RAPI NATIONAL PLANNING CONGRESS

EAROPH REGIONAL CONFERENCE, DARWIN
NORTHERN TERRITORY
19-23 SEPTEMBER 1999

FLOODPLAIN PLANNING:

TIME FOR A NEW APPROACH

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ABSTRACT

This paper questions the traditional view of floodplain planning which is restricted only to achieving limited management outcomes by the application of planning controls for only that part of the floodplain inundated by a nominal floodplain planning level (FPL). The argument is put that this traditional approach is contrary to a logical risk management rationale and has been generally unsuccessful in flood hazard mitigation.

A new approach is suggested which addresses the flood hazard across the whole of the floodplain (ie. up to the probable maximum flood) and allows for the management of the flood by the application of a graded set of planning controls which vary with the flood hazard and land use. The approach has been recommended by the NSW Department of Land and Water Conservation as an appropriate application of the principles embodied in the NSW State Government's "Merits Based" Flood Policy and draft Floodplain Management Manual currently on exhibition.

Most significantly, the new approach provides a generic philosophy and methodology for translating information regarding the extent and nature of flooding into the strategic and development assessment planning processes. We believe that this is rarely satisfactorily achieved with an application of the traditional approach, resulting in planning failing in its role of flood hazard mitigation.

The new approach has been adopted as part of the Hawkesbury-Nepean Floodplain Management Strategy (within the Sydney Region), produced by a special committee of the NSW Government Cabinet in 1998 and has been incorporated into the planning framework of 9 NSW local councils.

1.0 INTRODUCTION: Why the concern?

In June 1867, the Hawkesbury-Nepean Valley experienced its largest recorded flood, causing water to rise 19 metres above normal river flood level, creating an "inland sea" up to 11 metres deep and 200 kilometres in area. The media at the time reported the incident as follows:

> "The volume of water has astoundingly increased since Thursday. On Friday many buildings in the town were in jeopardy and on Saturday the whole township, excepting the two or three patches already named, was overwhelmed. The water rose very rapidly and the inhabitants were in dread of being swamped altogether. Most of them thought that they would have to betake themselves to the Terrace, the nearest and most accessible town in the Blue Mountains. The water continued to rise slowly during the night, but at 5 o'clock yesterday (Sunday) morning it was at a standstill…. Some portions of George Street, the main thoroughfare in Windsor, must be fifteen or sixteen feet deep, and in several places about the township the telegraph posts and wires were not visible. Mr Ascough's house is under water, so also are the Royal, The Australian, and Houlding's Hotel. …. Another six feet, or ten at the most, would not have left an inch of ground in Windsor unwashed by the flood."
>
> "The gloomiest foreboding as to probable loss of life are prevalent. It is reported that William and George Eather, farmers living at Cornwallis, places their wives and children on the roofs of their houses and there clung with them awaiting help until the rising waters washed them off. The two wives and their ten children were overwhelmed in the flood and the husbands saved themselves and one little boy by swimming to a willow tree from which they were shortly afterwards rescued and taken in a boat to Richmond." (SMH, 1867)

A repeat of the 1867 flood TODAY would have disastrous consequences (HFMAC, 1997)"

- Land occupied by approximately 62,000 people and 21,400 dwellings and hundreds of businesses would be inundated. Over 3,500 commercial industrial buildings would be affected.
- Some 40,000 people would need to be evacuated to safety.
- Limited warning time and transport capacity would mean that notwithstanding existing flood emergency plans, many of the inhabitants could not be evacuated to safety and under current circumstances, there would be considerable loss of life.
- Up to as many as 6,000 people could need alternative accommodation for up to 12 months. Residential buildings and essential services would require months to be restored.

- Some 50,000 people would be without power for 2 to 5 weeks. It would take 3 to 6 months to restore domestic gas services. Untreated sewage would flow into the Hawkesbury River for many weeks while the sewerage system was restored.

- The stress of being flooded, perhaps having the family home destroyed, of being evacuated or concern about the future would likely affect the general community health. It has been estimated that some 4,500 residents may need medical treatment.

- Many more people would be affected indirectly through disruption to essential services to a much wider area than the floodplain.

- The resultant flood damage would be in the order of $1.4 billion and would eclipse human suffering and damage caused by Cyclone Tracy and the Ash Wednesday fires combined.

