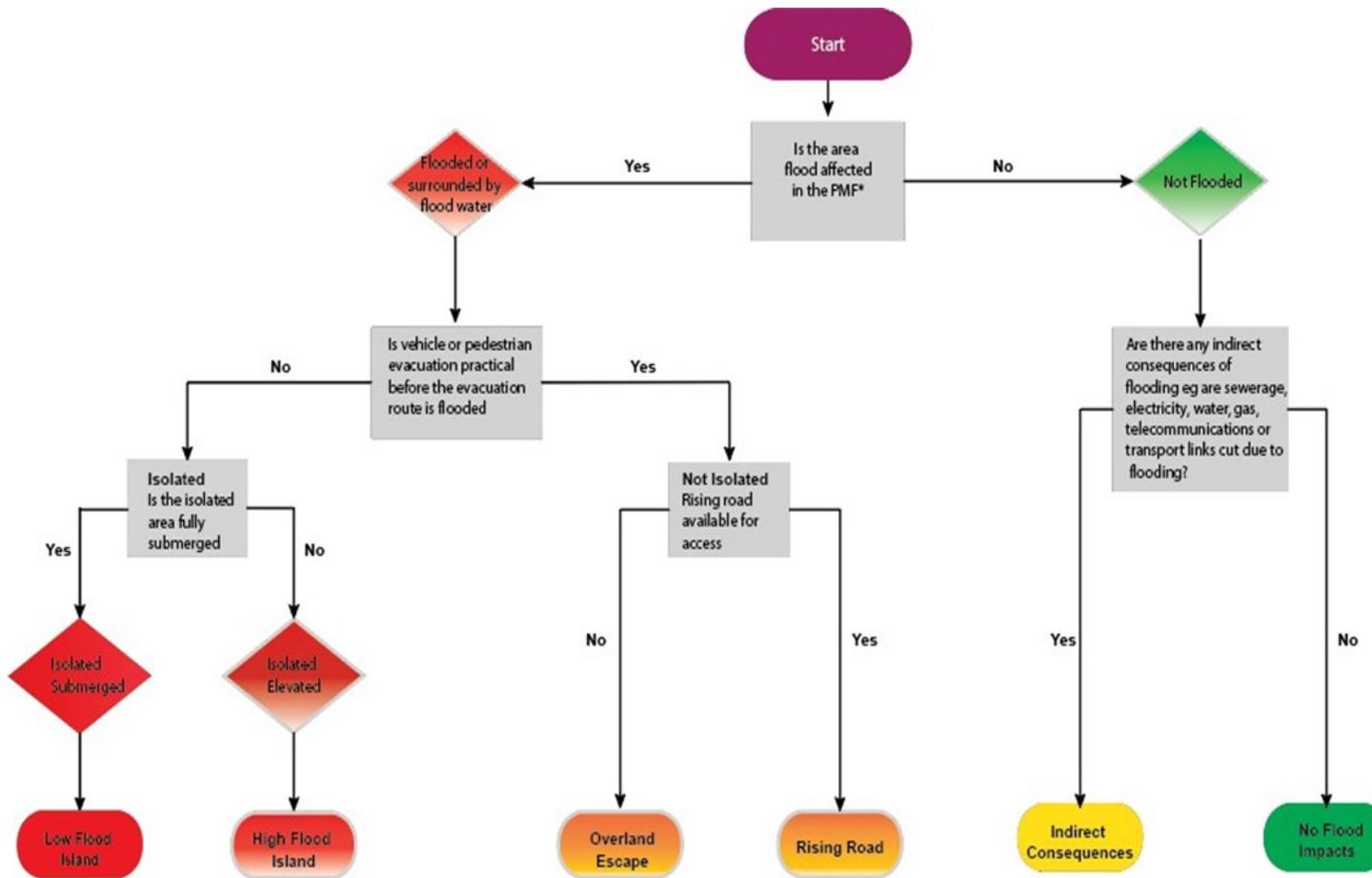
The updated NSW FERCC guide supports the availability of knowledge of emergency management constraints from flood studies. This information can be refined in the FRM study where better information becomes available or where additional breakdown into the cause for isolation (due to flooding or a combination of flooding and impassable terrain) is required to inform emergency management planning. Flow charts for determining FERCCs in flood studies (Figure 2) and where more detail is required (Figure 3) provide the basis for assessing the flood emergency management constraints of land. These flow charts consider both the original 2007 NSW guide and the 2017 equivalent national guide (ADR 2017b).

