



Planning for stronger, more resilient floodplains



Part 1 – Interim measures to support floodplain management in existing planning schemes



The scale and scope of the weather events which affected Queensland in 2010/2011 meant that to plan and build stronger, more resilient communities into the future, Councils need better information to make informed decisions about how and where we build.

To assist Queensland's Councils, the Queensland Reconstruction Authority (the Authority) has undertaken the largest floodplain mapping exercise in the State's history. The maps contained in the toolkit - **Planning for stronger, more resilient floodplains** are drawn from evidence of past flooding, including soils, topography and satellite imagery.

They are informed by the 2010/2011 summer disasters but do not represent the actual flood line for that period. Why? Because while the whole of Queensland was affected last summer, we know there have been larger floods in some areas in the past. What the maps do show are areas where inundation has previously occurred or may occur. At the conclusion of this mapping exercise, floodplain mapping will be available for the whole of Queensland.

The State's river systems do not stop at local government boundaries and so for the first time, these floodplain maps have been developed on a sub-basin wide basis. And with them, comes the opportunity for Councils to adopt the floodplain maps and supporting development controls into existing planning schemes.

This Guideline provides Councils - especially those who lack the resourcing capacity to undertake detailed studies - with a ready-made toolkit to help assess future development applications and the opportunity to better align floodplain management and land use planning.



Rockhampton
Source: Queensland Image Library

Part 1 Consultation period

On 17 September 2011, the Honourable Anna Bligh MP, Premier and Minister for Reconstruction, launched the guideline **Planning for stronger, more resilient floodplains - Part 1 - Interim measures to support floodplain management in existing planning schemes**. The Part 1 Guideline was open for consultation for 40 business days, closing on 11 November 2011.

During the consultation period, the Authority together with a representative from the Department of Environment and Resource Management (DERM) visited and briefed 34 Councils individually and undertook 29 industry briefings. These sessions were an invaluable exercise and in the case of each Council, allowed targeted consideration of the toolkit and its potential use.

A Consultation Report was prepared to provide an overview and analysis of the submissions and feedback received during the consultation period. The Authority duly considered the feedback received during the consultation period in the finalisation of this Guideline.

A copy of the Consultation Report is available at www.qldreconstruction.org.au.

The Authority acknowledges the following organisations that have provided their support to this important program of work:

- Geoscience Australia
- Banana Shire Council
- Fitzroy Basin Association
- Central Highlands Regional Council
- Local Government Association of Queensland
- Bureau of Meteorology
- CSIRO



The journey towards stronger, more resilient floodplains

Most of our towns and cities are located on floodplains, both inland and coastal. This is an historical fact, principally for reasons associated with water supply, transportation, waste disposal, advantageous points for river crossings, access to productive soils or recreation purposes. Hence, these towns and cities will be subject to flooding from time to time.

Put simply, if we are to use floodplains for these purposes, we need to acknowledge and plan for flooding in a way that improves resilience of our built form and encourages the safety and well being for our communities and individuals.

Seeing significant change in Queensland's floodplains will be generational – the full implementation of this improved resilience will be seen over time through specific shifts in local land use planning policy and development assessment decision-making that take account of the vulnerabilities of development in the floodplain. However, through interim changes to the way development is addressed in these risk areas, real steps can be taken now to ensure new development in Queensland's floodplains considers and responds to adverse flood events.

The key to ensuring our State copes with these flood events is improving the resilience of our communities. In response, the Authority has prepared the two-part Guideline **Planning for stronger, more resilient floodplains**.

As demonstrated in **Figure 1**, an important aim of **Planning for stronger, more resilient floodplains** is to provide a fit-for-purpose response to help Councils introduce consistent and specific planning controls to manage flood risks in the floodplain assessment area.

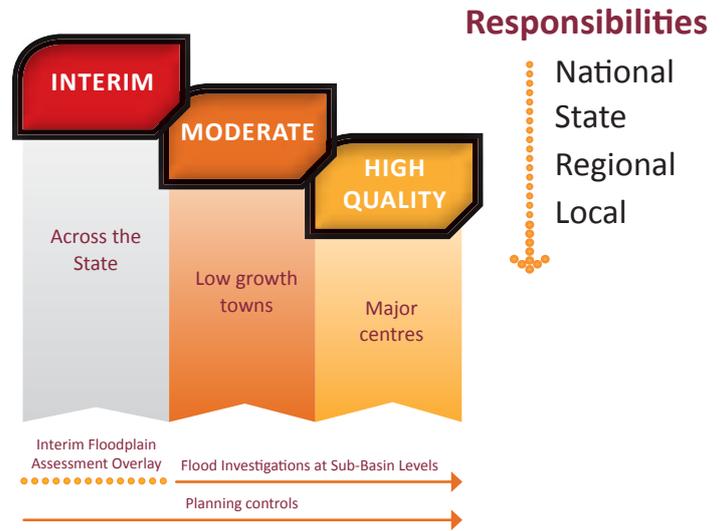
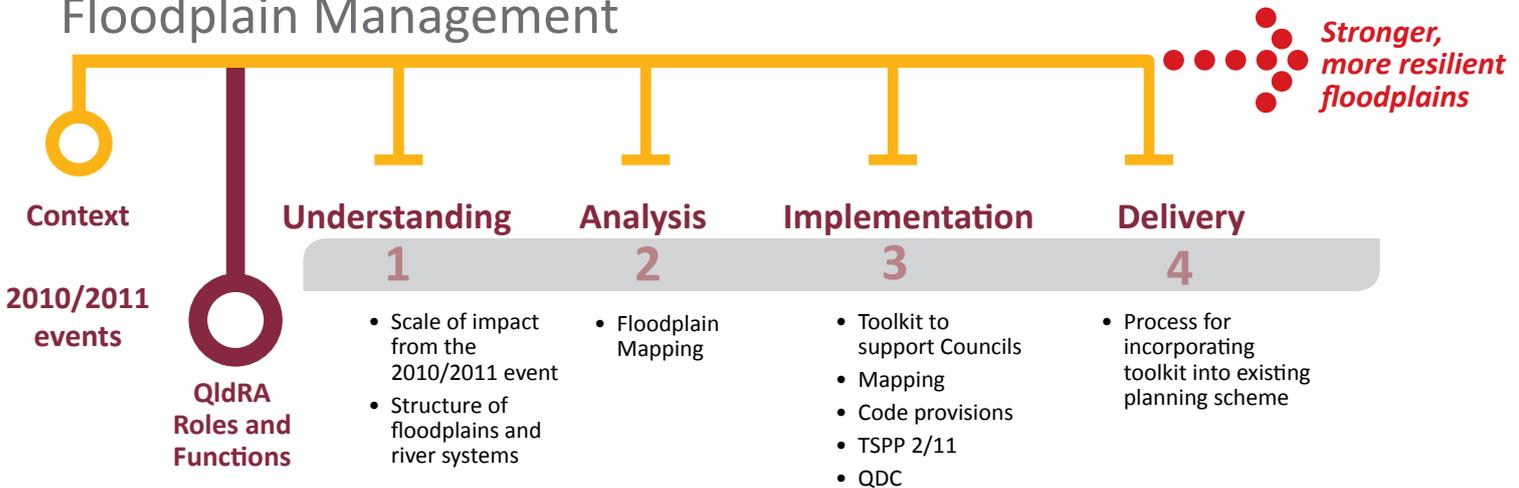


Figure 1: Fit-for-purpose flood mapping

Part 1 represents an interim response that can be applied across the entire State. Part 1 includes the development of an *Interim Floodplain Assessment Overlay* incorporating a mapping product and supporting planning scheme provisions. A major driver of this Guideline is the ability to provide low growth Councils with workable products now, in lieu of detailed flood investigations which will take significant time and resources to complete across the State. It is recognised that not all Councils will benefit from Part 1 as some Councils are well advanced with flood mapping and planning scheme provisions. However, all Councils can learn from recent events and incorporate the principles of floodplain management in the development and preparation of their new planning schemes.

Floodplain Management



Planning for stronger, more resilient floodplains aims to help Councils introduce consistent and specific planning controls to manage flood risks.

Key information is provided throughout this Guideline. It is marked with this symbol. It has been provided courtesy of the Queensland Floods Science, Engineering and Technology Panel *Understanding Floods – Questions and Answers*.

A full copy of this document can be downloaded from:

www.chiefscientist.qld.gov.au



The management of our floodplains is complex. Balancing the role of the floodplain from protection of agriculture and the environment, to stimulating economic growth and supporting new population growth is a difficult process to manage. Each has its role and arguably each is as important as the other.

To ensure that Queensland learns from the recent natural disasters the Authority has partnered with the Department of Local Government and Planning (DLGP) including Building Codes Queensland (BCQ), DERM and the Department of Community Safety (DCS) to deliver a body of work supporting greater resilience and understanding of our floodplains and to better inform and influence the land use planning process.

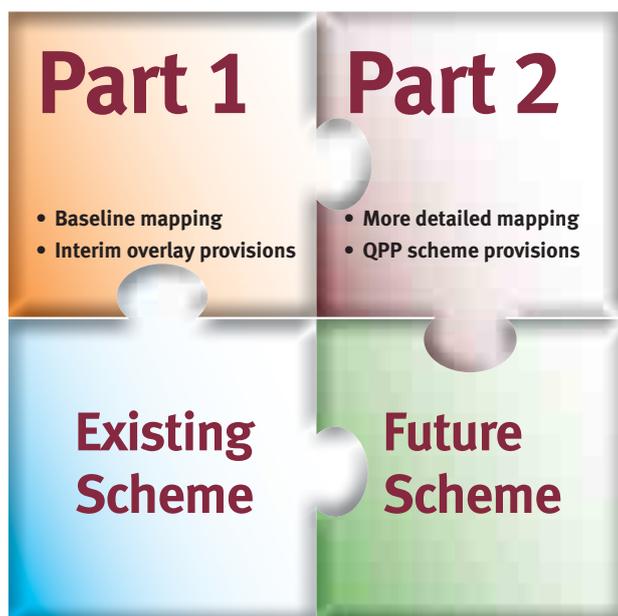
An outcome of this partnership is the development of the two-part Guideline, entitled **Planning for stronger, more resilient floodplains**. The Guideline raises awareness and represents the start of a journey to improve floodplain management throughout Queensland utilising the land use planning process.

Part 1 – **Interim measures to support floodplain management in existing planning schemes** delivers a toolkit that includes interim planning scheme measures and supporting mapping to those Councils who currently do not have any floodplain mapping. The mapping has been produced with the support of DERM and the mapping product provided represents an Interim Floodplain Assessment Overlay (Floodplain Maps). The Guideline also identifies a clear implementation path for those Councils that choose to adopt the interim code provisions and mapping.