The 1867 flood of the Hawkesbury-Nepean Valley would have about a 1 in 250 chance of occurring in any one year or about a 1 in 5 chance of occurring over a 70 year lifespan. Although not directly comparable, this contrasts starkly with the fatality risk level adopted by the NSW Department of Urban Affairs and Planning (DOP, 1992) of 1 in 1 million chance per year as the limit for risk acceptability for residential area exposure to hazardous industry. Clearly, the flood risk to persons and properties within a developing part of the Sydney Region, the Hawkesbury-Nepean Valley, is astonishingly high and at the same time, an issue which the planning fraternity is hesitant to embrace.

2.0 Why Has Development Been Exposed To Such Flood Risks?

Risk is a product of both the estimated frequency of occurrence of a hazard and the consequence of that hazard occurring. That is, a flood that has a high predicted recurrent occurrence interval of a 1 in 5 chance per year but results in only low level backwater flooding of sparsely grazed rural land, would be considered to be subject to low risk. A less frequent event such as the record flood in the Hawkesbury-Nepean, which would cause significant devastation and probable loss of life should be considered to have high risks.

Development within the floodplains of Australia over the last 200 years had mostly occurred with little or no knowledge of flood risk. While it could be assumed that people developing near to rivers and creeks would appreciate the potential risk associated with flooding, this would often be balanced against the aesthetic and economic value of locating in such places which had numerous attributes such as transport opportunities, water supply and arable land. As early as 1817, Governor Lachlan Macquarie commanded that an order be read in all churches throughout the colony on three successive Sundays instructing settlers not to place residences and stockyards within the reach of floods, which substantially remained unheeded . (Easten, J. 1999)

Development within the floodplains of Australia have progressed in parallel with the ability to estimate the recurrent frequency and nature of flooding, but planning contribution to the issue followed at the tail end of the process. While various statutory documents provided some references to the flooding issue associated with the development of Sydney since the introduction of planning controls in 1945, it was not until August 1977 that the then NSW Planning and

Environment Commission issued a circular to local councils regarding planning controls for "floodprone land". Floodprone land was defined as the area affected by that part of the floodplain which had a 1 in 100 chance per year of inundation. This standard is often also expressed as the hundred year average recurrence interval (ARI) flood or the 1% annual exceedance probability (AEP) flood, which are effectively the same for planning purposes, commonly referred to as the 100 year flood standard. This standard has its origins in Australia in the planning and development of Canberra and was understood to have been adopted primarily because it reflected a 50/50 chance of inundation over a lifespan of 70 years. It is also a 'nice round number'.

The 100 year flood standard has provided an adequate planning tool for some floodplains in the past. That is, in those floodplains where minimal potential consequences may arise from flooding due to low population and minimal development, and the nature of the flood hazard is not extreme (ie. there is no fast moving water and the differentiation between the 100 year flood level and the height of larger, more extreme floods is not great). However, in other cases, the 100 year flood standard is adequate, particularly where developed, more intensive occupation and development of floodplains has been occurring and the nature of the flood hazard is extreme due to the velocity and/or depth of water, available warning time, ability to evacuate occupants and the post flood consequences to individuals and the community. The Hawkesbury-Nepean Floodplain is a classic example of where the 100 year flood standard has been totally inadequate.

3.0 What Is The Role Of Town Planning?

The town planning role in floodplain management is about facilitating the occupation of the floodplain and optimising its use in a manner which is compatible with the flood hazard and at a level of risk which is expected by the community. Floodplain management also involves measures which modify the ability of the community to respond to floods (through education, flood warning systems, emergency evacuation strategies, post flood restoration programs, etc.) and modifying the flood behaviour (involving structural works such as construction of levies and dams). Those involved directly with floodplain management in recent years will have noted an increasing emphasis to seek non structural solutions to floodplain management – in particular, use of town planning controls.

Flooding is only one issue which decision-makers must consider in the planning process. However, it has become a very important issue, particularly in those areas where there is a direct and significant risk to the community because of potential for loss of life or huge flood losses. These risks must be clearly understood by decision-makers as they result directly from planning decisions, and importantly, they are readily foreseeable with the use of current engineering practice. The least the community expects is that these decisions are made on an informed and reasonable basis. Town planning involvement in floodplain management (floodplain planning) should involve more than the setting of a floodplain planning level (FPL) such as the 100 year flood standard. It is about comprehensively managing the risk to people and assets below and above the FPL by applying and integrating a range of available measures. In the Hawkesbury-Nepean Valley, there are many areas above the FPL which, although they have a low chance of inundation, have a significant flood risk given their flooding result in disastrous consequences. This flood risk must therefore be understood and proactively managed. Simply raising the FPL may not be the answer, as this may lead to unnecessary land sterilisation or failure to address other risks, as well as understandable community and political opposition.