The guide also recognises the importance of understanding tipping points (Table 1) that would influence emergency response. For example, the height at which external access may be cut isolating an area.

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		✓		✓			
Overground 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		✓	✓	✓	✓	✓	

Table 1 Key considerations/tipping points for areas with different flood emergency response classifications





Note:

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

Figure 3 Flow Chart for Determining more detailed Flood Emergency Response Classifications where required

The FERCCs guide will also inform the flood information needed to inform emergency management from flood studies and FRM studies under the FRM process. These information needs vary depending on the FERCC classification (see Table 1).

This information will assist flood emergency response planning and the development of local flood plans by the NSW SES plan. It will also assist in preparing communities for potential flooding, guide response operations and assist communities to begin their recovery following flood events.

The updated guide on flood information to support emergency management considers the significant changes to the capabilities of modelling software and the delivery of flood information that has occurred since the 2007 NSW guide. It also considers the:

- The transition from 1D to 2D and 1D/2D combinations in modelling
- Improvements in post processors for modelling results including AVIs.
- requirement to hand all information from studies under the Program over through the NSW Flood Data Portal. This provides a direct conduit for flood information flow to OEH and the NSW SES.
- improved clarity of specification of outputs from studies resulting from the implementation of the OEH Brief Development Tool
- changing information needs of the NSW SES.

#### Flood Hazard Categorisation

This new NSW Flood Hazard Categorisation guide provides a basis for understanding how variations in velocity and depth influence flood hazard and how this is to be categorised in future studies under the Program.

It considers ADR FRM Guide 7.3 Flood Hazard (ADR 2017d) and similarly enables the floodplain to be categorised into areas of different flood hazard based on categories H1 to H6 (see Figure 4), for different scales of flood events. An example of mapping of this information is given in Figure 5. The guide also provides a link back to low and high hazard, terms often used in decision making in current NSW practice.

Changing practice, as outlined in the ADR Handbook 7 series of documents, reduces the reliance on hazard mapping alone. It is now more regularly accompanied with FERCCs, flood function mapping, across a range of events. These are now also informing other spatial products, such as FPCC mapping (ADR 2017c), which combines hazard information with other flood related constraints on land so that these can be managed.

This means that the need to develop provisional hazard mapping and then translate this to true hazard is no longer needed. The issues of rate of rise, flood readiness, effective warning time, duration of flooding and type of development still need to be considered in understanding flood risk, so it can inform decision making. However, this is occurring in a different way and will be dealt with separately in the Manual and supporting guides.

The guide provides advice on how flood hazard can influence decisions including:

- Flood risk management. Flood hazard categorisation provides information on the varying scale of flood hazard to people, vehicles and buildings. It can influence flood risk, decisions on managing flood risk, and the types of mitigation measures suitable for managing risk in different areas of the floodplain.

