



PITTWATER COUNCIL

*NEWPORT BEACH  
FLOODPLAIN RISK MANAGEMENT STUDY  
AND PLAN*

*VOLUME ONE  
FLOODPLAIN RISK MANAGEMENT PLAN*

February 2004

Prepared by:



SMEC Australia Pty Ltd  
ABN 47 065 475 149

Project Number: 31039



**DOCUMENT RELEASE INFORMATION**

Client	Pittwater Council
Project Name	<b>Newport Beach Floodplain Risk Management Study &amp; Plan</b>
Document Number	31039
Document Title	Volume One – Floodplain Risk Management Plan
Revision Status	February 2004

**Document prepared by:**

**SMEC AUSTRALIA PTY LTD**  
**ABN 47 065 475 149**  
**Level 5, 118 Walker Street, PO Box 1052 North Sydney 2060**  
**Telephone (02) 9925 5555 Facsimile (02) 9925 5566**

Prepared by:

Shireen Murphy  
Water Resources Engineer

Reviewed by:

Neil Benning  
Principal Engineer, Floodplain Management

**© COPYRIGHT OF SMEC AUSTRALIA 2002**

Any use of this material except in accordance with a written agreement with SMEC Australia is prohibited.



# TABLE OF CONTENTS

<b>EXECUTIVE SUMMARY.....</b>	<b>i</b>
<b>1     INTRODUCTION .....</b>	<b>1-1</b>
1.1   PURPOSE OF THE PLAN.....	1-2
1.2   OBJECTIVES OF THE PLAN.....	1-2
1.3   STRUCTURE OF THE PLAN .....	1-3
1.4   STUDY AREA.....	1-3
1.5   COMMUNITY CONSULTATION.....	1-3
<b>2     THE FLOOD SITUATION .....</b>	<b>2-1</b>
2.1   FLOOD BEHAVIOUR .....	2-1
2.2   FLOOD AFFECTED PROPERTIES.....	2-2
2.3   FLOOD HAZARD .....	2-2
2.4   FLOOD DAMAGES .....	2-3
<b>3     FLOODPLAIN RISK MANAGEMENT MEASURES.....</b>	<b>3-1</b>
3.1   FLOOD MODIFICATION MEASURES.....	3-1
3.1.1 Retarding Basins.....	3-1
3.1.2 Levees .....	3-1
3.1.3 Overland Bypass Floodways .....	3-1
3.1.4 Channel Improvements .....	3-1
3.1.5 Piped Flood Bypass/Bypass Tunnels .....	3-2
3.1.6 Channel maintenance .....	3-2
3.1.7 Overland Flooding in Newport Beach Catchment.....	3-3
3.2   PROPERTY MODIFICATION MEASURES .....	3-3
3.2.1 Development Controls.....	3-3
3.2.2 Section 149 Certificates .....	3-3
3.2.3 State Environmental Planning Policy No. 5 (SEPP 5).....	3-4
3.2.4 Voluntary Purchase.....	3-4
3.2.5 Voluntary House Raising.....	3-4
3.2.6 Flood Insurance .....	3-4
3.3   RESPONSE MODIFICATION MEASURES .....	3-4
3.3.1 Community Awareness and Preparedness.....	3-4
3.3.2 Flood Emergency Plans .....	3-5
3.4   ASSESSMENT OF MEASURES .....	3-5
<b>4     IMPLEMENTATION SCHEDULE .....</b>	<b>4-1</b>
4.1   FUNDING .....	4-1

## FIGURES and PLANS

Figure 1 – Study Area

Figure 2 - Floodplain Risk Management Options

Plan 31039.001 - Flood Extent Mapping

Plan 31039.002 - Flood Hazard - 1% AEP Flood

Plan 31039.003 - Flood Hazard - PMF

## TABLES

Table 2.1 Recorded flood levels in Newport Beach Catchment .....	2-1
Table 2.2 - Number of flood affected properties in Newport Beach.....	2-2
Table 2.3 - Number of properties in Newport Beach flooded above floor level.....	2-2
Table 2.4 - Potential Flood Damages – Existing.....	2-4
Table 3.1 - Properties with Overfloor Flooding - Neptune Road Piped Flood Bypass.....	3-2
Table 4.1 - Summary of Recommended Floodplain Management Measures .....	4-2

## EXECUTIVE SUMMARY

In response to the potential impact of flooding on the Newport Beach community, Pittwater Council has recognised the need to undertake integrated floodplain management to manage the existing and future flood hazard in the community. Following engagement by Council in February 2000, SMEC Australia undertook a detailed Floodplain Risk Management Study (FRMS) and the preparation of a draft Floodplain Risk Management Plan. This document, Volume I – the Final Draft Floodplain Risk Management Plan, presents the plan for the management of flooding within the Newport Beach Catchment. Volume Two – the Floodplain Risk Management Study (FRMS), details the assessment of the various management options considered as well as providing the detailed background to the preparation of this Plan.