Part 2 – **Measures to support floodplain management in future planning schemes** provides more detailed floodplain assessment guidance to Councils who are looking to prepare their new Planning Schemes under the *Sustainable Planning Act 2009* (SPA).

In support of this process, the Authority has partnered with Banana Shire Council (BSC), a Council that was significantly affected by events in December 2010/ January 2011. Together with the Fitzroy Basin Association (FBA) the BSC will use both Part 1 and Part 2 to help improve the management of floodplains through the land use planning process.

Planning for stronger, more resilient floodplains is a two-part Guideline to help introduce consistent and specific planning controls into the land use planning framework.



Part 1 has been developed to support Councils by offering interim fit-for-purpose measures to ensure that potential flooding impacts are considered in the development assessment process. Part 1 has been divided into four key parts:

1 Understanding

- Scale of impact from the 2010/2011 event
- Structure of floodplains and river systems

2 Analysis

- Floodplain planning

3 Implementation

- Floodplain Mapping
- Model Code
- Temporary State Planning Policy 2/11
- Queensland Development Code

4 Delivery

- Proposed amendment process for existing planning schemes

As an interim solution, Part 1 does not offer a comprehensive solution for managing new or existing development in floodplain areas. It does however, offer those Councils and indeed applicants, additional scheme provisions to ensure that there is due consideration as to what and how a development proposes to respond to a potential flood impact. This toolkit does not replace or override any existing engineering development standards, such as local road design manuals or the Queensland Urban Drainage Manual. Critically, it also does not replace or diminish the need for disaster warning and response plans or evacuation procedures. Even after adopting the recommendations in this Guideline, people should not become complacent to the risk of flood.

What is Part 2?

Part 2 of the Guideline builds upon the Part 1 work by providing further guidance on integrating floodplain management principles and processes into future planning schemes. Across the State, Councils are currently in the process of preparing new planning schemes – either Queensland Planning Provision (QPP)-compliant Planning Schemes in accordance with the requirements of the SPA, or under the superseded *Integrated Planning Act 1997*. Both planning scheme formats will benefit from the Part 2 Guideline.

Part 2 – **Measures to support floodplain management in future planning schemes** delivers guidance on:

1. Undertaking flood investigations, including:
 - selecting the right investigation for each area
 - how to undertake the relevant flood investigation for your areas
2. Land use strategies for development in existing infill and broad hectare areas, including:
 - undertaking a planning evaluation to balance flood hazard with other land use considerations to identify planning specific-flood risk
 - transition strategies for existing areas to respond to flood risk
 - how a planning scheme can address the strategies
3. Example QPP-compliant planning scheme provisions developed from the land use strategies, including:
 - key considerations and example provisions for the strategic framework
 - model Zone codes that deliver the intent of the strategic framework and an Overlay code with additional provisions from the Model Code presented in Part 1.

1 Understanding

Overview of events

During July to December 2010, extremely heavy rainfall was experienced across large parts of eastern Australia, with Queensland experiencing its wettest spring on record. This rain pattern was influenced by the strongest La Niña affect in the Pacific Ocean since the mid 1970s and as a result, Queensland's catchments were significantly saturated before major rain events occurred during November 2010 to April 2011.

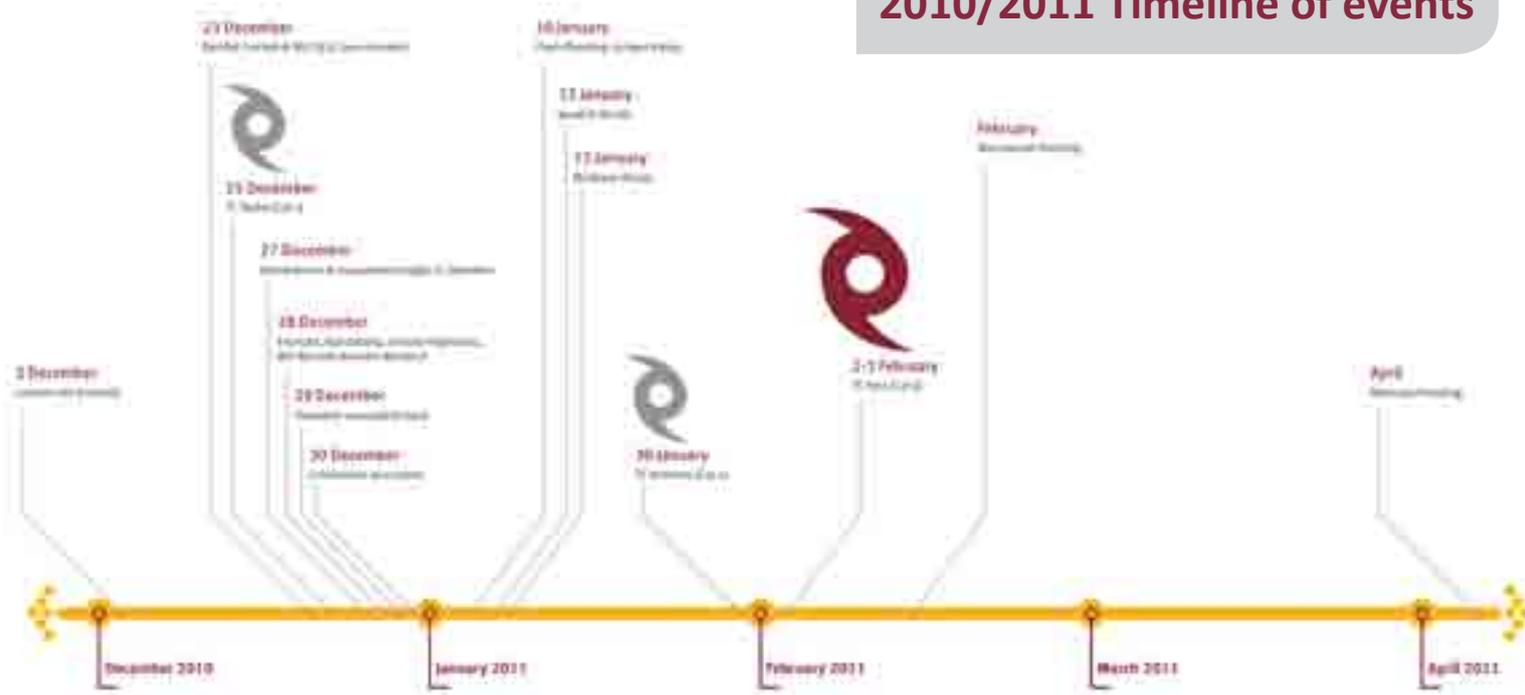
- On 25 December 2010, the Category 1 Tropical Cyclone Tasha crossed the Queensland coast between Gordonvale and Ravenshoe
- Pre-existing weather conditions and sustained high rainfall between 23–28 December 2010 resulted in flooding in many parts of central and southern Queensland
- On 29 December 2010, Theodore was the first town to be fully evacuated in the history of Queensland. Condamine became the second township. Each was fully evacuated twice.
- On 10 January 2011, the townships of Maryborough, Bundaberg and Gympie were affected by rising floodwaters, leading to the widespread inundation of houses and businesses. Additionally, the Bruce Highway was cut in several locations
- On 10 January 2011, exceptionally heavy rainfall intensified in Toowoomba, culminating in unprecedented flash flooding within Toowoomba's Central Business District
- On 10 January 2011, a further torrent of water hit the Lockyer Valley where the towns of Grantham, Murphy's Creek, Postman's Ridge, Withcott and Helidon were severely affected
- On 11 January 2011, heavy rain continued in the Brisbane River catchment with flooding of Laidley and Forest Hill
- On 12 January 2011, the Bremer River in Ipswich had reached 18 metres while some low-lying Brisbane suburbs had already started to be inundated

Flooding snapshot 2010/2011

- 210 towns and suburbs were affected by flooding
- 13 river catchments recorded their highest peak levels
- Total evacuation of a township, Theodore and Condamine (twice)
- Critical infrastructure was affected
- Rockhampton airport was closed
- Water purification systems were flooded hampering clean up efforts and access to safe drinking water
- 50,000 km of road requires rebuild or repair
- Damage bill from summer 2010/2011 exceeds \$6.8B

- On 13 January 2011, the Brisbane and Bremer Rivers peaked at 4.46 metres and 19.5 metres respectively. These were lower than 1974 flood levels but the flooding caused significant inundation in both cities
- On 30 January 2011, Category 2 Tropical Cyclone Anthony crossed the coast close to Bowen, battering the coastal strip between Townsville and Mackay, depositing significant rainfall on already saturated areas
- On 3 February 2011, Category 5 Severe Tropical Cyclone Yasi struck. The largest severe cyclone to hit Queensland in recent times, it comprised a damaging core some 400 kilometres across with associated severe weather activity across 1000 kilometres of coastline, including a storm tide of more than five metres, peaking near Cardwell.

2010/2011 Timeline of events



Flooding and floodplains

Australia's floodplains are the commercial, social and ecological arteries of the nation. As such they constitute a national asset: an asset subject to damage when floods occur.

Most of our towns and cities are located on floodplains, both inland and coastal. This is an historical fact, principally for reasons associated with water supply, transportation, waste disposal, advantageous points for river crossings, access to productive soils or recreation purposes. Hence, these towns and cities subject to flooding from time to time.

Over time, uses in these areas have also become entrenched and in more recent times lifestyle, mobility and consumer sentiment has meant that these areas continue to be used for a range of commercial, social and ecological purposes. While these uses remain, so too will the potential risks when floods occur.

Put simply, if we are to use floodplains for these purposes, we need to acknowledge and plan for flooding in a way that improves resilience of our built form and encourages the safety and well being for our communities and individuals.

In Australia, flooding can be caused by four different mechanisms: heavy rainfall, storm surge, tsunami and dam failure. Rainfall and storm surge flooding create the most common and significant threats to social and economic well being of flood-prone communities. Tsunami and dam failure can result in catastrophic damage and likely loss of life. The probability of this type of flooding in Australia is low.

Thus, as devastating as recent events have been, they are not unique: 77 floods were recorded in Australia in the last 35 years of the 20th century; eight major floods were recorded in Australia in the 19th century and six in the first decade of the 21st century. Nature will undoubtedly continue to surprise us.

Floodplains are generally the more fertile areas of the continent. A significant proportion of Australia's agricultural output is produced on floodplains including irrigated agriculture. Regular flooding of these areas enhances agriculture by increasing soil moisture.