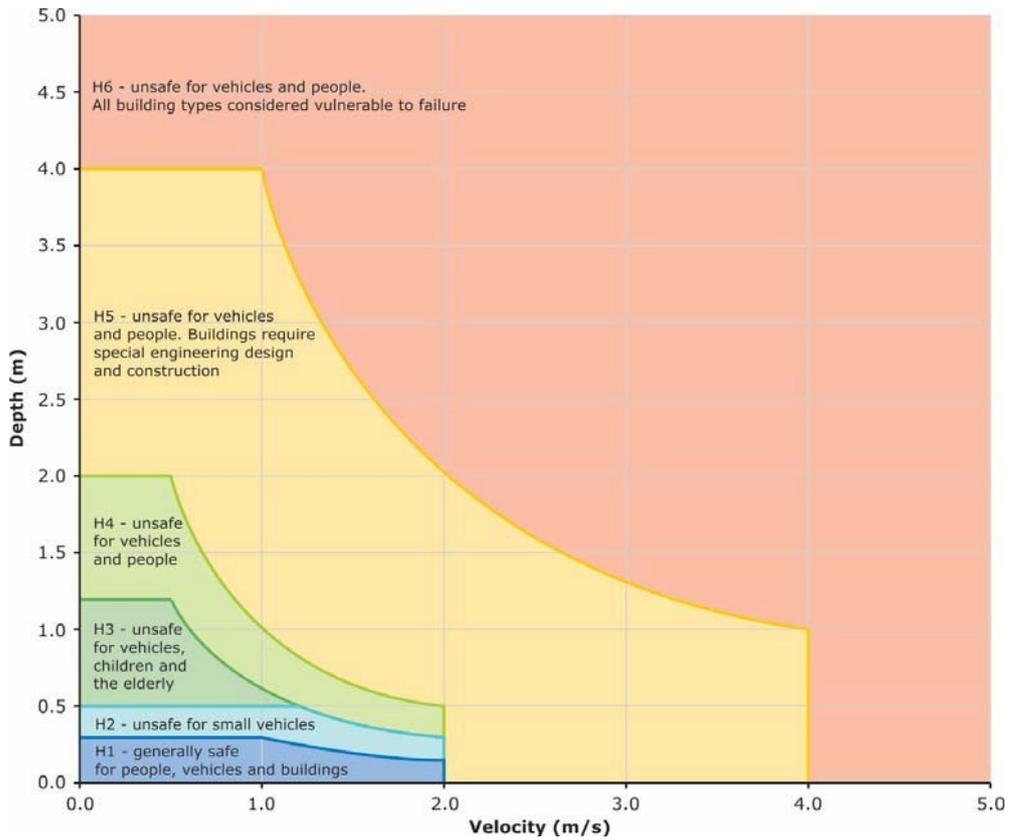


Figure 4 General flood hazard vulnerability curve (Figure 6 ADR 2017b)

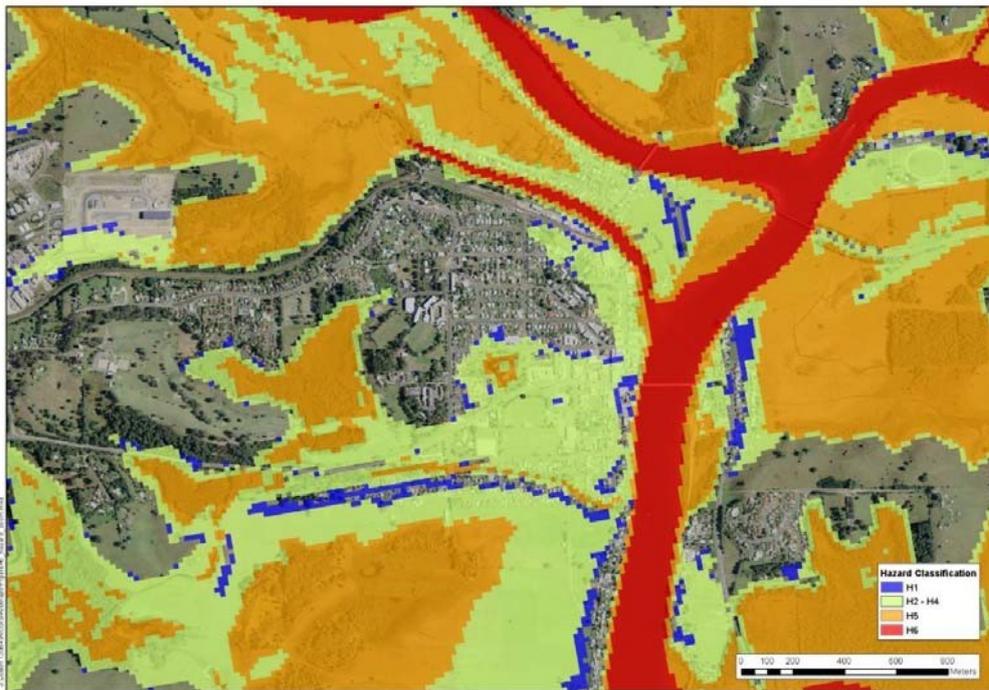


Figure 5 Flood Hazard for Categories H1 combined H2-4 and H5 and H6 for a localised area of a floodplain (Figure A6 ADR 2017b)