There are different types of flood risks and a range of ways in which each type of flood risk can be managed. This may vary from a genuine evaluation of the cost and benefits of developing part of the floodplain within the metropolitan planning process, allocation of land uses based on their sensitivity of the flood hazard, and the application of specific flood related development controls such as minimum floor levels, use of flood compatible materials, site flood plans to minimise flood damage and facilitate evacuation during floods, building design which has minimal impact on flood behaviour and promotion of flood awareness with the release of planning controls and documents.

4.0 How Is Traditional Floodplain Planning Undertaken?

In general terms, the real flood hazard within floodplains is poorly understood and appreciated by the community, particularly if significant flooding has not occurred for many decades. As a result of floodplain management investigations undertaken by the authors for over 20 local councils in NSW, and in particular, detail case studies for the 6 local councils within the Hawkesbury-Nepean Valley, there was an observed disparity between strategic policies and planning controls which related to the flood hazard, even within the same floodplain, and a general lack of knowledge by technical staff regarding issues associated with the flood hazard.

Often the community, and planners, consider there to be a flood hazard only on land below the FPL which is the level below which councils place restrictions on development, commonly the 100 year flood level. In fact, floods can occur well above this level (eg. in the Hawkesbury-Nepean River the 1867 flood level was up to 3.5 metres above the FPL, with only a relatively marginally greater chance of occurrence.

Illustration 1 presents the view of flood hazard generally. The flood hazard extent relates only to the FPL (in this case the 100 year flood). In the community's mind, there is no flood hazard above the 100 year ARI flood level.

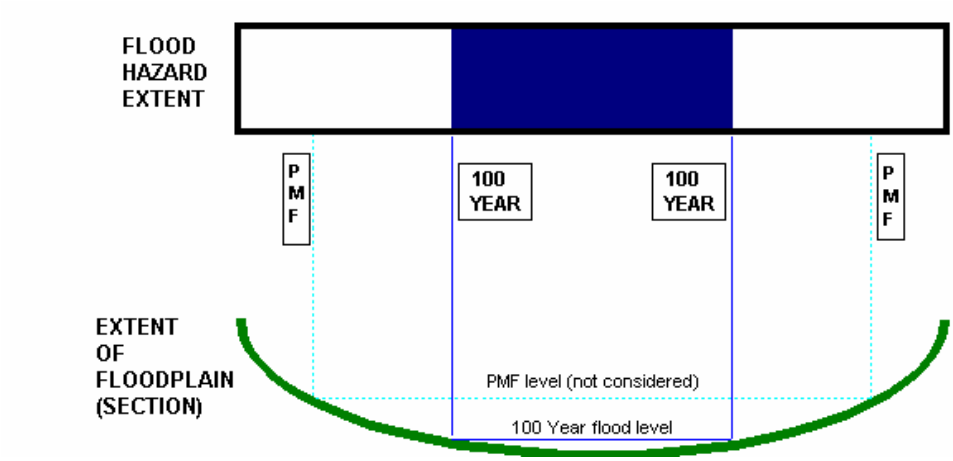


Illustration 1: Typical View of Flood Hazard Currently Held by Community

Throughout this report the term 'floodplain' has been used to define the area inundated in the probable maximum flood (PMF). This very rare flood (an approximate chance of 1 in 100,000 to 1 in a million of occurring in any one year) is the largest that could possibly occur and potentially pose a threat to communities. The PMF level is generally 1 to 2 metres above the 100 year flood level. Exceptions to this exist. In the Austral area (in the Liverpool Council area of south-western Sydney), the PMF level was found to be about 0.5 metres above the 100 year level, whilst on much of the middle Hawkesbury Valley, the PMF level may be more than 9 metres above the 100 year level.