Cost of flooding

In Australia, floods are the most expensive type of natural disaster with direct costs for the period from 1967 to 2005 estimated at an average of \$377 million per year (calculated in 2008 dollars).¹

Until recently, the most expensive year for floods in Australia was 1974, when floods affecting New South Wales, Victoria and Queensland resulted in a total damage bill in today's figures of \$2.9 billion. The Queensland Government estimates costs for the 2010/2011 floods will exceed this figure with the damage to local government infrastructure estimated at \$2.5 billion and the total damage to public infrastructure across the State at \$6.8 billion.

¹ Floodplain Management in Australia, Best Practice Principles and Guidelines, SCARM Report 73, CSIRO Publishing

Conversely, and as discussed in **Section 3 – Implementation**, flooding should be the most manageable type of natural disaster.

History of floodplain management

Floodplain management in Australia has evolved through four successive phases:

1. structural works
2. planning
3. flood emergency management
4. all-embracing management

During the structural works phase, predominantly in the 1970s, structural works (typically levees) were used to protect existing properties at risk. Little consideration was given to the use of levees and their potential impact on the environment, risk management planning or even land use planning. However, in 1974 a series of severe floods in New South Wales, Victoria and Queensland caused widespread and significant damage. The outcome was that a better understanding and regulation of levees was required.

In the 1980s and 1990s the importance of flood emergency management was brought into focus predominantly by the New South Wales Bogan River flood in April 1990 which required the forced evacuation of the town of Nyngan.

From the early 1990s the importance of an all-embracing approach to floodplain management was apparent with the States / Territories being far more advanced than previously in an integrated approach to floodplain management.

What exactly is floodplain management?

The objectives of floodplain management as determined by the Standing Committee on Agriculture and Resource Management (SCARM) are to:

- limit to acceptable levels the effect of flooding on the well-being, health and safety of flood-prone land, individuals and communities
- limit to acceptable levels the damage caused by flooding to private and public property
- ensure that the natural function of the floodplain – to convey and store floodwaters during a flood – is preserved
- encourage the planning and use of floodplains as a valuable and sustainable resource capable of multiple, but compatible, land uses of benefit to the community



What factors contribute to floods?

Rainfall is the most important factor in creating a flood, but there are many other contributing factors. When rain falls on a catchment, the amount of rainwater that reaches the waterways depends on the characteristics of the catchment, particularly its size, shape and land use. Some rainfall is 'captured' by soil and vegetation, and the remainder enters waterways as flow. River characteristics such as size and shape, the vegetation in and around the river, and the presence of structures in and adjacent to the waterway all affect the level of water in the waterway.



Floodplain Management Process

Understanding how our river systems work here in Queensland acknowledges that an integrated approach to land use planning on floodplains is required to bring together the diverse issues and stakeholders that affect, or are affected by, floodplain management. This approach takes flooding hazard and risk into account, along with all other relevant planning factors.

The end product of this process is an approach to floodplain management that facilitates the use of the floodplain for appropriate purposes; limits flood risk, and damage to socially acceptable levels; enhances the waterway and floodplain environment; and fosters flood warning, response, evacuation, clean-up and recovery in the onset and aftermath of a flood.

Ultimately the preferred way to manage our floodplains is through an integrated and appropriate mix of measures which are specific for each floodplain area.

Floodplain Management in Australia – Best Practice Principles recommends the adoption of an approach to floodplain management at a total catchment (sub-basin) level beyond the LGA boundaries.

The comprehensive floodplain management process typically encompasses three sequential stages²:

- **Flood Study** – a technical investigation to determine the nature and extent of flooding
- **Floodplain Risk Management Study** – an options assessment which evaluates management measures and options for the floodplain in respect to both existing and future development
- **Floodplain Management Plan** – formal adoption of a plan of management for the floodplain.

The time scale for this process can be in excess of 2 years and includes extensive community consultation. It is well understood that comprehensive community consultation throughout the floodplain management process leads to greater community acceptance of the outcomes. Without appropriate community consultation the estimate of flood risk can often be incorrect. This Guideline should be seen as part of a continuum towards best practice in mapping and managing risk in floodplains.

² Mark Babister, WMA Water, Natural Disaster Insurance Review August 2011

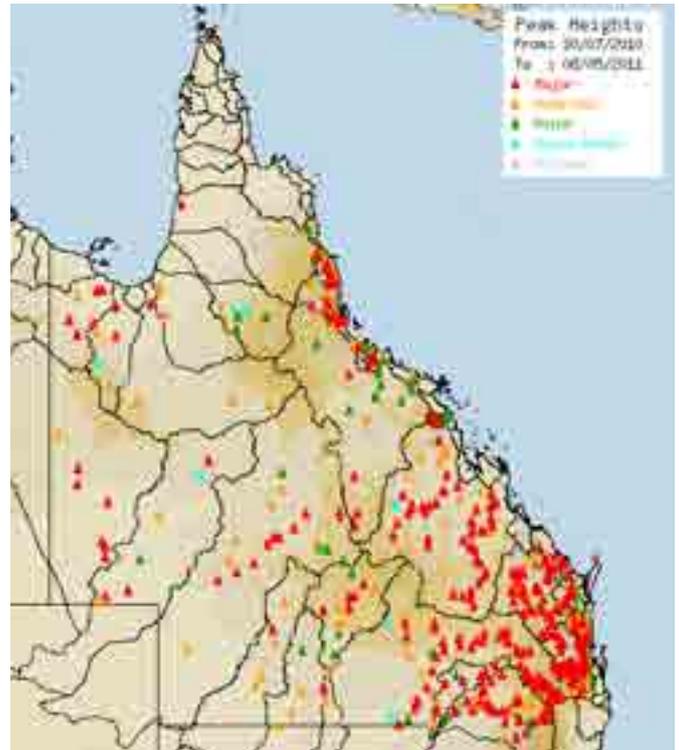


Figure 2: Peak heights during the 2010/2011 summer event. Source: Bureau of Meteorology

Six major floods occurred in Brisbane between 1885 and 1910, followed by more than 60 years without a major flood

Size of Flood (chance of occurrence in any year) ARI/ (AEP)	Probability of Experiencing the Given Flood in a Period of 70 Years	
	At least once	At least twice
1 in 10 (10%)	99.9%	99.3%
1 in 20 (5%)	97.0%	86.4%
1 in 50 (2%)	75.3%	40.8%
1 in 100 (1%)	50.3%	15.6%
1 in 200 (0.5%)	29.5%	4.9%

Probabilities of experiencing a given size flood once or more in a lifetime. Modified from *Floodplain Development Manual: the management of flood liable land, NSW Government, 2005*

ARI – Average recurrence interval

AEP – Annual Exceedance Probability

How do we estimate the chance of a flood occurring?



Understanding the chance of different sized floods occurring is important for managing flood risk. The chance of a flood event can be described using a variety of terms, but the preferred method is the Annual Exceedance Probability (AEP). A flood with a 1% AEP has a one in a hundred chance of being exceeded in any year. Currently, the 1% AEP event is designated as having an 'acceptable' risk for planning purposes nearly everywhere in Australia. However, good planning needs to consider more than just the 1% AEP flood.

Understanding the River Systems

Understanding Australia's river systems is integral to developing an appropriate interim land use planning and mapping solution (Refer to **Figure 3**). This exercise has been instrumental to guide and direct how to best map, plan and therefore manage appropriate land use responses.

In Australia there are twelve drainage divisions. Drainage divisions do not stop at state or territory boundaries and they continue until they terminate at the sea, ocean or inland lake.

Queensland hosts part of five (5) of these drainage divisions including:

- Northeast Coast Division (1)
- Gulf of Carpentaria Division (9)
- Murray Darling Division (4)
- Bulloo – Bancannia Division (11)
- Lake Eyre Division (10)

Within each drainage division there are several major river basins. Like the national drainage divisions, there are no river basins in Queensland that correlate with Local Government Areas (LGA). Therefore, the majority of Local Government Areas will contain several major river basins. There are 246 major river basins nationally, 75 of which are located in Queensland:

- Northeast Coast Division – 46 River Basins
- Gulf of Carpentaria Division – 19 River Basins
- Murray Darling Division – 5 River Basins
- Bulloo – Bancannia Division – 1 River Basin
- Lake Eyre Division – 4 River Basins

Drainage Divisions

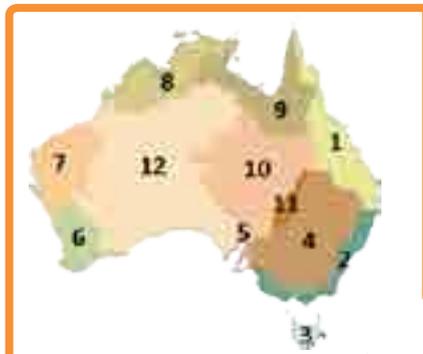
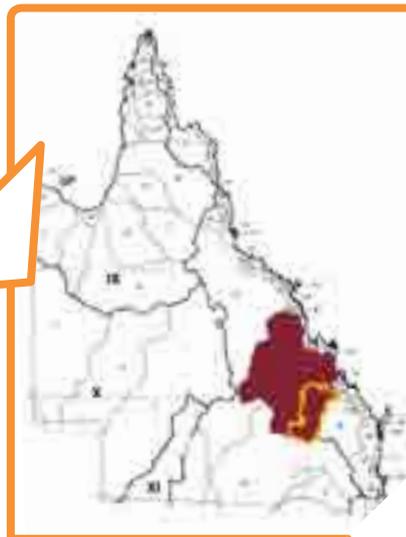
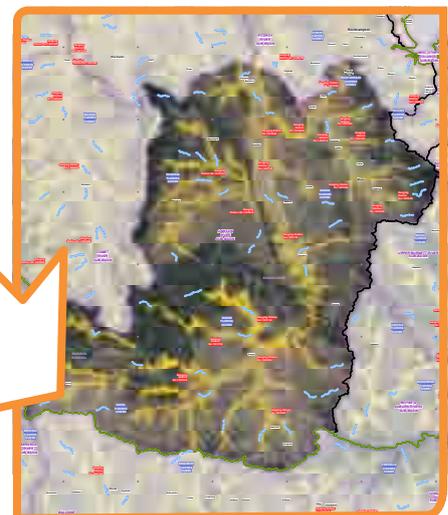


Figure 3 – Australian River Systems

River Basins



Sub-Basins



Major river basins usually comprise multiple rivers that converge on the river after which the river basin is named. For example, the Fitzroy River Basin includes the prominent rivers of Dawson and Nogoa, which drain into the Fitzroy River. Therefore, each river basin is usually comprised of one or more sub-basins. Again, for example, the Fitzroy River Basin is further divided into the following sub-basins:

- Isaac River Sub-Basin
- Nogoa River Sub-Basin
- Comet River Sub-Basin
- Dawson River Sub-Basin
- Mackenzie River Sub-Basin
- Fitzroy River Sub-Basin

Just like the major river basins, sub-basins do not correlate with LGA boundaries.

