# Appendix 3.26.3: International and national examples

## 1.1. Australia

### 1.1.1. New South Wales (NSW) Floodplain Development Manual 2005

#### 1.1.1.1. Introduction

The NSW Floodplain Development Manual is published by the NSW Government. This Manual implements the NSW Flood Prone Land Policy. It sets out high level policy and processes to be followed by the councils of NSW when formulating specific rules for development in flood areas managed by them. The first Manual was published in 1986 and the 2005 version is the third revision. It is administered by the NSW Department of Infrastructure, Planning and Natural Resources.

#### 1.1.1.2. Types of risk managed

The Manual promotes a flexible, merit-based approach to determining appropriate development in floodplains, balancing social, economic, environmental and flood risk parameters. It sets out state-wide, strategic-level policy and principles, but does not contain rules for development (as these are determined by councils). The Manual describes processes to be used by councils for flood planning, including carrying out Floodplain Risk Management studies, preparing Floodplain Risk Management Plans and selecting Flood Planning Levels. A broad risk management hierarchy of avoidance, minimisation and mitigation is used.

#### 1.1.1.3. Definitions

The Manual describes two main ways of defining flood hazards:

- **Flood planning levels** (FPLs) are appropriate flood events identified by councils (e.g. 1% AEP) and an appropriate freeboard as a safety factor, which are incorporated into Floodplain Risk Management Plans. FPLs can differ for different activity types.

- **Probable maximum flood** (PMF) is the largest flood that could conceivably occur. It is not generally possible to provide complete protection against this event, but the consequences need to be addressed when risk planning.

#### 1.1.1.4. Types of development

A range of factors are identified in the Manual that influence what types of development are inappropriate in flood areas and the setting of FPLs. These include:

- Activities with special difficulties evacuating (aged, disabled and childcare facilities, mobile homes and caravan parks, isolated houses, schools, hospitals and community centre)
- Level of occupant awareness (temporary and visitor accommodation)
- Hazardous industries and hazardous storage
- Critical emergency response and recovery facilities and infrastructure.

#### 1.1.1.5. Approaches

The formulation and implementation of Floodplain Risk Management Plans is the cornerstone of the Manual's approach. These plans require an involved process of research, flood studies and options assessment, as set out in the Manual. Floodplain Risk Management Plans are subject to public feedback before adoption.

During the Flood Study phase of the process, scientific and technical data is collected for the full range of flood events up to and including the PMF. Floodplains are categorised into three hydraulic categories – floodways, flood storage and flood fringe, and at least two hazard categories – high and low. These categories are used to influence the type of development considered appropriate for an area.

A Floodplain Risk Management Study is the next step, involving the assessment of options. Options to be considered during this phase are summarised in Table 9 below.

**Table 9: NSW Floodplain Management Approaches**

| Property Modification Measures | Response Modification Measures | Flood Modification Measures |
|---|---|---|
| Zoning | Community Awareness | Flood Control Dams |
| Voluntary Purchase | Community Readiness | Retarding Basins |
| Voluntary House Raising | Flood Prediction and Warning | Levees |
| Building and Development Controls | Local Flood Plans | Bypass Floodways |
| Flood Proofing Buildings | Evacuation Arrangements | Channel Improvements |
| Flood Access | Recovery Plans | Flood Gates |

The floodplain management studies also recommend appropriate Flood Planning Levels for the study area. Different FPLs can apply to different types of activities. Guidance is given in the Manual that FPLs would generally be around the 1% AEP with an appropriate freeboard (500mm) for typical residential development. The guidance states that it may be appropriate for activities with special difficulties evacuating and critical facilities and infrastructure to be subject a higher FPL, possibly the PMF. There is potential for FPLs for commercial and industrial activities to be lower than for residential, if determined appropriate on a merit-based approach.

A Floodplain Risk Management Plan is then to be produced with the involvement of the local community. This plan is to be implemented in part through development controls in Environmental Planning Instruments (land use planning documents of the councils). Another mechanism is a Local Flood Risk Management Policy which summarises the council's approach to flood prone areas. The Manual contains instructions on what this policy should contain, for example:

- Extensions to existing residential developments below the FPL should be subject to the same requirements as new residential developments below the FPL
- Special consideration should be given to managing essential community facilities and critical services
- Sporting grounds and carparks should be considered for flood prone land.