Traditional floodplain planning has relied almost entirely on the definition of a singular FPL, which has usually been the 100 year flood level. While such an approach has often been adequate, the approach has not worked well everywhere and has led to a number of problems including:

- creation of a 'hard edge' to development at the FPL;
- distribution of development within the floodplain in a manner which does not recognise the risks to life or the economic costs of flood damage;
- unnecessary restriction of some land uses from occurring below the FPL, while allowing other inappropriate land uses to occur immediately above the FPL;
- polarisation of the floodplain into perceived 'flood prone' and 'flood free' areas;
- lack of recognition of the significant flood hazard that may exist above the FPL (and as a result, there are very few measures in place to manage the consequences of flooding above the FPL);
- failure to make planning decisions based on actual risk as opposed to simply the predicted frequency of flooding; and
- creation of a political climate where the redefinition of the FPL (due to the availability of more accurate flood behaviour data, or for other reasons) is fiercely opposed by some parts of the community, due to concern about significant impacts on land values because land which was previously perceived to be 'flood free' will now be made 'flood prone' (despite the likelihood that such impacts may only be short term).

The current approach to floodplain planning discussed above may be typified by the example shown in **Illustration 2**, which flows from the inappropriate view of flood hazard presented in Illustration 1. No development is permitted below the FPL (ie 100 year ARI flood) because of an acknowledgement of the flood hazard. Above the FPL, no flood hazard is perceived and therefore there are no flood-related controls on development. Thus an abrupt change in development control occurs at the FPL.

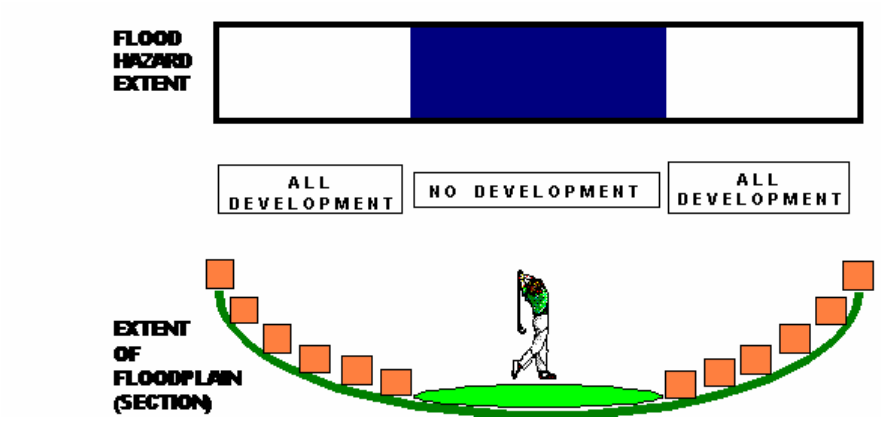


Illustration 2: Current Floodplain Planning

(Derived from an inappropriate view of flood hazard and the use of a singular flood planning level.)

The 100 year flood standard was effectively adopted by the State Government as the FPL for the whole of NSW in 1977 but because of its inadequacies, including difficulties in achieving political acceptability, it was disbanded in 1984 with the introduction of a merits based approach to be implemented at a local level by individual councils. However, it is rare to find councils which have determined their FPL using the merits based approach as clarified in the NSW State Government's Floodplain Development Manual (1986), ie. by:

> "*balancing the social, economic and ecological considerations against the consequences of flooding, with a view to minimising the potential for property damage and the risk to life and limb.*"

By default, most councils have adopted the 100 year FPL, given that this FPL has been widely used across the State and that councils have been unable to carry out the assessment necessary to establish appropriate alternatives. The merits based approach has been an engineering orientated policy for floodplain planning which has not been embraced by town planners. With the complexity of the ambit of issues required to be assessed as part of any planning decision (eg. heritage, threatened species, amenity, urban services, transport, utility services, etc), it is no wonder that the unquestioning acceptance of a singular FPL provided by an engineer is seen by most planners as the best way to tick off the issue of flooding. The consequences of such an approach, the Hawkesbury-Nepean Valley example being an extreme, warrants a revisiting of the approach taken by town planners to floodplain planning from first principles.

5.0 Alternative Approach

Given that the continued occupation and development of floodplains in Australia will not come to a screaming halt as engineering expertise provides for a more comprehensive understanding of the flood hazard, the planning matrix approach provides an example of a methodolo

gy which allows for strategic planning and control of development in the floodplains in a manner which is acceptable to the community. Both the input of technicians and the community is essential in understanding the flood hazard and its potential consequences, and identifying what level of risks are acceptable to the community, within each of the stages involving the preparation of the planning matrix described below.

5.1 Categorising the Floodplain

The first stage in developing a merits based flood policy is to delineate each of the floodplains to be subject to the preparation of a "planning matrix", while the second stage is to divide the floodplains into areas (or bands) of differing hazard. A key component of this process is to identify different bands, reflective of variable flood hazard within each floodplain. The bands will be unique to each floodplain.