By understanding how our major river systems are governed, it can help identify the best way to adopt a standardised approach to land use planning provisions. Given the importance of what happens within a sub-basin, it is recommended that the best management of floodplains is for planning to be undertaken at a sub-basin level. This means that every LGA is likely to have more than one sub-basin within their LGA boundaries and the size of the sections of sub-basins they contain will vary. This underlines the need for floodplain management to be a collaborative exercise across LGA. The Part 2 Guideline considers this in further detail and provides specific guidance on the sub-basin wide approach to floodplain management.

Local Government boundaries do not correlate with river systems or basin boundaries.

EXAMPLE

Dawson River – Sub-Basin

Drainage Division	1 – NorthEast Coast
River Basin	30 – Fitzroy
Sub-Basin	Dawson River
Applicable LGAs	Banana Shire Central Highlands Regional Maranoa Regional Western Downs Regional Rockhampton Regional Woorabinda Aboriginal Shire Gladstone Regional North Burnett Regional

2 Analysis

The recent flood events seen across the State have highlighted the importance of considered land use planning that responds to the risks presented by natural hazards and particularly flooding.

As per current best practice principles the approach to floodplain management is best undertaken at a total catchment (sub-basin) level.

This sub-basin approach is needed in order to manage effectively the result of existing development and the cumulative effects of future development on stormwater and mainstream flooding. It includes both the upstream and downstream implications of proposed land use developments and floodplain management activities.

This approach requires collaboration from many stakeholders to support the ultimate goal of integrated management of our floodplains and therefore should extend beyond the development assessment process.

Traditionally a flood study is a comprehensive technical investigation of flooding behaviour that defines the extent, depth and velocity of floodwaters for floods of various magnitudes.

There are two principle components to a conventional flood study:

Hydrologic analysis or estimation of flood discharges for floods of various magnitudes.

Hydraulic analysis or determination of the extent, depths and velocities of flooding.

This level of detail is not always required or necessary to facilitate improved floodplain management particularly in areas where there is limited population and/or growth. The Part 2 Guideline provides further detail on an alternative fit-for-purpose approach understanding the need to ensure land use planning gives due consideration to flood hazard and flood risk particularly in the preparation of future planning schemes.

In recognition of the time and cost to prepare detailed flood mapping and studies by Councils, the Authority, with the support of DERM, commenced a State-wide mapping exercise to establish interim mapping of floodplains at a sub-basin level. Acknowledging the need to improve the availability and quality of flood mapping across the State focus was initially applied to large areas of the State where no flood mapping existed. The mapping exercise has resulted in the development of a State-wide product known as the *Interim Floodplain Assessment Overlay* (Floodplain Maps).

Importantly, the preparation of the Floodplain Maps looks to the establishment of a consistent approach across the State acknowledging that continued improvement and refinement of the mapping would occur as more detailed and better information is collated.

In terms of a maturity model for flood mapping, the Floodplain Maps are at level one and provide a framework for communities to decide priorities for more detailed flood investigations (Refer to **Figure 4**).

Flood Mapping Maturity Levels

Level 0	No Flood Mapping
Level 1	Sub-Basin 'Interim Floodplain Assessment Overlay Mapping'
Level 2	Confirmed (by local govt) Floodplain Assessment Overlay Mapping
Level 3	Flood Investigations (sub-basin wide approach)
Level 4	Flood Risk Management Study
Level 5	Implemented Floodplain Management Plan

The dataset to inform the Floodplain Maps was developed using the following overall principles:

- suitability for a Statewide approach;
- a consistent approach;
- repeatable if more accurate data is available in the future and
- evidential and justifiable.

The mapping produced through this approach has resulted in 116 of the 130 sub-basins across Queensland being mapped to at least Level 1 on the flood maturity mapping model. Combined with existing mapping in the other sub-basins this will represent full coverage of all relevant areas of the State.

Stronger, more resilient floodplains

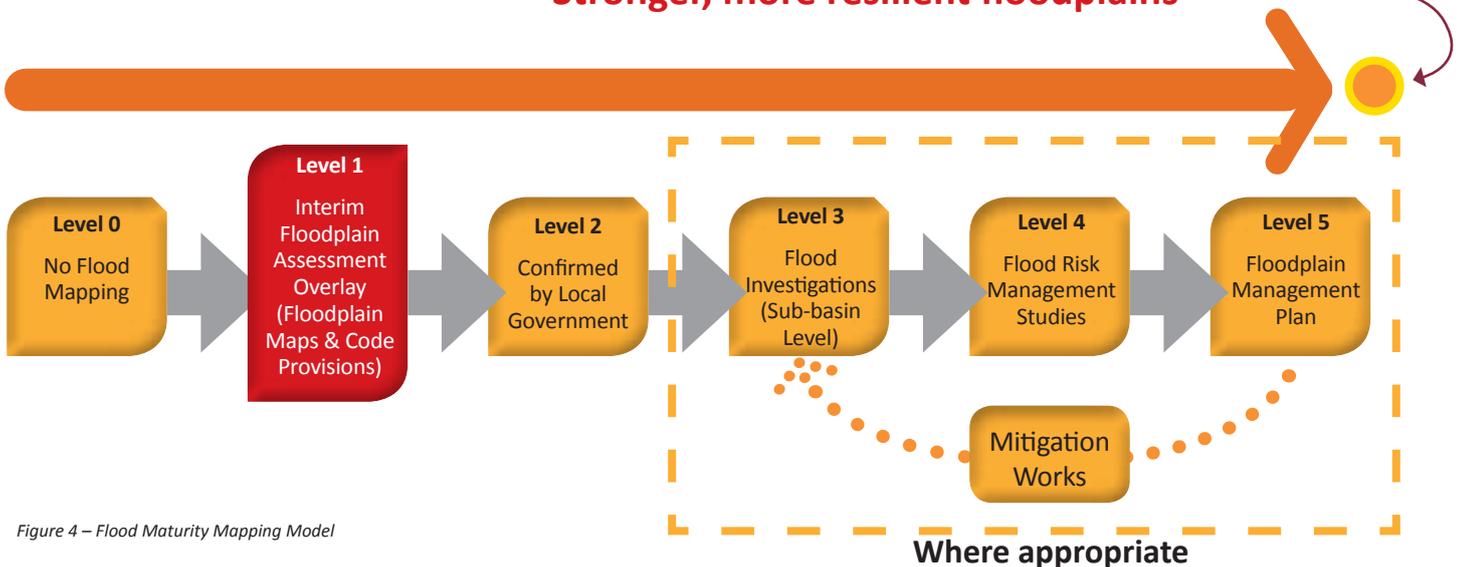


Figure 4 – Flood Maturity Mapping Model

Floodplain Mapping Methodology

A range of existing Statewide datasets were used in determining the Floodplain Maps. The mapping is not based on a particular Annual Exceedance Probability (AEP) event or Defined Flood Event (DFE) such as a '1% /Q100', nor does it represent the Probable Maximum Flood (PMF) which is commonly derived through detailed flood studies to identify the extent of the floodplain. The mapping also does not include or specify a flood level or flood flow velocity.

Instead, the mapping is generally based on various landform datasets that represent or indicate previous inundation. It is a spatial extent based on these datasets to determine an area of interest for potential flooding impacts. Given the mapping is based on a landform, the cartographic protocol of using a broken yellow line to indicate the floodplain extent has been used, rather than a solid blue line commonly used to denote water features.

The mapping was produced through a rigorous step-by-step process that interrogated the available datasets:

Step 1 – Identify each sub-basin and best available imagery

Step 2 – Assess stream drainage classification levels in the basin

Step 3 – Identify areas that indicate alluvial systems, estuarine and marine deposits

Step 4 – Identify stream gauges and their highest recorded levels

Step 5 – Incorporate available 2011 flood lines

Step 6 – Contours introduced as a constraint on soils and satellite flood lines datasets

Step 7 – Identify the IFAO extent using a visual estimation of the above data.

Importantly, the methodology provides for a consistent Statewide approach to floodplain mapping, even in areas where high resolution aerial photography, contour information or flood studies do not exist.

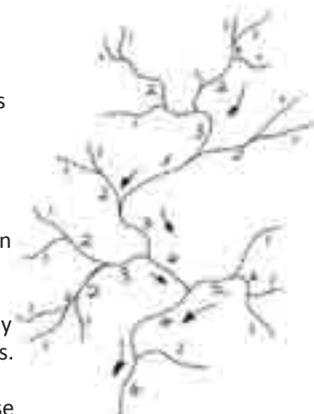
Imagery

Aerial imagery across the State is captured using different modes. The most common is through Landsat 5. Landsat 5 is the fifth satellite of the Landsat program. It was launched on 1 March 1984, with the primary goal of providing a global archive of satellite images. The program is managed by United States Geological Survey (USGS), and data from Landsat 5 is collected and distributed from the USGS's Center for Earth Resources Observation and Science. Australia like many countries has an agreement with the USGS where new satellite imagery is downloaded every 16 days and provided to Geoscience Australia. The imagery has a pixel resolution of 30 metres. In addition to Landsat more detailed aerial photography captured at the time of a flood over a town and cities has been used where available. During the summer 2010/2011 events, approximately 100 towns were captured with high resolution aerial imagery.

This is the largest mapping exercise currently underway in Australia. The mapping has been undertaken at a sub-basin level. Many Councils have more than one sub-basin within their Local Government Area.

Stream Orders

Starting at the headwater, the stream is assigned number one to be made 1st order. As several 1st order streams converge the resultant stream becomes 2nd order. Two 2nd order streams converging form a 3rd order, etc. This is known as the Strahler Method. The number of orders in Queensland's Sub-Basins vary. The Dawson River sub-basin for example is classified to a 9th order. Flooding can occur in the headwater streams (ie. 1st order), but is more likely to be significant in higher order streams. For each sub-basin the appropriate stream orders have been selected to use in developing the Floodplain Mapping.



Land zone 1



general term: estuarine (tidal flats and beaches)

Quaternary estuarine and marine deposits subject to periodic inundation by saline or brackish marine waters. Includes mangroves, salt pans, off-shore tidal flats and tidal beaches. Soils are predominantly Hydrosols (saline muds, clays and sands) or beach sand.

Land zone 3



general term: alluvium (river and creek flats)

Quaternary alluvial systems, including floodplains, alluvial plains, alluvial fans, terraces, levees, swamps, channels, closed depressions and fine textured palaeo-estuarine deposits. Also includes estuarine plains currently under fresh water influence, inland lakes and associated dune systems (lunettes). Excludes talus slopes, colluvial deposits and pediments. Includes a diverse range of soils, predominantly Vertosols and Sodosols, also with Hydrosols in higher rainfall areas.