This Plan has been developed in accordance with the NSW Flood Prone Land Policy and the principles and guidelines established in the Floodplain Management Manual (FMM), published in 2001. Accordingly, a Flood Study (FS) and a Floodplain Risk Management Study (FRMS) were undertaken for the Newport Beach Catchment Area. The purpose of these Studies was to:

- ◆ Describe the flooding characteristics in the Study area;
- ◆ Describe the social, economic and environmental characteristics of the Study area; and
- ◆ Identify floodplain risk management measures that address the particular characteristics and issues within the study area.

The Newport Beach catchment is situated on the northern beaches peninsula within the Sydney metropolitan area and has an area of 1.79 square kilometres. It is a fully urbanised catchment with residential and commercial properties lining the floodplain flowpaths. In some cases, these properties lie across the floodplain flowpaths.

Stormwater is managed through a system of pipe drainage and overland flows. Stormwater from the northern area flows into an incised gully (historically known as McMahons Creek) that forms one of the two main flow paths leading to the ocean (referred to as the north branch). In the western area, the overland flowpath is not clearly defined upstream of Barrenjoey Road though it does generally follow the line of the piped flow. Downstream, east of Barrenjoey Road, there is a man-made drainage channel to the drainage pipes under the beach dune (the ocean outfall).

In the upper catchment, flooding mainly affects those properties closest to the flow paths; this is particularly so in the north branch, which leads from very steep slopes to the flat area along Barrenjoey Road. Flows along this branch are very fast and there is, on the evidence of residents, a considerable debris load under flood flows, resulting in blocked drainage inlets and culverts. In the west branch, flows are usually slower and are more readily described as sheet flow.

However, when the flows combine in the low-lying areas adjacent to Barrenjoey Road (historically, a small coastal estuary/floodplain known as Farrels Lagoon), the depths of water may be in excess of one metre in a 1% AEP event. Many commercial properties and residential properties in The Boulevarde and Ross Street can be severely affected

The Floodplain Risk Management Study (Volume 2) examined a range of management measures to mitigate the flood impacts on the community of Newport and the broader Pittwater community. The Management Plan provides the management actions that Council will seek to implement as time and funding allow.

These management measures have been determined through the assessment of each option's social, economic and environmental, as well as flooding, impacts. A fundamental principle of this

management plan is to ensure that these measures are not considered individually or in isolation. Measures must be considered collectively so that their interactions, their suitability and effectiveness will ensure that a holistic approach to floodplain management is achieved.

Table 1 provides a summary of the Management Actions to be implemented within the Newport Beach Floodplain Risk Management Plan

**Table 1 – Summary of Recommended Floodplain Risk Management Measures and Implementation Strategies**

Floodplain Management Measures - Recommended
<b>Flood Modification Measures</b>
Howell Close Retarding Basin
Neptune Road Flood Bypass or Bypass Tunnel (Howell Close to Newport Headland) – subject to further investigation
Regrading and Split Flows Howell Close
Foamcrest Avenue Pit Inlet Capacity Upgrade in driveway of unit block
Flowpaths between Units to Barrenjoey Road
Channel maintenance
Investigate Overland Flood Bypass Foamcrest Avenue to Coles Parade
Investigate Overland Flood Bypass Ross Street to ocean outfall
Overland Flooding and Flow Assessment for Newport Catchment
<b>Property Modification Measures</b>
DCP 30 be applied to development within the floodplain
Pittwater 21 incorporate specific development controls for flood prone land
Flood Planning Level of 1% AEP + 0.5m be applied to flood prone land
Council continue to pursue exemption from SEPP 5 within the LGA
Council retain the current wording of S149 Certificates and revise the Notation as required
Implementation of a Voluntary House Raising Program
Property owners to contact insurance companies to determine the limits on flood cover of their insurance policies
<b>Response Modification Measures</b>
Develop Community Flood Awareness and Preparedness Program
Provide SES with updated 'Flood Intelligence' for Newport Beach based on the latest flood information
Consult with other Councils and SES regarding a Peninsula-wide Flood Plan

A further detailed investigation of the Howell Close Retarding Basin and Neptune Road Flood Bypass and Bypass Tunnel options is recommended to confirm project feasibility and cost estimates.