### 1.1.2. Queensland Flood Commission of Inquiry

### 1.1.2.1. Introduction

Prolonged and extensive rainfall over large areas of Queensland, coupled with already saturated catchments, led to flooding of historic proportions in Queensland in December 2010, stretching into January 2011. Thirty-three people died in the 2010/2011 floods; three remain missing. More than 78% of the state was declared a disaster zone; over 2.5 million people were affected. Some 29,000 homes and businesses suffered some form of inundation. The scale of the disaster led to the establishment of the Commission of Inquiry into the Queensland floods of 2010/2011.

This section details a number of key recommendations and comments from the Queensland Flood Commission of Inquiry (QFCI) in relation to flood management. This list is not exhaustive and is a summary of the recommendations detailed in the Commission of Inquiry's final report.

Overall, the Commission noted that in land use planning, attention to flood risk has been ad hoc. Recommendations were made to insert into the land planning system uniform controls which will ensure that the risk of flood is consistently recognised and planning assessments made with regard to it. The Commission also noted that Queensland lacks a coherent approach to floodplain management; and a number of recommendations were made relating to the need for current and comprehensive flood studies and flood mapping, particularly in urban areas.

### 1.1.2.2. Types of risk managed

In terms of flood management planning, the QFCI recommended the following specific risks need to be managed (in addition to the general concerns about habitable floors), due to these risks either having not been managed at all or having been managed inadequately in the past:

- Manufacture and/or storage of hazardous materials in flood plains
- Too much reliance on evacuation plans as a basis for approving developments susceptible to flooding
- The prospect of isolation or hindered evacuation
- Risk assessment of backflow flooding and consideration of the effect of backflow prevention devices
- Consideration of flood resilience of basements as a factor in determining the appropriateness of applications for a material change of use of buildings. This particularly related to basement car parking.

### 1.1.2.3. Flood mapping

The Commission found that additional effort needed to be placed in mapping likely flood events. A flood behaviour map should show information as to likelihood of flooding in particular locations, and the characteristics of the flood, such as velocity, rate of rise and depth. A map showing both likelihood and behaviour is best practice. It allows the risk of flooding to be understood across the full spectrum of floods, thus enabling the appropriate flood-related planning controls to be used in development assessment. Those controls can differ between different 'zones of risk', taking into account the likelihood of flooding alone, the behaviour of flooding alone, or the combination of likelihood and behaviour.

Queensland's State Planning Policy 1/03: *Mitigating the Adverse Impacts of Flood, Bushfire and Landslide* requires planning schemes to nominate a flood event, referred to as a defined flood event, which determines the land subject to flood-related planning controls. Where councils have decided to do so, most have nominated a single flood event with a 1% AEP (Q100) to govern planning decisions in their area.

The Commission notes that this focus on the Q100 and one defined flood event should not continue. Q100 represents only one possible flood. Reliance on a single defined flood event contains this limitation: there are only two areas by reference to which planning controls relevant to flood can be set – the area inside, and the area outside the line depicting the extent of the flood. Restricting development within the extent of the 1% AEP flood will manage a portion of the risk, but it does not deal with the risk of floods that are less frequent, but more severe, or those that will occur more often, but with less damaging consequences. Instead, the various areas to which planning controls apply should be selected having regard to the likelihood, behaviour and consequences of the full range of possible floods, up to and including the probable maximum flood.

For urban areas, or areas where development is expected to occur, councils with the requisite resources should develop a flood map which shows 'zones of risk' (at least three) derived from information about the likelihood and behaviour of flooding. Councils without the requisite resources to produce a flood behaviour map should develop a flood map which shows the extent of floods of a range of likelihoods (at least three).

### 1.1.2.4. Management of Development

The Commission recommended that councils consider using the state sanctioned "limited development" (constrained land) zone in their planning schemes for areas that have a very high flood risk. In addition, it was recommended that the Queensland Government should:

- *include in model flood planning controls, a model planning scheme policy that:*
  - *a. for development proposed on land susceptible to flooding, outlines what additional information an applicant should provide to the assessment manager as part of the development application, or*
  - *b. for development proposed on land where the potential for flooding is unknown, requires an applicant to provide:*
    - *i. as part of the development application, information to enable an assessment of whether the subject land is susceptible to flooding, and*
    - *ii. upon a determination the subject land is susceptible to flooding, more detailed information, to allow an assessment of the flood risk.*
- *ensure that the criteria under the Environmental Protection Act 1994 that apply to the assessment of development applications for material change of use include consideration of the risk of flooding at the site on which the activity is proposed to occur.*