- Management of flood hazard. In certain circumstances it is possible to modify flood hazard, generally by modifying flood depth by filling of the floodplain. However, filling the floodplain can affect the key flood functions (see updated FRM Guide: Flood Function of flow conveyance in floodways and flood storage), as well as impacting on local flowpaths. Therefore, modifying flood hazard cannot be looked at in isolation of other factors in decision making.
- Land-use planning. Flood hazard is an important constraint in considering the development of land. Information on where the varying degree of flood hazard to people, vehicles and buildings occurs on land across the floodplain can inform the setting of strategic land-use directions for a community. It is a key consideration used to determine flood planning constraint categories.
- Development controls relating to people safely traversing floodwaters. The threshold values for safety to people presented in this guide are not fit for purpose to use as maximum wading depths in determining the safe conditions for people to traverse floodwaters to safety to support the location of new or infill development in flood affected areas. The guide provides a threshold for limiting depths relating to the stability of capable adults in good conditions, such as in controlled conditions in a laboratory. Any decision relating to flood depths for wading need to consider a wide range of issues including: the varying capability and age of users, the varying conditions that people may need to traverse to safety such as opaque flood waters obscuring the ground surface, uneven ground, trip hazards including debris moved by flood waters and flowing water from local catchments in areas where water may appear relatively still. All these factors reduce the safe wading depths well below the thresholds provided in this guide.
- Building controls. Flood hazard categorisation can identify areas that may warrant additional structural building controls.
- Flood emergency response planning. Flood hazard categorisation can provide an indication of hazardous conditions to people, vehicles and buildings which can assist in emergency management planning and inform the development of Local Flood Plans.

#### Flood Function (Hydraulic Categorisation)

Understanding and maintaining the flood function of the floodplain is important to enable effective flood risk management. The key hydraulic functions of the floodplain are flow conveyance and flood storage in floodways and flood storage areas respectively. Techniques to identify these areas have been evolving, particularly with the increased use of 2D models or models with 2D components (1D-2D Models) which are now the norm in FRM in NSW.

To inform decision making as early as possible in the FRM process, flood function areas need to be identified in flood studies. They may be refined in FRM studies where new information becomes available.

The Flood Function guide provides advice on identifying flood function areas using characteristics of flooding, such as flood depths, levels, and velocities, and on setting and testing acceptable limits for changes and impacts. It aims to improve the derivation of floodway and flood storage areas in studies so that this information is more fit for purpose to inform decision making.

Floodways and flood storage areas should be identified in studies undertaken by councils so that decisions can consider the cumulative impacts of change on flood behaviour. The guide provides advice to councils which should be considered when setting limits for the cumulative impacts of change on flood function. It also provides advice on techniques that can be used to identify flood function areas and the requirements of a good technique. Good techniques need to:

- use calibrated and validated models wherever possible
- be reproducible and objective
- define the limits of the flood function areas based on the landform and hydraulic behaviour during floods and not existing or preferred land use
- define flood function areas across the full range of potential floods because flood function areas will vary with the magnitude of the flood
- include a review of results to ensure that the defined flood function areas are not overly constrained

If a defined floodway is too narrow it will not be able to convey sufficient flood flows. This can lead to new floodways developing in other locations, and flood levels, distribution, and/or inundation times changing beyond acceptable limits.

If flood storage areas are overly constrained, flood levels, distribution, and/or inundation times can be changed beyond acceptable limits.

The results application of a good technique should:

- produce floodways that:
  - are smooth and continuous to and from waterbodies and transition into and out of waterbodies
  - include all the in-bank sections of a waterway (where the majority of flow is conveyed) including as it enters and leaves a waterbody and some of the floodplain
  - include the full width of hydraulic structures (bridges and culverts) in the floodway, except for very wide bridges
- determine the extent of flood storage areas based on their flood function and should not relate purely to the depth of flooding. This requires practitioners to consider the floodplain in question and determine what constitutes “important” storage and what level of impact from filling would adversely affect flood function.