# FLOODPLAIN RISK MANAGEMENT PLAN



# 1 INTRODUCTION

---

Flooding is not a regular occurrence in Newport Beach and many residents in the community have not experienced a flood of major proportions. When floods do occur, water from the upper reaches of the catchment flows along historic flowpaths (now completely modified by urban development) into relatively low-lying areas of Newport Beach. Floodwaters accumulate in that area until they drain into the Pacific Ocean, through constructed drains or over the frontal beach dune. The areas most affected are the commercial area along Barrenjoey Road and the residential areas of Ross Street and The Boulevarde. Properties that adjoin the flowpaths in Howell Close, Seaview Avenue, Ocean Street and Foamcrest Avenue are also affected to varying degrees.

Flooding is a random occurrence in Newport Beach – there is no “flood season” and the extent of flooding can be very different from flood to flood. While the more recent floods – those that have occurred in March 1977, October 1987 and May 1988 – caused inconvenience, a major flood will significantly affect residential and commercial properties within the area. Although there have been no recent major flood events, it is essential that the community, as a whole, take precautions against future events, whether major or minor.

In response to the potential impact of flooding on the Newport Beach community, Pittwater Council has recognised the need to undertake integrated floodplain management to manage the existing and future flood hazard in the community.

Extensive consultation with the community and the Pittwater Joint Coastal, Estuary and Floodplain Management Committee (consisting of Councillors, key government agency representatives, council officers and community representatives) was undertaken as part of the study. The purpose of the consultation was to ensure that all issues relating to flooding were identified and agreement was reached on the floodplain risk management measures.

Each of the management measures was assessed against social, political, economic and environmental factors, as well as flooding factors. Strategies to implement these measures are the focus of the Floodplain Risk Management Plan (FRMP).

Some of the broad benefits gained by the existing flood affected community and residents from undertaking the recommended management actions include:

- ◆ A reduction in average annual damages (whether by the reduced occurrence and extent of over floor flooding; the reduced number of dwellings incurring above floor flooding; the reduced number of flooded allotments; and/or the reduced number of overall dwellings affected by flooding);
- ◆ A reduction in flood hazard levels;
- ◆ A reduction in adverse social impacts (including improved community protection in major floods; improved business viability in the long term);
- ◆ Improved protection of community infrastructure and essential services;
- ◆ Improved community responses to flood risk management (including plans put in place to deal with long duration flooding; better evacuation management, better flood awareness/warning); and
- ◆ Compatibility with ecologically sustainable principles (ESD) principles and incorporation of environmental considerations.

This Plan is a dynamic document, and needs to be reviewed and amended at regular intervals in order to maintain its relevance.

## 1.1 PURPOSE OF THE PLAN

The purpose of the FRMP is to provide Pittwater Council with management measures for addressing the hazards associated with major flooding in the Newport Beach catchment and are aimed at minimising financial and personal loss in the event of flooding to the community directly affected in Newport as well as the broader community of Pittwater.

A fundamental principle of this management plan is to ensure that these measures are not considered individually or in isolation. Measures must be considered collectively so that their interactions, their suitability and effectiveness will ensure that a holistic approach to floodplain risk management is achieved.

This Plan has been developed in accordance with the NSW Flood Prone Land Policy and the principles and guidelines established in the Floodplain Management Manual (FMM), published in 2001. A Flood Study (FS) and a Floodplain Risk Management Study (FRMS) were undertaken for the Newport Beach Catchment Area. The purpose of these Studies was to:

- ◆ Describe the flooding characteristics in the Study area;
- ◆ Describe the social, economic and environmental characteristics of the Study area; and
- ◆ Identify floodplain risk management measures that address the particular characteristics and issues within the study area.