- *draft assessment criteria to be included in the model flood planning controls that require that:*
  a. *the manufacture or storage of bulk hazardous materials (as defined in State Planning Policy 1/03) take place above a certain flood level, determined following an appropriate risk based assessment, or*
  b. *structures on land susceptible to flooding and used for the manufacture or storage of bulk hazardous materials (as defined in State Planning Policy 1/03) be designed to prevent the intrusion of floodwaters.*

  *When approving applications for development which involve the manufacture or storage of hazardous materials, councils should not restrict the conditions imposed to ones which are solely reliant on human intervention to remove the materials in the event of flood.*

- *consider drafting assessment criteria to be included in the model flood planning controls which require that works in a floodplain:*
  a. *do not reduce on-site flood storage capacity*
  b. *counteract any changes the works will cause to flood behaviour of all floods up to and including the applicable defined flood event by measures taken within the subject site (for example, use of compensatory works, detention basins or other engineering mechanisms)*
  c. *do not change the flood characteristics outside the subject site in ways that result in:*
     i. *loss of flood storage*
     ii. *loss of/changes to flow paths*
     iii. *acceleration or retardation of flows, or*
     iv. *any reduction in flood warning times elsewhere on the floodplain.*
- *draft assessment criteria to be included in the model flood planning controls that address:*
  a. *the prospect of isolation or hindered evacuation*
  b. *the impact of isolation or hindered evacuation.*

The Commission further recommended that councils should not rely on a condition requiring an evacuation plan as the sole basis for approving a development susceptible to flooding. In addition, councils should consider amending their planning schemes to include provisions directed to consideration of the flood resilience of basements as a factor in determining the appropriateness of a material change of use.

## 1.2. United Kingdom

### 1.2.1. Planning Policy Statement 25

#### 1.2.1.1. Introduction

"Planning Policy Statement 25: Development and Flood Risk" (PPS 25) sets out the UK Government's national policies on flood risk management as part of land use planning in England. Originally published in 2006, it was revised in December 2009 following the Pitt enquiry into widespread flooding during 2007.

The policies in the PPS have to be taken into account by regional planning bodies in the preparation of Regional Spatial Strategies, by the Mayor of Greater London in relation to the Spatial Development Strategy in London and, in general, by local planning authorities in the preparation of local development documents and in decisions on individual planning applications.

### 1.2.1.2. Types of risk managed

The aims of the PPS is to ensure the flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk. Where new development is, exceptionally, necessary in such areas, the policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall.

### 1.2.1.3. Different approaches

The PPS requires regional planning bodies and local planning authorities to prepare and implement planning strategies that help to deliver sustainable development through approaches including:

*Appraising risk*

- Identifying land at risk and the degree of risk of flooding from river, sea and other sources in their areas;
- Preparing Regional Flood Risk Appraisals or Strategic Flood Risk Assessments as appropriate, as freestanding assessments that contribute to the Sustainability Appraisal of their plans;

*Managing risk*

- Framing policies for the location of development which avoid flood risk to people and property where possible, and manage any residual risk, taking account of the impacts of climate change;
- Only permitting development in areas of flood risk where there are no reasonably available sites in areas of lower flood risk and benefits of the development outweigh the risks from flooding;

*Reducing risk*

- Safeguarding land from development that is required for current and future flood management (e.g. conveyance and storage of flood water and flood defences);
- Reducing flood risk to and from new development through location, layout and design, incorporating sustainable drainage systems (SUDS);

- Using opportunities offered by new development to reduce the causes and impacts of flooding (e.g. surface water management plans; making the most of the benefits of green infrastructure for flood storage, conveyance and SUDS; recreating functional floodplain and setting back defences.

#### 1.2.1.4. Assessment matters

A sequential risk-based approach to determining the suitability of land for development in flood risk areas is central to the PPS and is required to be applied at all levels of the planning process.

The overall aim of decision-makers should be to steer new development to Flood Zone 1. Where there are no reasonably available sites in Flood Zone 1, decision-makers identifying broad locations for development and infrastructure, allocating land in spatial plans or determining applications for development at any particular location should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2, applying the Exception Test if required.