SALI Soil Limitation Mapping

Refers to a soil type which has a limitation of flooding. Soil qualities and limitations are properties that can be assessed on an individual soil material basis and can affect the viability and sustainability of land uses.

Contours

Contour data with 10 metre vertical intervals available over the whole State has been used. In some selected cases to aid the visual interpretation, other available contour information has been used.

Example - Dawson River Sub-Basin

The Floodplain Maps for the Dawson River Sub-Basin were derived using the following datasets:

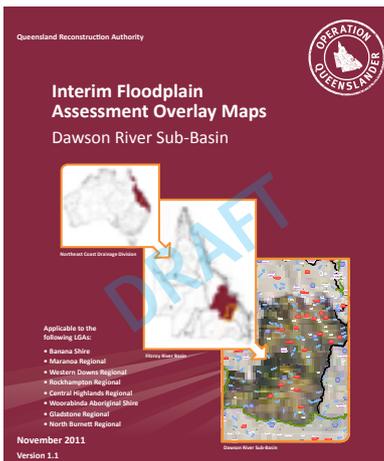
- Landsat imagery
- Stream orders 5 – 9
- Pre-cleared vegetation mapping of Landzones 1 & 3 combined with soil flooding limitation mapping
- Gauging stations
- Flood extent for 2011 generated from aerial photography
- Aerial photography taken at or near flood peak
- 10 metre contours

Once the floodplain maps have been captured they are provided to Councils as:

- a Mapbook covering the whole sub-basin which includes a series of A3 Mapsheets at 1:50 000 scale in both electronic and hard copy format;
- digital data compatible with geographic information systems (GIS) and
- interactive lot and plan search.

What are Land Zones?

Land zones represent major differences in geology and in the associated landforms, soils, and physical processes that gave rise to distinctive landforms or continue to shape them (Sattler and Williams 1999). Land zones are generally derived by amalgamating a range of geological, land system and/or soil mapping units at 1:100 000 to 1:250 000 scale. *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland. Version 3.1. Updated September 2005. Queensland Herbarium*



Dawson River Sub-Basin
Mapbook Cover



Landsat



Stream Orders



Pre Cleared Mapping



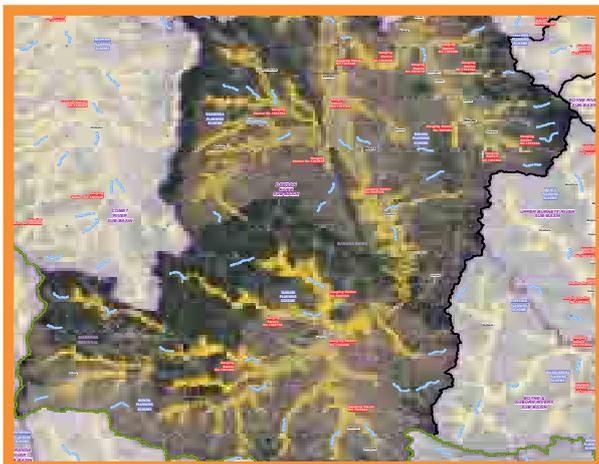
Gauging Heights



Aerial Taken – Theodore



Contours



Example: Interim Floodplain Assessment Overlay for the Dawson River Sub-basin



Example: Interim Floodplain Assessment Overlay for the town of Biloela

3 Implementation

Planning for stronger, more resilient floodplains is a journey towards achieving better floodplain management through the land use planning process. Whilst not all Councils require assistance in achieving this objective, some do and may benefit from the use of this Guideline.

Floods are the most manageable of all natural disasters. Unlike other natural disasters, generally there is an understanding of where floods will occur and estimates of the likelihood of flooding, flood behaviour and the consequences of flooding in some cases. On the other hand the unpredictability of Severe Tropical Cyclone Yasi meant it was not known when and where it would make landfall until just hours before it crossed the coast. Therefore, through a combination of learning from the Yasi experience and analysing its aftermath, we can plan more efficiently for similar events and, at the same time, create more resilient communities.

New Construction Standards

The Australian Building Codes Board has developed a draft national Standard for Construction of Buildings in Flood Hazard Areas (draft Standard), which is scheduled to be introduced into the *Building Code of Australia* (BCA) in 2013, following appropriate consultation. The scope of the draft Standard is limited to class 1 (houses and townhouses), class 2 (units and flats), class 3 (hotels, motels and backpackers), class 4 (caretakers dwelling), class 9a (health care) and class 9c (aged care) buildings. It provides specific performance requirements and deemed-to-satisfy (DTS) provisions for the design and construction of new buildings in a flood hazard area, as designated by the relevant authority (ie. Local Government).

DLGP is proposing early adoption of the draft Standard as a new mandatory part of the *Queensland Development Code* (QDC). Additional non-mandatory provisions, which are currently outside the scope of the draft Standard, are also proposed to be included in the QDC to be adopted by Councils on a voluntary basis through a planning scheme, Temporary Local Planning Instrument, or by resolution. It is proposed that the new QDC will apply to new buildings and additions to existing buildings, but not generally to building alterations (for example, internal repairs such as adding a bathroom or removing a wall).

Temporary State Planning Policy

The Authority partnered with DLGP to implement a new *Temporary State Planning Policy 2/11 (TSPP) – Planning for stronger, more resilient floodplains* – which creates the statutory mechanism by which a Council may look to adopt the Interim Floodplain Assessment Overlay as part of their existing planning scheme.

The TSPP suspends the effect of paragraphs A3.1 and A3.2 of Annex 3 of *State Planning Policy 1/03 Mitigating the Adverse Impacts of Flood, Bushfire and Landslide*, which identifies the process by which a Council may designate a Natural Hazard Management Area (Flood) (NHMA).

The effect of the TSPP is to allow amendments to an existing planning instrument under the SPA for a NHMA (Flood) to include:

- land inundated by a Defined Flood Event (DFE) and identified in a planning instrument; or
- the Interim Floodplain Assessment Overlay mapping and Model Code provided by the Queensland Reconstruction Authority; or
- the Interim Floodplain Assessment Overlay mapping and Model Code as amended by the relevant Local Government.

The TSPP therefore gives effect for a Council to designate a NHMA (Flood) through a minor planning scheme amendment process. The mapping may be adopted either in the current form provided by the Authority, or as amended by the Council following local verification of the mapping, provided that the amendment does not deviate from the intent of the interim provisions and the purpose as outlined in this Guideline and the TSPP. A Temporary Local Planning Instrument (TLPI) may also be an option for adoption of the mapping and code provisions however, the preference is for a minor scheme amendment process be followed.

The TSPP commenced on 14 November 2011 and remains in effect for a period of 12 months. It is expected that these amendments will be taken into consideration in the review of the SPP1/03 and an amendment of SPP1/03 will be undertaken prior to the expiry of the TSPP.

Interim Toolkit supporting the TSPP

Part 1 of this Guideline provides a voluntary interim toolkit which includes:-

- Floodplain Maps prepared by the Authority in both digital and hard copy; and
- the Model Code.

It is acknowledged that not all local governments require this interim toolkit. Councils with adequate provisions and mapping will not need this Guideline. The response needs to be fit-for-purpose recognising the differing needs of each local government. However, even for those Councils who feel that there are adequate provisions within their existing scheme, the floodplain maps may help to:

- inform the strategic planning process for the preparation of their new QPP compliant planning scheme; and
- identify areas that may require more detailed flood investigations, particularly those areas where there is existing or proposed critical infrastructure, transport and communications linkages and other places of high economic importance.

For those Councils wishing to adopt the interim provisions, this can be done through incorporating a new section into the existing planning scheme, titled “Flood Hazard Overlay- Floodplain Assessment” and incorporating as a minor amendment to the planning scheme. Alternatively, a Council may use a TLPI however the minor amendment process is preferred.

It is also important to note the adoption of the Floodplain Maps is not intended to alter the level of assessment for development within the overlay area.

The adopted Floodplain Maps are proposed to be used as a trigger for already Assessable Development to be assessed against the Model Code. Any changes to the levels of assessment will require specific consideration by Council and DLGP as part of the amendment process.

Mapping

As outline in **Section 2** of this Guideline the floodplain maps have been derived from a state-wide methodology using state-wide datasets. The datasets are available to Councils via a secure FTP service from the Spatial Information Group within DERM. The data consists of a number of whole of state datasets and contour datasets specific to each sub-basin. There are staff members within each Council who currently have access to the DERM FTP service via a secure login and password. Please contact DERM at productdelivery@derm.qld.gov.au to request access to the datasets via the FTP service.

Planning scheme provisions – Model Code

To support the Floodplain Maps a Model Code has been prepared to support the assessment of development on land wholly or partially within the area shown on the Floodplain Maps.

The Model Code is provided in **Schedule 1**.

Councils may decide on the types of development to which the Model Code applies.

The purpose of the code is to manage built form outcomes in the floodplain so that risks to life and property during future flood events are minimised, and to ensure that future development does not increase the potential for flood damage on site or any other property.

For clarity and consistency, all development-related terms defined elsewhere in other Queensland legislation (such as the *Sustainable Planning Act 2009*, *Dangerous Goods Safety Management Act 2001*) have the same meaning in this Guideline and its Schedules.

To demonstrate the practical application of this toolkit (including the Floodplain Maps and the Model Code) in a development assessment context, a number of case studies are provided following **Schedule 1** of this Guideline. These identify how certain types of assessable development may be assessed against the Model Code.

Minor Vs Major Amendment

The TSPP allows for Councils to undertake a Planning Scheme amendment that can be considered as a Minor Amendment, in order to adopt the interim provisions as outlined in this Guideline.

The Honourable Paul Lucas MP, Attorney-General, Minister for Local Government and Special Minister of State has agreed that where a Council uses the TSPP and this Guideline that the amendments will be considered under the Minor Scheme Amendment process under *Statutory Guideline 02/09*. However, where a Council seeks to undertake further amendments to the Planning Scheme, beyond the scope of those outlined in this Guideline, the amendment may be classified as a “Major Amendment”.

Any change deemed to substantially deviate from the intent may need to undergo the Major Amendment process before being adopted into a Planning Scheme.

To provide clarity, the Authority advises that an example of where an amendment may not be considered as Minor would be a change to the Performance Outcomes identified in the Model Code. Councils can choose to amend the Acceptable Outcomes where it is necessary to deal with a localised issue.

The Authority has established an arrangement with DLGP to support those Councils wishing to utilise this toolkit and amend their existing planning schemes. DLGP will lead the proposed amendments and work closely with the Authority. The Authority and DERM will continue to provide support to Councils who are looking to refine the floodplain maps based on local verification. Guidance can also be provided to those Councils who are looking to further refine the Model Code provisions to suit their local circumstance.