The Management Plan forms the fifth stage in the Floodplain Risk Management Process, which includes:

- ◆ Formation of a Committee;
- ◆ Data Collection;
- ◆ Flood Study;
- ◆ Floodplain Risk Management Study;
- ◆ Floodplain Risk Management Plan; and
- ◆ Implementation of the Plan

## 1.2 OBJECTIVES OF THE PLAN

The primary objectives for the Newport Beach FRMP are:

- ◆ To reduce the flood hazard and risk to people and property in the existing community and to ensure future development is controlled in a manner consistent with the flood hazard and risk by fostering flood compatible best practices.
- ◆ To reduce private and public losses resulting from floods;
- ◆ To protect and where possible enhance the floodplain environment;
- ◆ To be consistent with the objectives of relevant State Policies;
- ◆ To ensure the FRMP is fully integrated with Councils' existing corporate, business and strategic plans, existing and proposed planning proposals, meets Council's obligations under the Local Government Act, 1993;
- ◆ To ensure the FRMP has community support;
- ◆ To ensure actions are sustainable in social, environmental and economic terms
- ◆ To ensure the FRMP is fully integrated with the local emergency management plan and other relevant catchment management plans; and
- ◆ To establish a program for implementation and a mechanism for the funding of the FRMP.

## 1.3 STRUCTURE OF THE PLAN

The Newport Beach Floodplain Management Plan has been structured into two Volumes.

**Volume One – Floodplain Risk Management Plan** is structured to:

- ◆ Identify the area to which this plan applies;
- ◆ Summarise the flood situation in the study area and the main impacts of flooding;
- ◆ Summarise the key findings of Volume Two – Newport Beach FRMS and the key issues that need to be addressed within the plan;
- ◆ Identify the floodplain risk management measures considered for the Plan; and
- ◆ Provide an implementation strategy for the identified management measures.

Volume Two, the Flood Risk Management Study, provides the detail of the review and assessment of management options considered for implementation within the Flood Risk Management Plan, in line with the Floodplain Management Manual (2001). In developing the Plan extensive review of a range of floodplain management measures was undertaken, assessing hydraulic, environmental, social and economic factors and recommendations made on these bases.

## 1.4 STUDY AREA

This plan applies to the Newport Beach catchment area that is affected by mainstream flooding. The area to which this plan applies is shown on Figure 1.

The Newport Beach catchment as addressed in this Plan has an area of about 1.79 square kilometres. The catchment is fully urbanised with residential properties occupying the majority of the area, including the steep slopes along the northern portion of the catchment. The lower lying areas adjacent to the beachfront are generally commercially developed however there are a number of residential properties to the east of Barrenjoey Road that are liable to flooding. The commercial area and its adjoining residential area are developed on what was, historically, a small coastal estuary/floodplain known as Farrels Lagoon. Across the catchment, residential and commercial properties line the flowpaths, and, in some cases these properties lie across the drainage paths.

## 1.5 COMMUNITY CONSULTATION

The Community Consultation Plan involved:

- ◆ Collection of data and community input through direct surveys;
- ◆ Maintaining public awareness of the Study through a newsletter and regular newspaper articles; and
- ◆ Utilising the membership of the Pittwater Joint Coastal, Estuary and Floodplain Management Committee (FMC) as a conduit for community views throughout the Study.

Once the draft Reports were completed, they were reviewed in detail and placed on public exhibition for the standard period before finalisation.



## 2 THE FLOOD SITUATION

---

### 2.1 FLOOD BEHAVIOUR

Stormwater is managed through a system of pipe drainage, open channels and overland flows. Stormwater from the northern area flows into an incised gully (historically known as McMahons Creek) that forms one of the two main flowpaths paths leading to the ocean (referred to as the north branch). In the western area, the overland flowpath is not clearly defined upstream of Barrenjoey Road though it does generally follow the line of the piped flow. Downstream, east of Barrenjoey Road, there is a man-made drainage channel to the drainage pipes under the beach dune (the ocean outfall).

In the upper catchment, flooding mainly affects those properties closest to the flowpaths; this is particularly so in the northern flowpath, or the north branch, that leads from very steep slopes to the flat area along Barrenjoey Road. Flows along this branch are very fast and there is, on the evidence of residents, a considerable debris load under flood flows, resulting in blocked drainage inlets and culverts. In the western flowpath, or the west branch, flows are usually slower and are more readily described as sheet flow.