Only where there are no reasonably available sites in Flood Zones 1 or 2 should decision-makers consider the suitability of sites in Flood Zone 3, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required.

Within each Flood Zone, new development should be directed first to sites at the lowest probability of flooding and the flood vulnerability of the intended use is matched to the flood risk of the site, e.g. higher vulnerability uses located on parts of the site at lowest probability of flooding.

The three different flood zones are described in Table 10 below:

**Table 10: Annual probabilities of flooding associated with PPS25 Flood Zones**

| Flood Zone | Annual probability of flooding |
|---|---|
| 1 | < 1 in 1,000 (<0.1 %) from river or sea flooding |
| 2 | Between 1 in 1,000 (0.1%) and 1 in 100 (1%) for river flooding or between 1 in 1,000 (0.1%) and 1 in 200 (0.5%) for flooding from the sea |
| 3a | > 1 in 100 (>1%) for river flooding and > 1 in 200 (>0.5%) for flooding from the sea |
| 3b | Functional floodplain (see paragraphs 4.87-4.95 below). |

The PPS then goes on to describe less and more vulnerable activities. This classification is important in how development is to be managed. Activities are grouped into four main types, based on their tolerance of flood related effects, as set out in the Table 11 below.

**Table 11: Flood Risk Vulnerability Classification, Table D2 in PPS25**

| | |
|---|---|
| Essential Infrastructure | • Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.<br>• Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.<br>• Wind turbines. |
| Highly Vulnerable | • Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations required to be operational during flooding.<br>• Emergency dispersal points.<br>• Basement dwellings.<br>• Caravans, mobile homes and park homes intended for permanent residential use.<br>• Installations requiring hazardous substances consent.[19] (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure'[20]). |
| More Vulnerable | • Hospitals.<br>• Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.<br>• Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels.<br>• Non–residential uses for health services, nurseries and educational establishments.<br>• Landfill and sites used for waste management facilities for hazardous waste.[21]<br>• Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan. |

| | |
|---|---|
| Less Vulnerable | • Police, ambulance and fire stations which are *not* required to be operational during flooding.<br>• Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non–residential institutions not included in 'more vulnerable'; and assembly and leisure.<br>• Land and buildings used for agriculture and forestry.<br>• Waste treatment (except landfill and hazardous waste facilities).<br>• Minerals working and processing (except for sand and gravel working).<br>• Water treatment works which do not need to remain operational during times of flood.<br>• Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place). |
| Water-compatible Development | • Flood control infrastructure.<br>• Water transmission infrastructure and pumping stations.<br>• Sewage transmission infrastructure and pumping stations.<br>• Sand and gravel workings.<br>• Docks, marinas and wharves.<br>• Navigation facilities.<br>• MOD defence installations.<br>• Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.<br>• Water-based recreation (excluding sleeping accommodation).<br>• Lifeguard and coastguard stations.<br>• Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.<br>• Essential ancillary sleeping or residential accommodation for staff required by uses in this category, **subject to a specific warning and evacuation plan.** |

Based on this categorisation, the PPS goes on to set out the management approach, based on the flood zone framework. As can be seen in Table 12 below, in Flood Zone 3 (generally equivalent to 1% AEP), less vulnerable activities are possible, subject to specific assessment of flood risks and mitigation measures (Flood Risk Assessment, or FRA). More vulnerable activities should not locate in Flood Zone 3 areas unless the benefits of so doing significantly outweigh the costs (based on the Exception Test).

**Table 12: Flood Risk Vulnerability and Flood Zone 'Compatibility', Table D3 in PPS 25**

| Flood Risk Vulnerability classification (see Table D2) | | Essential Infrastructure | Water compatible | Highly Vulnerable | More Vulnerable | Less Vulnerable |
|---|---|---|---|---|---|---|
| Flood Zone (see Table D.1) | Zone 1 | ✔ | ✔ | ✔ | ✔ | ✔ |
| | Zone 2 | ✔ | ✔ | Exception Test required | ✔ | ✔ |
| | Zone 3a | Exception Test required | ✔ | ✗ | Exception Test required | ✔ |
| | Zone 3b 'Functional Flood plain' | Exception Test required | ✔ | ✗ | ✗ | ✗ |

Key:

✔ Development is appropriate

✗ Development should not be permitted

The Exception Test covers the necessity of more vulnerable activities to locate in Flood Zone 3 areas. For the Exception Test to be passed:

a) It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk.

b) The development should be on developable previously-developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously-developed land; and

c) It must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

The Exception Test can only be applied by decision-makers after the Sequential Test (the sequence described above) has been applied and in the circumstances shown in Table 6 above, i.e. when 'more vulnerable' development and 'essential infrastructure' cannot be located in Flood Zones 1 or 2 and 'highly vulnerable' development cannot be located in Zone 1. It cannot be used to justify 'highly vulnerable' development in Flood Zone 3a, or 'less vulnerable'; 'more vulnerable'; and 'highly vulnerable' development in Flood Zone 3b.

The PPS also addresses minor development and changes of use of existing buildings in flood plains.

- Applications for minor development and changes of use should not be subject to the Sequential or Exception Tests but will still have to meet the requirements for FRAs and flood risk reduction set out in the PPS.
- Minor developments are unlikely to raise significant flood risk issues unless they would:
  a. have an adverse effect on a watercourse, floodplain or its flood defences;
  b. would impede access to flood defence and management facilities; or
  c. where the cumulative impact of such developments would have a significant effect on local flood storage capacity or flood flows.

Caravans and Camping; Chalets and Mobile Homes (including Gypsy and Traveller Sites)

- Land used for holiday or short-let caravans and camping, other temporary occupancy sites and permanently occupied caravan, mobile home and 'park home' sites that use similar structures give rise to special problems in relation to flooding. Caravan or park-home sites intended for permanent occupation are regarded as 'highly vulnerable'. The instability of such structures places their occupants at special risk and they are likely to be occupied during periods when flood risk is likely to be higher.
- Sites intended for temporary occupation are classified as 'more vulnerable' because they are usually occupied at times of the year when flood events are less likely to occur, although they may be located for amenity and recreational reasons on coastal or riverside sites with a high residual risk of flooding. However, the attractiveness of waterside sites for holiday accommodation also has to be recognised, provided that proper warning and evacuation arrangements are put in place through appropriate planning conditions.
- In either case, the Sequential Test and Exception Test should be used by decision-makers (where applicable, – remembering that 'highly vulnerable' development should not be permitted in Zones 3a and 3b and 'more vulnerable' development should not be permitted in Zone 3b).

## 1.3. United States

### 1.3.1. Denver Urban Drainage and Flood Control District

The Denver Urban Drainage and Flood Control District Floodplain Regulations is one example of a very wide range of locally-based management approaches used in the US. The Denver Regulation was pointed out to us by a member of Auckland Council's stormwater unit as being a representative approach.

The Denver regulations have been established to promote public health, safety, and general welfare; to minimise flood losses in areas subject to flood hazards and to promote wise use of the flood plain.

The specific purposes of the regulations are:

- To reduce the hazards of floods to life and property by:
    i. Prohibiting certain uses which are dangerous to life or property in time of flood.
    ii. Restricting uses which would be hazardous to the public health in time of flood.
    iii. Restricting uses which are particularly susceptible to flood damage, so as to alleviate hardship and eliminate demands for public expenditures for relief and protection.

iv. Requiring permitted flood plain uses, including public facilities which serve such uses, to be protected against floods by providing flood proofing and general flood protection at the time of initial construction.

- To alert flood plain occupants or potential occupants to flood damages, which may result from their own, or other, land use and which is or may be undertaken without full realisation of the danger by:
  i. Regulating the manner in which structures designed for human occupancy may be constructed so as to prevent danger to human life within such structures.
  ii. Regulating the method of construction of water supply, sanitation systems and other utilities, so as to prevent disease, contamination and unsanitary conditions.
  iii. Delineating and describing areas that could be inundated by floods so as to protect individuals from purchasing flood plain lands for purposes which are not in fact suitable.

- To protect the public from the burden of avoidable financial expenditures for flood control and relief by regulating all uses within the flood plain areas so as to produce a method of construction and a pattern of development which will minimise the probability of damage to property and loss of life or injury to the inhabitants of the flood hazard area.

- To protect the storage capacity of flood plains and to assure retention of sufficient floodway area to convey flood flows which can reasonably be expected to occur by:
  i. Regulating filling, dumping, dredging, and alteration of channels by deepening, widening, or relocating.
  ii. Prohibiting unnecessary and damage-creating encroachments.
  iii. Encouraging open space uses such as agriculture and recreation.