5.2 Prioritising Land Uses in the Floodplain

The next component in the preparation of the planning matrix is to prioritise land uses within the floodplain (see **Illustration 3**). This is achieved by identifying discreet categories of land uses with similar levels of sensitivity to the flood hazard. The following categories are typical of those often adopted:

- Essential community facilities
- Critical utilities
- Filling
- Residential
- Commercial or industrial
- Open space/rural or non-urban uses
- Minor development.

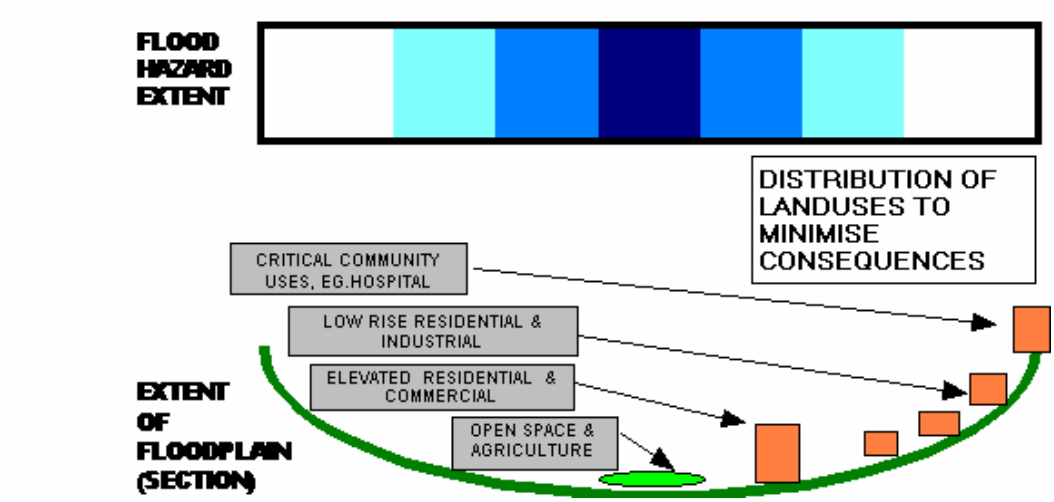


Illustration 3: Distributing Land Uses under the Planning Matrix Approach

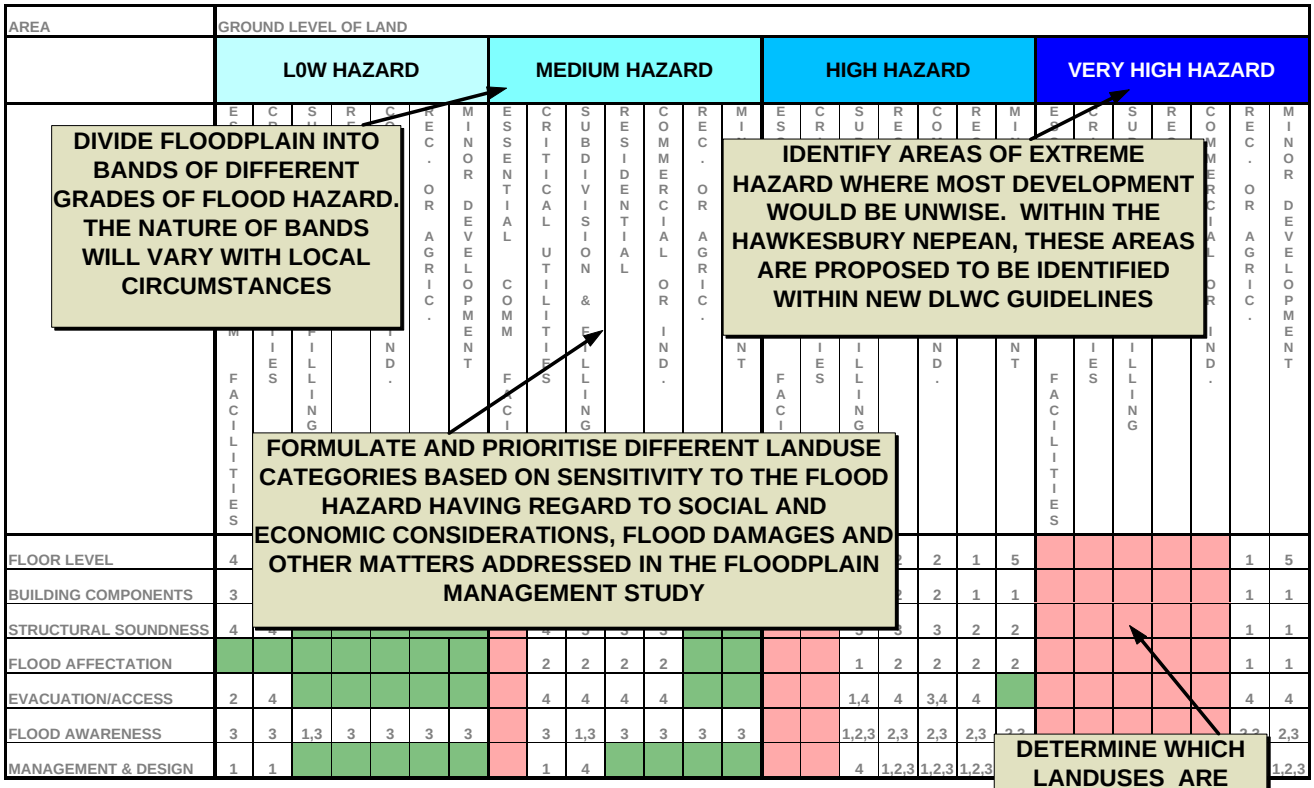
These categories are then listed under each hazard band in the planning matrix dependent upon the level of flood risk which is considered acceptable by the community (see **Illustration 4**). This provides a basis for specifying whether certain categories are unsuitable land uses in different parts of the floodplain or whether they are suitable subject to varying degrees of development control.