However, when the flows combine in the low-lying areas adjacent to Barrenjoey Road, the depth of water may be in excess of one metre in a 1% AEP event. Many commercial properties and residential properties in The Boulevarde and Ross Street can be severely affected. Historical flood levels, as identified in the Flood Study, are listed in Table 2.1. These flood levels were obtained from responses to questionnaires distributed to residents during the Flood Study.

**Table 2.1 Recorded flood levels in Newport Beach Catchment**

Flood Event	Address	Reported Flood Level (m AHD)
March 1977	4 The Boulevard	3.56
March 1977	4 Ross Street	3.59
March 1977	6 Ross Street	3.57
March 1977	14 Ross Street	3.45
November 1984	Bramley Avenue Carpark	3.22
April 1998	Bramley Avenue	3.03

A general analysis of the available flood records reveals that flooding in the Newport Beach catchment is an irregular process. There is no consistency within the process other than the predominance of short duration, high intensity rainfall, usually associated with thunderstorm activity.

This inconsistent, randomly occurring flood event pattern is one of the principal issues that must be understood and addressed in the development of the FRMP. It is worth noting that these events are the result of climatic effects however changes to land use and other developments within the catchment have increased the severity of flooding.

As part of the Newport Beach Flood Study, a MIKE 11 hydrodynamic model of the catchment was developed. This model covers the pipe drainage and overland drainage paths identified in the catchment. Floods assessed in the Study were the 20%, 5%, 2% and 1% Annual Exceedance Probability (AEP) floods and the Probable Maximum Flood (PMF).

## 2.2 FLOOD AFFECTED PROPERTIES

There are significant numbers of flood affected commercial and residential properties within the Newport Beach catchment. Table 2.2 summarises the numbers of affected properties. Plan 31039.001 shows the extent of the 1% AEP, flood planning level (1% AEP + 0.5m) and PMF floods in the study area.

**Table 2.2 - Number of flood affected properties in Newport Beach**

Flood Event (AEP)	Residential	Commercial
20%	47	21
5%	63	33
2%	68	36
1%	69	44
PMF	112	123

The property numbers in Table 2.2 include those properties where floodwaters only affect land as well as where floodwater exceeds the floor level of a residence or commercial property. Table 2.3 summarises the numbers of properties where the flood level exceeds the floor level for residential and commercial properties. A detailed analysis of these figures can be found in Section 7 of the FRMS, dealing with flood damages.

**Table 2.3 - Number of properties in Newport Beach flooded above floor level**

Flood Event (AEP)	Residential	Commercial
20%	19	13
5%	38	22
2%	45	30
1%	49	31
PMF	86	120

Previous floodplain risk management measures adopted in the Newport Beach catchment have concentrated on upgrading the piped drainage system. This has occurred in the Bramley Avenue Carpark, leading to the ocean outfall, and along Robertson Road.

While these measures have reduced overland flow flooding in some areas, they are not a comprehensive solution to the Newport Beach catchment flooding. A more comprehensive approach is discussed in Section 8 of the FRMS.

## 2.3 FLOOD HAZARD

Identification of the flood hazard category was determined in accordance with the NSW Floodplain Management Manual (FMM) 2001, with the assistance of recent technical papers further addressing the issue of hazard in flood prone areas.

The FMM defines flood zones into three categories, namely, "floodways", "flood storage" and "flood fringe".

- ◆ Floodways are areas with significant flowpaths that should be kept free of obstructions, else upstream flood levels may increase.

- ◆ Flood storage areas hold significant volumes of water during floods and should not be filled (for development) else downstream flood discharges may increase.
- ◆ Flood fringe areas are inundated but pass no significant amounts of flood and hold no significant storage.

The FMM also categorises flood affected areas into two hazard categories, namely, "high hazard" and "low hazard". These categories are generally assessed based on flow depth and flow velocity as indicated in Figure G2, Appendix G of the FMM. There are other factors that influence flood hazard including flood rate of rise, warning time, access or evacuation opportunities that also need to be considered in the assessment of flood hazard categories.