- To protect the hydraulic characteristics of the small watercourses, including the gulches, sloughs and artificial water channels used for conveying flood waters, which make a portion of the urban drainage system by:
  i. Regulating filling, dumping and channelisation so as to maintain natural storage capacity and slow flow characteristics.
  ii. Prohibiting encroachment into the small watercourses to maintain their water carrying capacity.
  iii. Encouraging uses such as greenbelt, open space, recreation and riding trails.

The Regulations go on to set out a number of activities that require permits where they are located within flood plains. Flood plains are separated into three different areas:

- Flood regulatory area - the 100 year flood plain.
- Floodway area - 100-year flood which is characterized by hazardous and significant depths and velocities.
- Flood storage area - the fringe portion of the flood regulatory area in which flows are characteristically of shallow depths and low velocities.

Activities within the Flood Regulatory area include:

Permitted Uses

- Agricultural uses such as: general farming, pasture, truck farming, forestry, sod farming, and wild crop harvesting;
- Industrial-commercial uses such as: loading areas, parking areas, airport landing strips, and storage yards for equipment or machinery easily moved or not subject to flood damage;
- Public and private recreational uses not requiring "permanent or temporary structures" designed for human habitation such as: parks, swimming areas, golf courses, driving ranges, picnic grounds, wildlife and nature preserves, game farms, fish hatcheries, shooting preserves, target ranges, trap and skeet ranges, and hunting, fishing and hiking areas.

Special Exceptions: The following uses may be permitted only upon the issuance of a special exception permit by the Flood Plain Administrator:

- Residential Construction. New construction or substantial improvement of any residential structure may be permitted only upon a finding by the Flood Plain Administrator that the lowest floor, including basement, is to be elevated to or above the flood protection elevation.

- Non-residential Construction. New construction or substantial improvement of any commercial, industrial or other non-residential structure may be permitted only upon a finding by the Flood Plain Administrator that the lowest floor, including basement, is to be elevated to or above the flood protection elevation or, together with attendant utility and sanitary facilities, is to be flood proofed so that below the flood protection elevation the structure is water tight and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy. A registered professional engineer or architect shall certify to the Flood Plain Administrator that the standards of this subsection are satisfied.

Within the Floodway area additional provisions apply:

- No encroachments, including fill, new construction, substantial improvements, or other development shall be permitted within the Floodway District that would result in any increase in flood levels during the occurrence of the 100-year flood.
- No mobile homes shall be placed in the Floodway District.
- No building designed for human occupancy shall be placed in the Floodway District.

## 1.4. New Zealand

A number of councils in New Zealand are updating and expanding their district plan provisions relating to flood plain management. The following are some examples from outside the Auckland region.

### 1.4.1. Hamilton City Council Draft Plan Change

#### 1.4.1.1. Introduction

The 2012 Draft Hamilton City District Plan Discussion Document included a discussion on natural hazards and changes to the provisions applying to development in flood plain areas. The proposed rezoning of properties to identified Flood Hazard Areas was disputed by many residents and the Council has subsequently put on hold further consultation of this part of the District Plan review. However, despite the issues with the flood modelling, the objectives, policies and rules framework provides a useful indication of the direction Hamilton City Council are promoting in relation to flood hazard management.

#### 1.4.1.2. Flood hazards

The proposed provisions identified that land may fall within one or more hazard areas as set out within the Planning Maps. In relation to flood hazards, these areas are:

- High Flood Hazard Area
- Medium Flood Hazard Area
- Low Flood Hazard Area.

The Low, Medium and High Flood Hazard Areas have been derived from flood hazard modelling. Two levels of modelling have been completed. The first is a broad level assessment that covers the whole City while the second targets various sub-catchments to a greater level of detail. Where detailed modelling is available it is used instead of the broad level modelling.

The potential consequences of allowing activities within areas affected by natural hazard events vary according to the nature and scale of the proposed activity. The hazard areas identified within the draft District Plan are affected by potentially significant hazards. Most activities within these areas will involve the preparation of a Risk Assessment Report as part of information requirements for building and resource consents.

The draft Plan notes that some land uses have the effect of concentrating people into defined locations. Concentrating people in locations (e.g. residential activities at urban densities) that may be subject to natural hazards creates a greater risk than if the land was used only for lower population uses.