Further advice on how Councils can utilise this toolkit is provided in **Section 4 - Delivery**.



Brisbane River in flood 1974

Source: Queensland State Archives



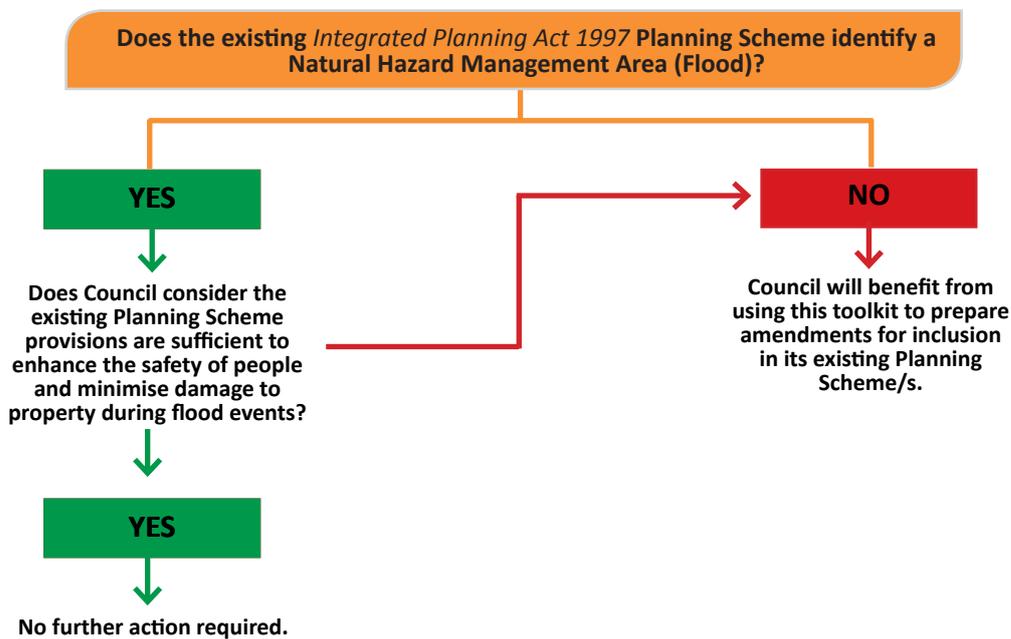
Brisbane River in flood 2011

Source: Queensland Reconstruction Authority

The Minister has agreed that where a Council uses the TSPP and this Guideline that the amendments will be considered under the Minor Scheme Amendment process.

4 Delivery

The following flow chart has been prepared to help Councils decide if the interim solution should be considered and adopted within their existing planning scheme.



Understanding the operation of the toolkit

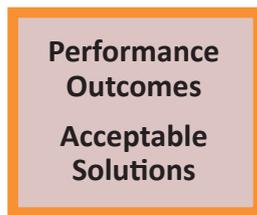
The toolkit includes the Floodplain Maps that for already assessable development will trigger assessment against the additional provisions included in the Model Code. The toolkit can be incorporated into the planning scheme as a new section titled “Flood Hazard Overlay - Floodplain Assessment”. In other words, development identified within the specific mapped area (Floodplain Maps) will trigger an additional set of provisions (Model Code) that will be used to assess development applications within the overlay area. The terminology for the new section of the planning scheme will however be dependent on the existing structure of the scheme/s.

The toolkit is not intended to change the level of assessment for development within the mapped overlay area. However, Councils can use the toolkit to change levels of assessment to respond to localised issues or if their existing planning scheme/s change the level of assessment for overlay areas. Similarly, if an existing planning scheme already nominates Building Work as assessable development then the Council may elect to apply this Guideline to Building Work in their existing planning scheme.



Floodplain Maps

+



Model Code Provisions

Flood Hazard Overlay Floodplain Assessment

Incorporation into existing Planning Schemes

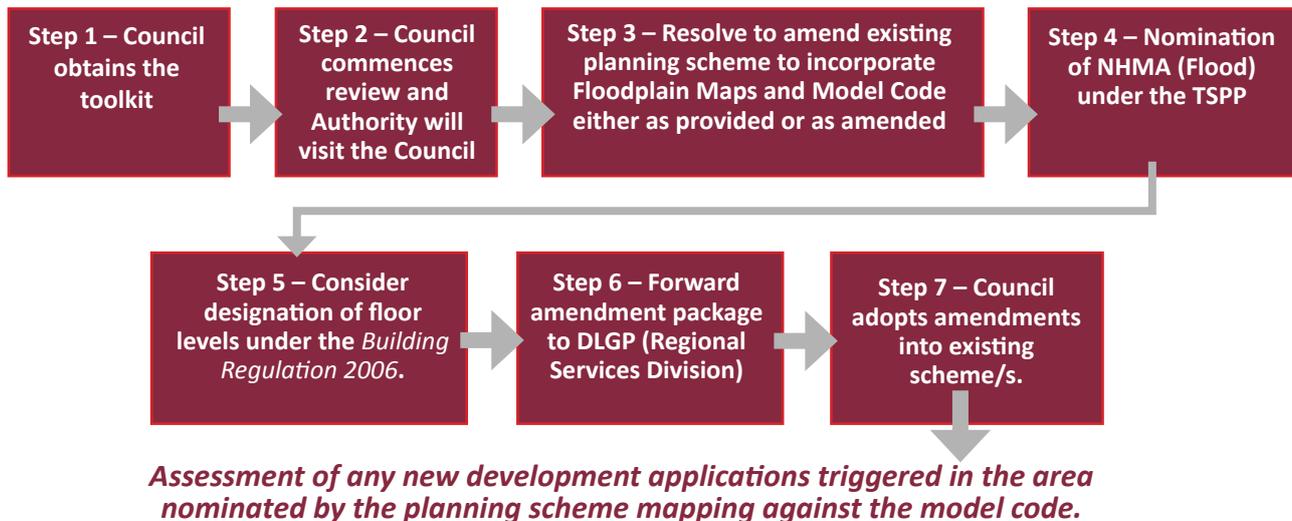
Existing Planning Schemes in Queensland utilise a number of approaches to trigger additional provisions for certain areas and sensitive development within the LGA. **Table 1** below provides a simplified explanation of how the toolkit might be incorporated into different planning schemes across the State.

Existing planning scheme	Incorporation method
Planning Scheme uses overlays which, when assessing development in a particular (mapped) area to which the overlay applies, triggers an additional set of provisions or regulation. <i>For example some Planning Schemes may include existing overlays such as Acid Sulphate Soils Overlay, Conservation Overlay and Road and Rail Noise Impacts Overlay.</i>	Include an additional overlay in the ‘Overlays’ part of the Planning Scheme entitled ‘Flood Hazard Overlay - Floodplain Assessment’ which will include reference to the Floodplain Maps and the additional provisions included in the Model Code.
Planning Scheme does not include an ‘Overlays’ section, rather uses the ‘Codes’ Part of the planning scheme to identify area codes that are based on mapping and trigger additional provisions for development within that area. <i>For example some Planning Schemes may include existing area codes such as Biodiversity Code, Heritage Place Code and Aviation Area Code.</i>	Include an additional code in the “Codes” Part of the Planning Scheme entitled ‘Flood Hazard - Floodplain Assessment Code’ which will act as an area code and will include reference to the Floodplain Maps that will trigger the additional provisions included in the Model Code.

Table 1: Incorporation into existing planning schemes.

Process

If Councils decide this toolkit is applicable to their local government area, Councils can follow the steps below to adopt the Floodplain Maps and Model Code within their existing Planning Scheme.



Step 1: Council obtains toolkit

The Authority will provide each Council with the toolkit, containing:-

- a. Guideline
- b. Model Code
- c. Floodplain Mapping
 - i. Hard copy mapbook
 - ii. Digital copy mapbook
 - iii. Digital datasets
- d. Templates for scheme amendment process

Step 2: Council commences review process

Once the toolkit is obtained, Councils are encouraged to commence reviewing both the mapping and the model code provisions. The Authority will also visit each Council once the mapping has been completed.

In reviewing the mapping, Councils are encouraged to utilise existing flood studies, records, photographs and local knowledge to visually inspect and ground truth the floodplain mapping.

In finalising any amendments made to the mapping, Council is to use the following mapping specification/ categories to ensure that the source of the information is clearly identified and distinguishable against the various methodologies that have been used:

- a. Floodplain Assessment – for use where Council does not propose to amend the floodplain mapping prior to inclusion in the planning scheme.
- b. Locally Verified – for use where local information exists and the parts of the floodplain mapping has been refined to reflect this. This local information can include mapped floodlines, historic flooding and information sourced from consultants.
- c. Flood Study – for use where an existing flood study exists that has been used to review the floodplain mapping.

DERM have developed template mapsheets and this can be provided to Councils for preparation of their new planning scheme reference map. This will also include the symbology to be used for the categories identified above. An example of this mapping is included at **Schedule 2**.

Councils are also encouraged to review the Model Code for appropriateness in the local context, and to make amendments to the wording if required. Councils should note the comments provided regarding the Minor Scheme amendment process.

Step 3: Council resolution

Council resolves to undertake a minor scheme amendment to either:

- a. Adopt mapping and model code as provided by the Authority unchanged; or
- b. Adopt model code as provided by the Authority and adopt locally amended mapping; or
- c. Adopt mapping as provided by the Authority and adopt amended Model Code; or
- d. Adopt locally amended mapping and amended Model Code.

Councils can choose to adopt either of the options or a combination of the above to all planning schemes applicable in their jurisdiction.

A template Council resolution is available from the Authority that includes the appropriate terminology to assist Council in preparing the resolution required to resolve to adopt the mapping and model code.

Where amendments are proposed either under b), c) or d) above, Council should outline the basis for the amendments (ie. based on a localised flood study) as identified through Step 2 above.

During the amendment process to either the floodplain mapping / model code provisions, the Authority can assist Councils in making any refinements. The mapping refinement process is further outlined in **Schedule 2** of this Guideline.

Step 4: NHMA (Flood)

In accordance with the TSPP, Council may resolve to adopt either all or only part of the mapped floodplain area as an NHMA (Flood) for the purposes of applying the relevant building provisions specified under the *Building Act 1975*.

For example, Council may wish only to designate those mapped areas within towns as an NHMA (Flood) – this way, the building assessment provisions will only apply to development within those urban areas, rather than applying in all areas that are mapped.

For clarity, areas that are mapped within the planning scheme but not designated as the NHMA (Flood) will still trigger the development assessment provisions (i.e. the Model Code) where they are called up in the planning scheme, but will not trigger the relevant building assessment provisions.