Prioritisation of land uses is identified through the normal community consultation process which forms part of most floodplain management studies.

5.3 Controls to Modify Building Form and Community Response

The next component in the preparation of the planning matrix is to assign different planning controls to modify building form and the ability of the community to respond in times of flooding, depending upon the type of land use and the location of that land use within the floodplain (see **Illustration 5**). The type of controls can be categorised under seven main headings, being:

- Floor levels
- Flood compatible building components
- Structural soundness
- Flood effect on others
- Evacuation/access
- Flood awareness
- Management and design.



NOTES

NOT RELEVANT

UNSUITABLE LAND USE

HHF REFERS TO THE HIGHEST HISTORICAL FLOOD AS DEFINED IN THE GLOSSARY

PMF REFERS TO THE PROBABLE MAXIMUM FLOOD AS DEFINED IN THE GLOSSARY

FLOOR LEVEL

1 ALL FLOOR LEVELS TO BE EQUAL TO OR GREATER THAN THE 1 IN 5 YEAR FLOOD PLUS 0.5M (FREEBOARD)

2 HABITABLE FLOOR LEVELS TO BE EQUAL TO OR GREATER THAN THE 1IN 100YR FLOOD PLUS 0.8M (FREEBOARD)

AND OTHER FLOOR LEVELS TO BE EQ

3 ALL FLOOR LEVELS TO BE EQUAL TO C

4 ALL FLOOR LEVELS TO BE EQUAL TO C

5 FLOOR LEVELS TO BE AS CLOSE TO TH G FLOOR LEVEL WHEN AN ADDITION TO AN EXISTING BUILDING

SPECIFY PLANNING CONTROLS TO BE APPLIED TO LANDUSES TO FACILITATE DEVELOPMENT WITHIN DIFFERENT FLOOD HAZARD BANDS. THE AIM IS TO ACHIEVE LEVELS OF RISK EXPECTED BY THE COMMUNITY

FLOOD COMPATIBLE BUILDIN

1 ALL STRUCTURES TO HAVE FLOOD CO OOD LEVEL

2 ALL STRUCTURES TO HAVE FLOOD CO

3 ALL STRUCTURES TO BE CONSTRUCTED OF FLOOD COMPATIBLE MATERIALS BELOW OR AT THE PMF LEVEL

STRUCTURAL SOUNDNESS

1 ENGINEERS REPORT TO PROVE ANY STRUCTURE SUBJECT TO A FLOOD UP TO & INCL. THE 1 IN 100 YR LEVEL CAN WITHSTAND THE FORCE OF FLOODWATER, DEBRIS & BUOYANCY

2 ANY STRUCTURE SUBJECT TO A FLOOD UP TO & INCL. THE 1 IN 100 YEAR SHOULD WITHSTAND THE FORCE OF FLOODWATER, DEBRIS & BUOYANCY