Some activities are vital for emergency response and disaster recovery, including hospitals, emergency service facilities, and lifeline utilities. These activities need to be located in areas where their exposure to natural hazards is minimised. In some situations it will be impossible to provide lifeline utility services to the City without entering a hazard area (e.g. Three Waters infrastructure or the strategic transport network crossing the Waikato River). Where it has been established that there is no reasonable or practical alternative that would avoid a hazard area, then the activity should be allowed to proceed in a manner that minimises the level of risk.

Some activities are not sensitive to the effects of natural hazards and are considered low risk. These should be allowed to occur in hazard areas. These may include, for example, outdoor recreational spaces and their associated activities. This ensures that the land is still able to contribute towards the functioning of the City while minimising the consequences of a natural hazard event.

New activities should not be allowed to create a new, or exacerbate an existing, hazard, e.g. development which diverts flood water on to a neighbouring site or alters the hydrological capacity of a flood plain. These include walls, fences, earthworks, vegetation removal, construction of buildings and structures, and increasing impervious surfaces.

#### 1.4.1.3. Proposed activity controls

Activities are listed as being either tolerant of flood hazards or vulnerable to such hazards.

Tolerant land uses are generally permitted within the identified hazard areas. Tolerant land uses include recreational activities; farming, horticultural or domestic gardening activities; storage of goods and materials (excluding hazardous facilities).

Vulnerable activities cover most urban activities, including residential, industrial, retail, educational and community land uses. Within the High Hazard area, all such vulnerable activities are non-complying. Within the medium hazard area, the following are non complying:

- Residential
- Child care
- Schools

The other activities are discretionary (e.g. industrial, office, retail, tertiary, health care).

Separately listed is essential infrastructure, which includes hospitals, emergency service facilities and ground level lifeline utilities.

Policies to guide assessment of non-complying and discretionary activities include:

- New essential service infrastructure shall avoid areas affected by flood hazards if the activity could become unusable or inaccessible during flood events.

- New essential service infrastructure shall be allowed in areas affected by flood hazards only when:
  - They cannot reasonably or practicably be located elsewhere
  - The adverse effects of a flood event on the infrastructure are minimised
  - Overland flow paths have been avoided

- New subdivision, use and development within a Medium Flood Hazard Area shall be allowed only when:
  - The adverse effects of a flood event on vulnerable activities have been minimised
  - The activity will not create a new or exacerbate an existing flood hazard.

### 1.4.2. Clutha District Council

#### 6.14.2.1. Introduction

In 2012, Clutha District Council and Otago Regional Council jointly released for comment the Draft Flood Risk Management Strategy for Milton and the Tokomairiro Plain. Flooding has been a hazard for the Milton area since European settlement in the 1850s.

The strategy's objectives are to help the community understand and be better prepared for the effects of future flooding, and to ensure that the way land is used does not increase flood risk, and the existing risks to the community are reduced. The combined effect of these activities is to ensure Milton can continue to grow and prosper in a safe and effective way.

### 6.14.2.2. Management approaches

The methods proposed in the strategy to address flood management have been grouped as:

- Personal accountability (readiness and response)
- Defining and protecting access and escape pathways
- Managing risks posed to and by community infrastructure and services
- Enabling relocation out of hazardous areas / redevelopment into safe areas
- Land use controls
- Ensuring adequate floodwater conveyance and efficient drainage
- Preventing alteration of overland flow paths
- Preventing the creation of new flood hazard, or the aggravation of existing flood hazard.

The strategy proposes the inclusion of a range of land use controls in the Clutha District Plan. They include:

- The avoidance of development in areas where an unacceptable level of flood hazard has been identified.
- That suitable forms of new development and redevelopment occur in areas of moderate flood hazard, so that there is no increase in risk over time.
- Where development has already occurred in areas subject to flooding, the existing flood risk is gradually reduced over time.