Step 5: Setting floor levels

To bring the relevant building assessment provisions into effect, Councils also need to give consideration to determining appropriate floor levels for habitable rooms in accordance with section 13 of the *Building Regulation 2006*.

This combination of both the mapped NHMA (Flood) area(s) in the planning scheme and the adoption of floor levels for habitable rooms will trigger the relevant building assessment provisions for the areas mapped as the NHMA (Flood).

This floor level may be based on an historic flood (such as the highest recorded) in a particular location, or other level as determined to be appropriate by the Council. Council will also need to ensure this floor level includes a ‘freeboard’ level – an additional height above the flood level to provide a factor of safety – of 300mm above the selected flood height level.

Table 2 may assist in determining how to adopt a level within a local government area.

Please note that this above advice relates to the building assessment provisions currently in force in Queensland. The Implementation section of this Guideline noted the early adoption of the draft *National Standard for Construction of Buildings in Flood Hazard Areas* into the QDC. This is expected in early 2012. Once the relevant provisions are adopted into the QDC, there may be changes to the way in which the relevant building assessment provisions related to flood will be triggered.

DATA	APPLICATION
Historical Flood Data	Where historical flood data exists, it may be possible to use this information to help inform the adoption of a level. Historical data may include: <ul style="list-style-type: none"> formally recorded gauge height records for a number of floods; formally surveyed peak flood levels throughout the area of interest; photographs of a historical flood; ‘high-water’ marks recorded on public or private property; and interviews with long-term residents.
Existing Flood Studies	A number of river systems in Queensland have been the subject of a flood study. In many cases, these studies were either limited in their scope or performed a number of years ago. Ideally, they should be updated with current data and techniques and/or extended to cover the full range of floods and incorporate catchment development changes as well as future scenarios.
Topography	There may be circumstances where the topography suggests floods are not an issue (i.e. large elevated areas such as plateaus with no significant watercourses). Care should be taken in making such a determination, as land subject to flood hazards is not always obvious.

Table 2: Data sources to support adoption of floor levels.

Step 6: Minor scheme amendment package to DLGP

The Council forwards to DLGP a minor scheme amendment package(s) for each of the planning schemes where amendments are proposed.

If the amendment package is proposed under option a in Step 3 above, DLGP will fast-track the amendment if no change is proposed to either the mapping or the Model Code provisions.

If Council elects to proceed with option b), c) or d) from Step 3 above, DLGP will refer the amendment package to Authority for review.

The Authority will liaise with DERM to confirm any amendments or refinements to the IFAO mapping and update the State-wide information with the proposed amendments.

The Authority will review any such amendments within 5 business days of receipt from DLGP.

DLGP will then provide to the Minister for consideration, the minor scheme amendment package within 10 business days from either receipt of a package provided under option a) or following confirmation from the Authority that the amendments are appropriate.

Step 7: Incorporation into planning schemes

Once consideration has been made by the Minister and approval granted, Council will need to resolve to incorporate the approved planning scheme amendments into the applicable planning schemes. Once adopted, any new applications triggered in the area nominated by the new planning scheme mapping will be assessed against the new code. Councils are encouraged to continue to amend their schemes when further information such as through the completion of more detailed flood investigations.

Council's may undertake minor scheme amendments as required to reflect updated flood mapping.

Floods can vary in size

Flood magnitudes are usually classified by their height, and the *Bureau of Meteorology* uses three general categories of flooding related to water level:

Major: This causes inundation of large areas, isolating towns and cities. Major disruptions occur to road and rail links. Evacuation of many houses and business premises may be required. In rural areas, widespread flooding of farmland is likely.

Moderate: This causes the inundation of low lying areas requiring the removal of stock and/or the evacuation of some houses. Main traffic bridges may be closed by floodwaters.

Minor: This causes inconvenience such as closing of minor roads and the submergence of low level bridges and makes the removal of pumps located adjacent to the river necessary.

Built Form

Managing flood risk can be delivered through both planning scheme and non-planning scheme measures. During Summer 2010/2011 we witnessed just how well our built form performed.

It was evident that the traditional 'Queenslander' style home provided the best built form outcome. This is expected given that the traditional 'Queenslander' was designed to allow the cool breezes to circulate through the house in the hot summer and to let flood waters flow underneath.

Since the Summer events we have seen many residents respond by lifting their homes to build in a level of immunity. This has been evident from the north in Hull Heads, to Condamine/ Dalby in the south-west to areas within Brisbane and Ipswich.

The proposed amendments to the building standards will further support non-scheme measures which will further improve our communities ability to prepare, recover and respond to further flood impacts.

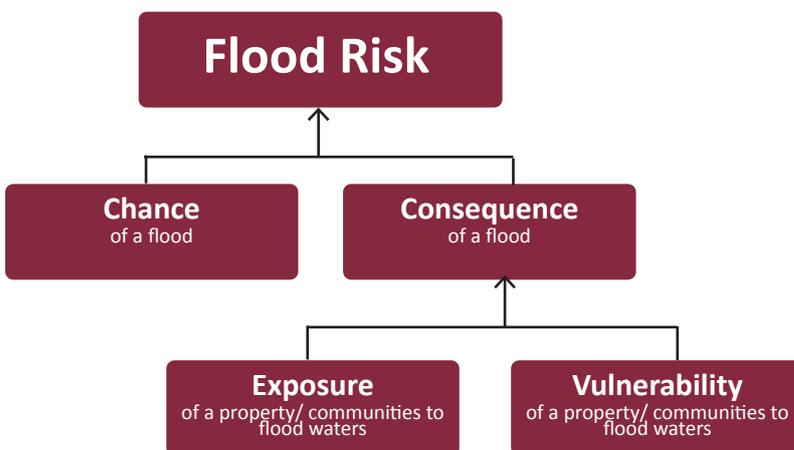


New house in Condamine (left) and house that has been raised in Dalby (right) after 2010 flood
Source:- Queensland Reconstruction Authority



Above images sourced from:- Queensland Image Library and Getty Images

Components of Flood Risk



Source:- Queensland Floods Science, Engineering and Technology Panel
Understanding Floods – Questions and Answers

How do we manage flood risks?



Flood risk includes both the chance of an event taking place and its potential impact. Land use planning informed by floodplain management plans can reduce risk for new development areas. Flood risk is harder to manage in existing developed areas; however modification measures such as dams or levees can change the behaviour of floodwaters. Similarly, property modification measures can protect against harm caused by floods to individual buildings, and response modification measures help communities deal with floods. Further guidance on the management of flood risk is provided in the Part 2 Guideline - *Measures to support floodplain management in future planning schemes.*

Schedule 1 – Model Code

1. Application

This Code is an applicable code for assessable development prescribed by a level of assessment table in a zone, overlay and/or local plan and involving land wholly or partially within the area identified in the Flood Hazard Overlay- Floodplain Assessment maps provided at xxxxxx.

This Code is a Queensland Planning Provision (QPP)-compliant Code. For the avoidance of doubt, the following QPP-specific terms in this Code have the following meanings under *Integrated Planning Act 1997* (IPA)-compliant planning schemes:

QPP Compliant Term	Corresponding IPA- compliant Term
Overall Outcome	Overall Outcome
Performance Outcome	Specific Outcome
Acceptable Outcome	Acceptable Solution/Probable Solution
Zone	Area, Precinct, Domain or District or other term commonly understood as a zoning mechanism

Compliance with the Acceptable Outcomes should not be regarded as satisfying all elements of the Performance Outcomes.

The Code must be considered together with other relevant Planning Scheme codes that are applicable to the subject development.

2. Purpose

The purpose of the Code is to manage development outcomes in the floodplain so that risk to life, property, community and the environment during future flood events is minimised, and to ensure that development does not increase the potential for flood damage on site or to other property.

3. Overall Outcomes

The purpose of the Code will be achieved through the following overall outcomes:

- Development maintains the safety of people on the development site from flood events and minimises the potential damage from flooding to property.
- Development does not result in adverse impacts on people's safety, the environment or the capacity to use land within the floodplain.

4. Performance Outcomes and Acceptable Outcomes

Performance Outcomes	Acceptable Outcomes
<p>PO1. Development siting and layout responds to flooding potential and maintains personal safety at all times. ¹</p>	<p>For Material Change of Use</p> <p>AO1.1 New buildings are:</p> <ul style="list-style-type: none"> not located within the overlay area, or; located on the highest part of the site to minimise entrance of floodwaters; or elevated; and provided with clear and direct pedestrian and vehicle evacuation routes off the site. <p><i>Note: If part of the site is outside the Flood Hazard Overlay area, this is the preferred location for all buildings.</i></p>
	<p>For Reconfiguring a Lot</p> <p>AO1.2 New lots are:</p> <ul style="list-style-type: none"> located outside the overlay area; or where possible, located on the highest part of the site to minimise entrance of floodwaters. <p><i>Note: If part of the site is outside the Flood Hazard Overlay area, this is the preferred location for all lots (excluding park or other relevant open space and recreation lots).</i></p> <p><i>Note: Buildings subsequently developed on the lots created will need to comply with the relevant building assessment provisions under the Building Act 1975.</i></p>