3 ANY STRUCTURE SUBJECT TO A FLOOD UP TO & INCL. THE HHF SHOULD WITHSTAND THE FORCE OF FLOODWATER, DEBRIS & BUOYANCY

4 ANY STRUCTURE SUBJECT TO A FLOOD UP TO & INCLUDING THE PMF LEVEL SHOULD WITHSTAND THE FORCE OF FLOODWATER, DEBRIS & BUOYANCY

5 GEOTECHNICAL ENGINEERS REPORT REQUIRED TO SPECIFY APPROPRIATE FILLING/EARTHWORKS & THE MEANS OF RETENTION OF BATTERS AGAINST SCOURING/EROSION

FLOOD EFFECT ON OTHERS

1 ENGINEERS REPORT REQUIRED TO PROVE THAT THE DEVELOPMENT OF AN EXISTING ALLOTMENT WILL NOT INCREASE FLOOD AFFECTATION ELSEWHERE

2 THE IMPACT OF THE DEVELOPMENT ON FLOOD AFFECTATION ELSEWHERE TO BE CONSIDERED

EVACUATION/ACCESS

1 RELIABLE ACCESS FOR PEDESTRIANS REQUIRED DURI

2 RELIABLE ACCESS FOR PEDESTRIANS & VEHICLES RE

3 ELECTRONIC FLOOD WARNING DEVICES TO INSTALLED

4 CONSIDERATION REQUIRED REGARDING AN APPROPRIA FLOOD

DETERMINE SPECIFIC CONTROLS ON THE DESIGN AND MANAGEMENT OF DEVELOPMENT THAT CAN BE APPLIED TO DIFFERENT LANDUSES DEPENDING ON THE HAZARD BAND, TO MINIMISE THE POTENTIAL CONSEQUENCES .EG. FLOOR LEVEL CONTROLS TO REDUCE PROPERTY DAMAGE OR EVACUATION ROUTES & PROCEDURES TO MINIMISE RISK TO LIFE

FLOOD AWARENESS

1 RESTRICTIONS TO BE PLACED ON TITLE ADVISING OF MINIMUM FLOOR LEVELS REQUIRED RELATIVE TO THE FLOOD LEVEL

2 S149(2) CERTIFICATES TO NOTIFY AFFECTATION BY THE 1 IN 100 YEAR FLOOD

3 S149(2) CERTIFICATES TO NOTIFY AFFECTATION BY THE PMF FLOOD

MANAGEMENT & DESIGN

1 FLOOD PLAN REQUIRED WHERE FLOOR LEVELS ARE BELOW THE DESIGN FLOOR LEVEL

2 APPLICANT TO DEMONSTRATE THAT THERE IS AN AREA WHERE GOODS MAY BE STORED ABOVE THE 1 IN 100 YEAR FLOOD LEVEL PLUS 0,5M(FREEBOARD) DURING FLOODS.

3 NO EXTERNAL STORAGE OF MATERIALS BELOW THE 1 IN 100 YEAR LEVEL PLUS 0.5M(FREEBOARD) WHICH MAY BE POTENTIALLY HAZARDOUS DURING FLOODS

4 APPLICANT TO DEMONSTRATE THAT POTENTIAL DEVELOPMENT AS A CONSEQUENCE OF A SUBDIVISION PROPOSAL CAN BE UNDERTAKEN IN ACCORDANCE WITH THIS POLICY

Illustration 4: Planning Matrix and Explanation

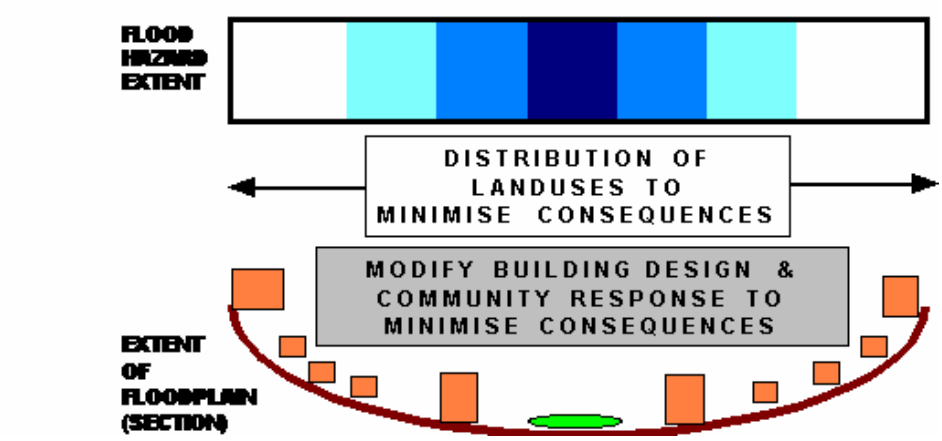


Illustration 5: The Planning Matrix Approach to Floodplain Planning

There should be varying severity of development controls reflecting the sensitivity of the land use to the flood hazard, and the location of the land use within the floodplain.