The strategy proposes the following flood hazard zones and land use controls:

**Table 13: Milton and Tokomairiro River flood hazard zones**

| Area | Proposed land use controls |
|---|---|
| 1A Tokomairiro River floodplain | Residential and other buildings will require resource consent. Consent applications will need to show that the development can occur in a way that will not be susceptible to flooding, and that it will not adversely affect neighbouring properties. |
| 1B Tokomairiro River floodway corridor | Residential buildings will be non-complying. They will require resource consent, and will generally not be approved unless there are exceptional circumstances. Other buildings will also require resource consent, but can be approved provided that they do not increase flood risk elsewhere. A review of the appropriateness of industrial activity within this area is also planned. |
| 2A, 2B Low-lying ponding areas | New development and redevelopment can take place, but will require resource consent to ensure that:<br>• Floor heights are above the level to which flooding can occur<br>• Buildings are constructed in a manner that can cope |

| Area | Proposed land use controls |
|---|---|
| | with extended periods of inundation<br>• Buildings can be accessed and evacuated easily during a flood event |
| 3A Urban area excluding 2A, 2B & 3B | No additional land use controls are proposed |
| 3B Urban floodway corridor | New development and redevelopment can take place, but will require resource consent to ensure that:<br>• Areas of excessive depth or velocity are avoided<br>• Floor heights are above the level to which flooding can occur<br>• Buildings are constructed in a manner that can cope with extended periods of inundation<br>• Buildings can be accessed and evacuated easily during a flood event<br>• It does not cause flood flows to be redirected onto neighbouring properties |
| 4A Rural and semi-rural floodplain | No additional land use controls are proposed |
| 4B Rural and semi-rural floodway corridor | New development and redevelopment may be able to take place in certain circumstances, but will require resource consent to ensure that:<br>• Areas of excessive depth or velocity are avoided<br>• Floor heights are above the level to which flooding can occur<br>• Buildings are constructed in a manner that can cope with extended periods of inundation<br>• Buildings can be accessed and evacuated easily during a flood event<br>• It does not cause flood flows to be redirected onto neighbouring properties |

### 1.4.3. Upper Hutt City Council Proposed Plan Change 15

#### 1.4.3.1. Introduction

Upper Hutt City Council notified Proposed Plan Change 15 on 3 October 2012. This plan change seeks to introduce flood hazard information for the Mangaroa River into the district plan, and to update and expand flood hazard information for the Hutt River. It seeks to manage development within identified flood hazard areas appropriately through proposed objectives, policies, rules and maps. Data from flood mapping work by the Greater Wellington Regional Council was used to identify the flood hazard areas. Erosion hazards are also to be managed as part of this plan change.

#### 1.4.3.2. Flood Hazard Area

A 'Flood Hazard Area' is to be shown on the planning maps and within this, four sub-areas will be shown on an additional series of hazard maps. These sub-areas are:

- River Corridor (the minimum area of land adjacent to the river able to contain a major flood and enable water to pass safely to the sea)
- Overflow Path (a channel for flood waters often characterised by fast flowing water during a flood event)
- Ponding Area (area where slower-moving waters could pond either during or after a flood event)
- Erosion Hazard Line (a line showing land potentially at risk of erosion from river movement or flood water – this may overlap with other sub-areas or be outside them).

The proposed hazards policy states that in areas at high risk from natural hazards, most forms of residential, industrial or commercial development would not be considered appropriate and should be avoided, unless it is shown that the effects, including residual risk, will be managed appropriately. It states that the Council will discourage activities such as emergency services, the storage of bulk hazardous substances, and key network facilities services critical for the ongoing function of utility services (e.g. electricity transformers, water and wastewater pumping facilities) from locating in areas at high risk from natural hazards.

The proposed new / amended rules control the following activities:

- Buildings and structures within the Ponding Area are a discretionary activity, and buildings and structures within the River Corridor, Overflow Path or Erosion Hazard Line are a non-complying activity.

- As exemptions to the above, one accessory building of 20m² or less floor area is permitted in the Ponding Area, and wire and post fences and gates less than 1.2m in height are not included in the definition of 'structure'.

- Subdivision within the Ponding Area is a discretionary activity, and subdivision within the River Corridor, Overflow Path or Erosion Hazard Line is a non-complying activity.

- Earthworks within the Flood Hazard Area (except flood mitigation works undertaken by a local authority on community flood protection grounds, and works that have regional consent) are a restricted discretionary activity.

- The construction, operation and maintenance of selected utilities within the Flood Hazard Area (transformers, water and wastewater pumping stations, telecommunication and radio communication facilities (excluding cables and lines)) are a discretionary activity.

- Storage of hazardous substances in the Flood Hazard Area is a discretionary activity.