Performance Outcomes	Acceptable Outcomes
<p>Cont'd. PO1. Development siting and layout responds to flooding potential and maintains personal safety at all times.</p>	<p>AO1.3 Road and/or pathway layout provides a safe and clear evacuation path:</p> <ul style="list-style-type: none"> • if a flood level is adopted², by locating entry points into the reconfiguration above the flood level and avoiding culs-de-sac or other non-permeable layouts; or • by direct and simple routes to main carriageways.
	<p>AO1.4 Signage is provided on site (regardless of whether land will be public or private ownership):</p> <ul style="list-style-type: none"> • indicating the position and path of all safe evacuation routes off the site; and • if the site contains or is within 100m of a floodable waterway, hazard warning signage and depth indicators are also provided at key hazard points, such as at floodway crossings or entrances to low-lying reserves.
<p>PO2. Development is resilient to flood events by ensuring design and built form account for the potential risks of flooding.</p>	<p>For Material Change of Use (Residential Uses)</p> <p>AO2.1 Residential dwellings are not constructed as single-storey slab on ground.</p> <p><i>Note: The highset 'Queenslander'-style house is a resilient low-density housing solution in floodplain areas. Higher density residential development should ensure only non-habitable rooms (e.g. garages, laundries) are located on the ground floor.</i></p>
	<p>AO2.2 Residential buildings:</p> <ul style="list-style-type: none"> • use screening to ensure that the understorey is not visible from the street; and • orient to the street by ensuring that the stairs to the dwelling and at least one habitable room overlook the street; and • have ground floors that allow for the flow through of flood water. <p><i>Note: Commercial activities on the ground floor are acceptable where the ground floor has been specifically designed in accordance with the relevant building assessment provisions to include resilient materials and to be structurally appropriate.</i></p> <p><i>Note: The highset 'Queenslander'-style house is a resilient low-density housing solution in floodplain areas. Higher density residential development should ensure only non-habitable rooms (e.g. garages, laundries) are located on the ground floor.</i></p>
	<p>For Material Change of Use (Non-Residential Uses)</p> <p>AO2.3 Non residential buildings and structures:</p> <ul style="list-style-type: none"> • orient to the street by activating the street frontage through ground floor commercial uses or urban design treatments such as recess wall treatments, screening and or landscaping; and • allow for flow through of flood waters on the ground floor. <p><i>Note: Businesses should ensure that they have the necessary continuity plans in place to account for the potential need to relocate property prior to a flood event (e.g. allow enough time to transfer stock to the upstairs level of a building or off site).</i></p> <p><i>Note: The relevant building assessment provisions under the Building Act 1975 apply to all building work within the Flood Hazard Overlay area and must take account of the flood potential within the area.</i></p> <p><i>Note: Resilient building materials for use within the Flood Hazard Overlay area should be determined in consultation with Council, in accordance with the relevant building assessment provisions.</i></p>
<p>PO3. Development directly, indirectly and cumulatively avoids any significant increase in water flow, velocity or flood level, and does not increase the potential for flood damage either on site or on other properties.¹</p>	<p>For Material Change of Use, Reconfiguring a Lot and Operational Works</p> <p>AO3.1 Works in urban areas³ associated with the proposed development do not involve:</p> <ul style="list-style-type: none"> • any physical alteration to a watercourse or floodway including vegetation clearing; or • a net increase in filling. <p>AO3.2 Works in areas other than an urban area³ either:</p> <ul style="list-style-type: none"> • do not involve a net increase in filling greater than 50m³; or • do not result in any reductions of on-site flood storage capacity and contain within the subject site any changes to depth/duration/velocity of flood waters; or • do not change flood characteristics outside the subject site in ways that result in: <ul style="list-style-type: none"> o loss of flood storage; o loss of/changes to flow paths; o acceleration or retardation of flows; or o any reduction in flood warning times elsewhere on the floodplain.

PO4. Development avoids the release of hazardous materials into floodwaters.

For Material Change of Use

AO4.1 Materials manufactured or stored on site are not hazardous in nature; or

AO4.2 If a flood level is adopted², material manufacturing equipment and containers are located above this level, or

AO4.3 If a flood level is not adopted, material manufacturing equipment and containers are located on the highest part of the site to enhance flood immunity.

Note: Refer to the Dangerous Goods Safety Management Act 2001 and associated Regulation, the Environmental Protection Act 1994 and the relevant building assessment provisions under the Building Act 1975 for requirements related to the manufacture and storage of hazardous substances.

PO5. Community Infrastructure is able to function effectively during and immediately after flood events.

For Material Change of Use

AO5.1 No Acceptable Outcome specified.

¹ Council may chose to require the applicant submits a site-based flood study that investigates the impact of the development on the floodplain and demonstrates compliance with the relevant Performance Outcomes.

² As resolved by Council under section 13 of the *Building Regulation 2006*.

³ As defined in the *Sustainable Planning regulation 2009*.

Case Study 1

Material Change of Use – Residential (Six Townhouses)

Site Location:

Substantially within IFAO Floodplain Mapped Area

Other Planning Considerations:

Within relevant Zone in Planning Scheme that envisages higher density residential development

Proposed Development:

6 x 3 storey townhouses with ground floor car accommodation

Assessment against IFAO Model Code:

This proposed development complies with the Model Code, as:

- Council sought a flood/hydraulic study identifying a flood level for the site, which the applicant provided
- Buildings are elevated above this level and development has a simple direct evacuation route off site
- Dwellings are not single storey slab on ground – habitable rooms are elevated through ground floor used as car accommodation
- Site is in urban area and no alteration to watercourse or filling is proposed
- No hazardous materials to be stored on site
- Not a Community Infrastructure item

Application is supported by Council



Case Study 2

Reconfiguring a Lot – Residential (1 into 8)

Site Location:

Part of site within IFAO Floodplain Mapped Area

Other Planning Considerations:

Within relevant Zone in Planning Scheme that envisages residential subdivision

Proposed Development:

Residential Subdivision 1 into 8 lots

Assessment against IFAO Model Code:

This proposed development complies with the Model Code, as:

- Council requested verification of flood level through flood/hydraulic study during application stage, which applicant provided
- All proposed new lots located outside of IFAO Floodplain Mapped Area, with a balance park within the overlay area – while not mandatory, this is the most appropriate design outcome to ensure house lots will not be inundated
- Road layout is direct and simple to allow for evacuation during flood
- Appropriate signage is provided indicating evacuation routes
- Site is in urban area and no alteration to watercourse or filling is proposed

Application is supported by Council



SCHEDULE 2 - Refinement (Local Verification) Process

Central Highlands Planning Schemes

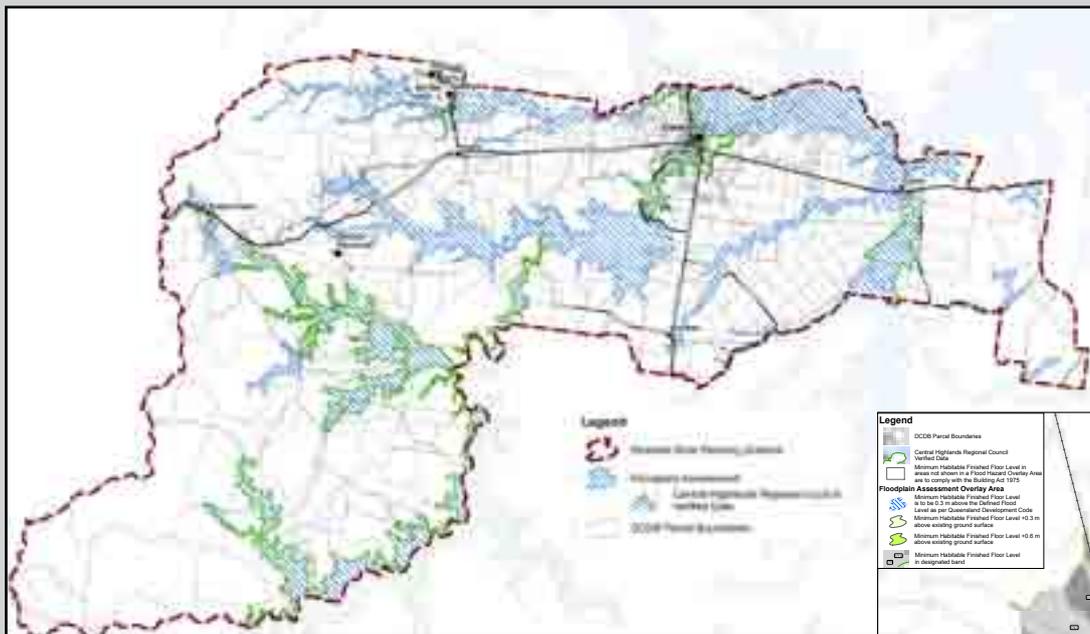
On 7 November 2011, the Central Highlands Regional Council (CHRC) resolved to progress minor scheme amendments to all four of their existing planning schemes being the former Emerald, Bauhinia, Peak Downs and Duaringa Planning Schemes.

The Authority, together with the Department of Environment and Resource Management (DERM), worked with the Council to undertake refinement to the Interim Floodplain Assessment Overlay (IFAO) relevant to the sub-basins within their local government area. Using local information such as data collated from the highest recorded flood event of December 2010, amendments to the mapping were completed.

Categories for the mapping were developed to ensure that the source of the information is clearly identified and distinguishable against the various methodologies that have been used (Refer to **section 4 - Delivery** of the Guideline). For CHRC two categories were required being the Floodplain Assessment and Locally Verified. The Floodplain Assessment line was derived from the IFAO and identified as a blue hatch on the map. Where amendments to the IFAO were made based on local verification, it is identified as a green line (Refer to map examples below). In addition to the Flood Hazard Overlay maps for each scheme, CHRC had historical data for the township of Emerald which enabled the adoption of flood levels. These levels are reflective on a specific map for the Emerald townships ensuring that future Building Work would consider new floor levels based on the highest recorded event.

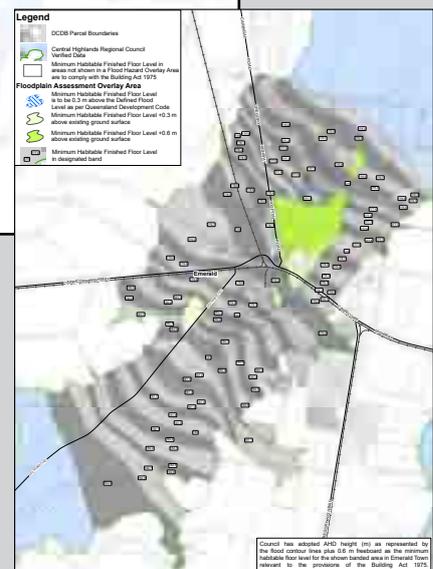
The Authority and DERM worked with Department of Local Government and Planning (DLGP) to ensure that the resultant maps reflected the symbology consistent with Queensland Planning Provisions.

DLGP's Regional Services Division led the approval process for each of the minor scheme amendments. In December 2011, the Minister for Local Government's approved the proposed minor scheme amendments. On 23 December 2011, Central Highlands Regional Council (CHRC) gazetted the amendments and became the first Council to utilise the Part 1 toolkit. Together with the Model Code provisions, all four of CHRC's existing schemes now include the Flood Hazard Overlay - Floodplain Assessment maps and supporting code provisions.



Flood Hazard Overlay - Floodplain Assessment for the former Emerald Planning Scheme

Source: Central Highlands Regional Council



FLOOD HAZARD OVERLAY - FLOODPLAIN ASSESSMENT EMERALD SHIRE PLANNING SCHEME OVERLAY MAP NO. NDIS - 3

Based on the experiences learnt from the CHRC exercise, DERM have now established mapsheet templates that Councils can obtain to prepare the proposed planning scheme maps. DERM together with the Authority have also developed a Mapping Specification providing a step-by-step guide to Councils to help in the preparation of maps suitable for inclusion within the planning scheme.

Councils are encouraged to contact DERM productdelivery@derm.qld.gov.au to discuss the proposed preparation of maps and to obtain a copy of the Mapping Specification.



Rockhampton

Source: Queensland Image Library

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