5.4 Adoption and Application

The planning matrix approach provides an example of a methodology which can replace the traditional approach of adopting a singular FPL and provide guidance for both strategic planning and development control. At a strategic planning level, the planning matrix approach provides direction regarding the preferred allocation of land uses across the floodplain, dependent upon sensitivity to the flood hazard, thereby reducing the potential for damages and risk to life.

At the detail development assessment level, the planning matrix specifies those specific measures which need to be applied to different land uses in order to ensure that they will be subjected to an acceptable level of risk having regard to their location within the floodplain. For example, a more flood sensitive land use such as a hospital within a more hazardous part of the floodplain, may only be acceptable subject to more stringent development controls and evacuation measures. The process of preparing the planning matrix provides a mechanism for identifying and understanding the risk and allows the community with the input of technicians to decide on the manner in which the floodplain may be occupied and developed.

The appropriate mechanism for the implementation of the flood policy in NSW is normally its adoption as a Development Control Plan (DCP), as well as being an integral component of Floodplain Management Plans required to be prepared by local councils in accordance with the State Government Flood Policy. The local policy document would also provide a sound basis for the consideration of the issue of flooding when preparing zoning plans (Local Environmental Plans in NSW) as well as guidance for regional planning.

As a council often has a number of drainage catchments within its LGA, there is merit in developing a comprehensive and generic floodplain planning policy which can be applied to all catchments whilst considering the local differences of each catchment. That is, a singular document can be prepared which includes separate matrices for each floodplain. Ideally,

cooperation between adjoining local councils which share the responsibility of floodplain planning for the same floodplain should be achieved. This is the approach which the authors have recommended as part of the Hawkesbury-Nepean Floodplain Management Strategy, now adopted by the State Government, and have pursued and implemented for the Liverpool local council which has five unique catchments. Following the development of the generic policy within the Liverpool Council area, it has been extended to other councils in NSW, and the Western Sydney Regional Organisation of Councils (WESROC), the Westpool Insurance Group, the Upper Parramatta River Catchment Trust (UPRCT) and other groups including the NSW Department of Land and Water Conservation have either adopted or endorsed the generic policy.

6.0 Concluding Comments

Hydraulic engineering practice has developed substantially since European occupation of Australia to the extent that detail forecasts of the frequency and nature of flooding can be provided. Such information forms an essential component to floodplain management with which town planning has an increasingly important role.

However, town planning methodologies for addressing the flooding issue within the planning process has not progressed beyond the traditional approach of adopting a singular FPL. This traditional approach has been exposed to have a number of inadequacies, and in the case of the Hawkesbury-Nepean Valley, has perpetuated the continual occupation and development of this expanding fringe of the Sydney Metropolitan Area in a manner which has created significant flood-related risk to people and property. While engineering advances have only allowed for a full understanding of the flood hazard in the Hawkesbury-Nepean over the last couple of decades, the traditional floodplain planning approach could only attempt to address the issue by raising the FPL which could never hope to be accepted by the community because of the political, social and economic consequences associated with indiscriminately sterilising more of the floodplain.

The planning matrix approach outlined within this paper is directed towards changing our current view of floodplain planning. It provides for a top-down approach (starting by looking at the overall floodplain and then determining the required levels of management across the floodplain) as opposed to the traditional bottom-up approach of starting at the 100 year flood level. This approach is flexible and can be adopted as a model for most floodplains. The flood hazard categories, land use categories and development controls are all those which can and should be tailored to suit specific floodplains.

The new approach provides greater flexibility to consider the broad range of issues (ecological, economic, social, etc) and a more comprehensive resource to assist town planners in their strategic planning role beyond the traditional “line on the map” mentality. Hopefully, this will progress the ability for town planning to have an effective and meaningful role in floodplain management, which in the main has not been well achieved to date.

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