The categorisation across the floodplain has taken all issues into account, particularly the depth of flooding, the limited warning time and generally rapid rise of water level. The "high hazard" rating applied to some areas within the floodplain is not intended to sterilise the land for any use. Rather, it is a signal that any development that occurs in these areas should be planned with due attention to the flood related issues and that strict implementation of flood related development controls is essential for the reduction of flood damages. All development within flood affected areas should address Pittwater Council's flood risk management development controls

All six flood hazard categories have been found to be applicable in the study area and are illustrated in Plans 31039.002 and 31039.003. The flood hazard categories are:

- ◆ low hazard floodway;
- ◆ low hazard flood storage;
- ◆ low hazard flood fringe;
- ◆ high hazard floodway;
- ◆ high hazard flood storage; and
- ◆ high hazard flood fringe.

The key issues that need to be considered to determine appropriate management options are summarised below and the measures to address them are described in Section 8 of the FRMS:

- ◆ There is a need to recognise and plan for the random occurrence of flooding that affects Newport Beach Catchment;
- ◆ There are significant numbers of residential and commercial properties that are flood prone in Newport Beach. This situation is largely historical in nature with the catchment now being fully urbanised. Ongoing development needs to be undertaken with due regard for the type of flooding that does occurs within parts of the Catchment;
- ◆ As recent flooding has been of a minor nature and the experience of major flooding is disappearing with time flood awareness would be expected to be low; and
- ◆ The floodplain around the lower parts of the Catchment and the floodways should be considered high hazard due to the short warning time and general depth of flooding.

## 2.4 FLOOD DAMAGES

An important component of the study was the estimation of flood damages and a calculation of the Average Annual Damages. At the broadest level, flood damages are either financial or social in nature and are often respectively referred to as the tangible and intangible costs of flooding. The total financial "damage" caused by a flood can be separated into two major components:

- ◆ The cost of the direct damage to inundated property; and
- ◆ The cost of the indirect damage associated with the disruption of social, community and business relationships during the aftermath of a flood.

A detailed description of the assessment of these damages is presented in Section 7 of the FRMS. The results of these calculations for existing conditions are summarised in Table 2.4. The resulting flood damage estimates were used as part of the economic assessments undertaken for the floodplain management measures. These are detailed in Section 8 of the FRMS.

**Table 2.4 - Potential Flood Damages – Existing**

Flood Event (AEP)	Residential Damage (\$)	Commercial Damage (\$)	Infrastructure Damage (\$)	Total (\$)
20%	693,600	909,800	1,000	1,604,400
5%	1,384,600	1,288,600	5,000	2,678,200
2%	1,812,100	1,599,400	10,000	3,421,500
1%	2,158,500	2,123,000	312,300	4,593,800
PMF	5,331,300	23,183,900	5,668,600	34,183,800
<b>AAD (\$)</b>	<b>365,100</b>	<b>489,700</b>	<b>32,300</b>	<b>887,100</b>

It should be noted that these estimates are potential damages and do not necessarily reflect actual damages that may occur during a flood. The actions of emergency services, the evacuation of residents and their property and, most especially, the evacuation of goods and equipment from commercial properties in the flood affected areas will significantly reduce the level of flood damage.

## 3 FLOODPLAIN RISK MANAGEMENT MEASURES

Floodplain management measures that may reduce flood losses can be divided into three categories:

- ◆ **Flood Modification:** modifying the behaviour of the flood itself;
- ◆ **Property Modification:** modifying and/or imposing controls on property and infrastructure development; and
- ◆ **Response Modification:** modifying the response of the population at risk to better cope with a flood event.

### 3.1 FLOOD MODIFICATION MEASURES

#### 3.1.1 Retarding Basins

A suitable site for a retarding basin was identified in Newport Park however, it was determined by hydraulic modelling that it was not a viable flood modification measure. It provided minimal reduction in flood levels for what would be a significant cost.

A suitable site for a retarding basin was identified in the upper reaches of the north branch (above Howell Close in Crown of Newport Reserve). This basin would have significant effects on downstream flows, flood levels and rate of rise and is a recommended management option. This Measure should be designed and constructed as a high priority.

#### 3.1.2 Levees

From a strictly technical viewpoint, levees may be a feasible option to protect some of the lower lying parts of the Newport Beach catchment from a range of floods. However, while levees may be feasible, it is considered that the disbenefits of a levee – the environmental impact, the cost and consequences of failure - far outweigh any potential benefits. Accordingly, levees are not considered a viable floodplain management option for the Newport Beach catchment.