When flood function is mapped in an accurate and reproducible manner it can inform, for example:

- Flood risk management. Flood function categorisation identifies areas which have the functions of conveying or storing floodwaters. These are areas that will be sensitive to change. Understanding the location of these areas can influence the management of flooding including the location of works to mitigate flood risk to the existing community.
- Emergency risk management. Understanding flood function can also give an indication of the variation in flood behaviour. Floodways are generally areas with significant water and often debris movement which can impede evacuation and therefore influence decisions on the suitability of evacuation routes. Floodways, and in some cases flood storage areas, are also areas where the use of temporary mitigation works may alter flood behaviour with adverse impacts on the community.

This needs to be considered in decisions to undertake any such works in response to a flood threat.

- Land-use planning. Flood function is an important constraint to consider in the use and development of land. Information on the location of floodways and flood storage areas can inform the setting of strategic land-use directions for a community. It is a key consideration used to determine FPCCs (ADR 2017c).
- Flood dependent ecosystem management. Understanding flood function can inform decisions that may impact on ecological health of flood dependent ecosystems, particularly on the larger floodplains of the Murray Darling Basin where minor changes in hydraulic connectivity to flood dependent ecosystems can cause adverse ecological impacts.

## Conclusions

NSW OEH, as the lead agency in FRM in NSW, continues to work with other agencies and with NSW local councils to improve the management of flood risk for NSW communities. The update of the Manual and associated guidance is progressing in parallel with other work being undertaken to support local councils and other agencies to improve FRM and consideration of flood information in decisions by both the government and the community.

This project will continue to progress with input in consultation with industry through reference groups, through discussions at Floodplain Management Australia meetings and workshops.

During the review of the Manual and guidelines councils should continue to proceed with their program of current and proposed FRM projects, including those funded under the Program, so that their communities can be better informed and more resilient to flood risk. They should continue to liaise with their regional OEH flood contacts in scoping and delivering projects.

## References

- ADR 2017a Australian Disaster Resilience Handbook 7: Managing the floodplain: A guide to best practice in flood risk management in Australia (2017).
- ADR 2017b Australian Disaster Resilience Guideline 7-2: Flood emergency response classification of the floodplain (2017)
- ADR 2017c Australian Disaster Resilience Guideline 7-5: Flood information to support land-use planning
- ADR 2017d Australian Disaster Resilience Guideline 7-3: Flood hazard
- McLuckie, D., (2017). National Best Practice Guidance in Flood Risk Management – Fitting the Pieces Together, Floodplain Management Australia Conference, Newcastle, May 2017.
- McLuckie, D., Toniato A, (2018). Improving Delivery under the NSW Flood Prone Land Policy, Floodplain Management Australia Conference, Gold Coast, May 2018.
- McLuckie D, Babister, M, Askew, E, Gear, A, Grech, P (2017). Using Flood Planning Constraint Category Mapping in Planning Activities – an example considering NSW Practice, Floodplain Management Australia Conference, Newcastle, May 2017. Note this was presented by Mark Babister at the conference.



McLuckie, D., Toniato, A. Askew, E. Babister, M. Retallick, M. (2016). *Supporting Land use planning by providing improved information from the floodplain management process*, Nowra, Floodplain Management Australia Conference, Nowra, May 2016.

NSW Government (2005). *Floodplain Development Manual*. Department of Infrastructure Planning and Natural Resources. DIPNR 05\_020.

NSW Office of Environment and Heritage (OEH 2019a) draft *Flood Risk Management Guide: Flood Emergency Response Classification of Communities*, OEH, (unpublished)

NSW Office of Environment and Heritage (OEH 2019b) draft *Flood Risk Management Guide: Flood Function*, OEH, (unpublished)

NSW Office of Environment and Heritage (OEH 2019c) draft *Flood Risk Management Guide: Flood Information to Support Land Use Planning*, OEH, (unpublished)

NSW Office of Environment and Heritage (OEH 2019d) draft *Flood Risk Management Guide: Information to Support Emergency Management*, OEH, (unpublished)