#### 3.1.3 Overland Bypass Floodways

Within the Newport Beach catchment, opportunities for the construction of bypass floodways are limited because of the topography, environmental and ecological considerations and the availability of land. Two possible locations for bypasses have been identified:

- ◆ Foamcrest Avenue to Coles Parade; and
- ◆ Ross Street to the ocean outfall.

The bypass options may be viable and it is recommended that they be further investigated as a separate study with a medium priority.

#### 3.1.4 Channel Improvements

This option was considered in conjunction with the Howell Close retarding basin. Channel improvement options were investigated for the existing channel downstream of Barrenjoey Road on the west branch however it was determined, by hydraulic modelling, that flood modification measures were not viable.

Several options were investigated for the north branch, and were found to be effective in reducing flood levels. However, in the upper reaches, these structural works would impact markedly on properties and could result in potentially greater impact downstream. In addition, for events greater than the 1% AEP flood, properties would still be exposed to high hazard flows.

Improving flowpaths at the downstream end of this branch to Barrenjoey Road are recommended for implementation, as they provide flood benefits at a reasonable cost and will result in minimal impact to properties. These Measures should be designed and constructed as a high priority.

### **3.1.5 Piped Flood Bypass/Bypass Tunnels**

Piped flood bypass systems or a tunnel redirect a portion of the floodwaters away from areas under threat, reducing flood levels along the channel downstream.

Flood modelling and hazard assessment indicate that properties along the north branch are subject to high hazard flood flows in the 1% AEP flood event. Due to current urban development, the likelihood of providing any realistic drainage reserve/channel improvements to mitigate this hazard is very limited. High hazard floodways run through a number of properties where channel improvement options would isolate properties, increase blockage potential and result in safety hazards.

Therefore consideration was given to the redirection of overland floodwaters from the proposed retarding basin in the Crown of Newport Reserve behind Howell Close, to the northern end of Newport Beach. This would entail a new stormwater system along Howell Close and down Neptune Road, discharging to an upgraded outlet at the northern end of the Newport Beach carpark or alternatively a Bypass Tunnel from the proposed Retarding Basin to Newport Headland at the northern end of Newport Beach.

This option is attractive on social, economic and environmental, as well as flooding, grounds however detailed design is required to ensure its full operational effectiveness. This Measure should be designed and constructed as a high priority.

***Table 3.1 - Properties with Overfloor Flooding - Neptune Road Piped Flood Bypass***

Flood Event (AEP)	Existing Conditions		Neptune Road Piped Bypass	
	Residential	Commercial	Residential	Commercial
20%	19	21	2	13
5%	38	33	8	16
2%	45	36	20	17
1%	49	44	22	17
PMF	86	123	44	104

### **3.1.6 Channel maintenance**

Debris may exacerbate potential flooding, blocking flowpaths and pipes and should be removed from drainage channels on a regular basis. A major source of debris, particularly in the north branch, is from trees. While little can be done to stop foliage falling and being swept into the stormwater system during storms, it may be viable to encourage volunteer bush regeneration groups and residents to manage vegetation to reduce the amount of debris entering the stormwater system. In addition, a maintenance program should be implemented by Council and subject to available funding, debris traps should be

provided at appropriate locations to reduce blockages at pipe inlets. This Measure should be implemented as a high priority.

### **3.1.7 Overland Flooding in Newport Beach Catchment**

A number of small overland flowpaths within the Newport Beach catchment contribute to flooding in the main streams. They may have a localised flooding impact on individual properties but do not pose a significant impact when compared to mainstream flooding. These flowpaths have been taken into account in the rainfall/runoff model for input into the mainstream flood analysis, but have not been specifically modelled hydraulically. It is recommended that they be investigated on a case by case basis with a medium priority.

## **3.2 PROPERTY MODIFICATION MEASURES**

Issues affecting the Newport Beach catchment relate to the nature and pattern of development in flood affected areas. Property Modification Measures ensure that potential damage to developments at risk is limited to acceptable levels by means of minimum floor levels, flood proofing etc. Appropriate development controls are an integral part of a Floodplain Risk Management Plan and are essential if the rate of growth of future flood damage is to be limited. The measures outlined below should be implemented as a high priority.

### **3.2.1 Development Controls**

During the preparation of this Floodplain Risk Management Study and Plan for the Newport Beach catchment, Council undertook a review of its flood policy and flood-related development controls, with adoption of the Flood Risk Management Policy for Pittwater and Development Control Plan 30 – Pittwater Flood Risk Management.

Council has adopted Pittwater 21, under the State Government's PlanFIRST initiative. The draft Pittwater 21 LEP includes reference to the flood hazard and the new Pittwater 21 DCP includes development controls for flood prone land consistent with the current DCP 30.

With regard to the Flood Planning Level, it is recommended that the present 1% AEP flood level plus 0.5 m freeboard continue to be applied to all properties located within the Newport Beach catchment subject to the FPL or affected by the PMF (whichever is the higher) with the objective, over time, to raise the floor levels of all flood affected single residences to the Flood Planning Level and floor levels of multi-unit development (including SEPP 5 developments) to the greater of the FPL or the Probable Maximum Flood level.

### **3.2.2 Section 149 Certificates**

The primary function of S149 Certificates is to notify purchasers and development applicants that the land is affected by a policy that restricts development due to the likelihood of a risk. The S149 Certificates can play a role in community awareness but should not be relied upon to provide detailed flood information.

Council has a statutory responsibility to update S149 Certificates as new information becomes available, and has done so recently.

### **3.2.3 State Environmental Planning Policy No. 5 (SEPP 5)**

Schedule 1 of the SEPP, describes those lands which are environmentally sensitive and that the SEPP does not apply to - these lands can be described as being either 'floodway' or 'high flooding hazard'. No reference is made in the SEPP as to whether this is applicable for the Flood Planning Level or for the entire floodplain (i.e. up to the Probable Maximum Flood). Given the risks associated with flooding in Newport, it is strongly recommended that Council continue to pursue exemption from SEPP5 for the entire LGA.

Whatever the outcome, the requirements of DCP 30 must be applied to SEPP 5 developments.

### **3.2.4 Voluntary Purchase**

Following a review, and subject to other measures being put in place, no properties were identified for voluntary purchase.

### **3.2.5 Voluntary House Raising**

The Newport Beach catchment was reviewed and 30 houses were identified for house raising over time through redevelopment and the application of the Flood Planning Level.

### **3.2.6 Flood Insurance**

Flood insurance as a means of reducing the impact of flooding by providing some form of cost recovery after a flood occurs. However, it is not strictly a mitigation measure but simply a way of spreading the financial risk and cost across a broader section of the community. Owners of flood prone land should inform themselves as to the details of their insurance cover.

## **3.3 RESPONSE MODIFICATION MEASURES**

Response Modification Measures encompass various means of modifying the response of the community to the flood threat. Such measures include flood warning, plans for the protection and evacuation of an area and for recovery after a flood. Planning for natural disasters is covered in DISPLANS.

Unless the Probable Maximum Flood is adopted as the design flood, all flood and property modification measures will ultimately be overwhelmed by a larger flood. The development and implementation of effective emergency response plans are a means of reducing flood-related damages. The measures outlined below should be implemented as a high priority.

### **3.3.1 Community Awareness and Preparedness**

Recommended measures for enhancing flood awareness and preparedness are:

- ◆ advice about flooding sent to ratepayers and tenants/residents from time to time;
- ◆ development of school programs;
- ◆ displays of flood photographs, videos and newspaper articles at Council offices, shopping centres and at festivals/community events;
- ◆ erecting signs showing where flood waters have come to in previous flood events; and
- ◆ encouraging the preparation of flood plans by individual commercial property owners.

A major part of the Community Awareness and Preparedness Program should be devoted to information dissemination.

### **3.3.2 Flood Emergency Plans**

The SES ‘Flood Intelligence’ for Newport Beach requires updating to include the new detailed information available in the recent Flood Study and this Study. In particular, the Flood Intelligence needs to include the flood extent map (Map 1) and flood hazard maps (Maps 2 and 3) prepared for this report. A flood level warning system could also be investigated for the proposed retarding basin.

For rare flood events, Council and the SES will need to assist residents in determining measures that need to be put in place to gain safe refuge, or if this is not possible, identification of evacuation routes that are not cut-off in a major flood (if available).

Given that the Peninsula as a whole may be affected by flooding at a number of locations at the same time, it is strongly recommended that Council commence consultation with Manly and Warringah Councils and the SES with the aim of establishing a Peninsula-wide Flood Plan.

## **3.4 ASSESSMENT OF MEASURES**

During the FRMS, a range of options was developed for the Newport Beach catchment. The FRMS undertook a review of these various flood mitigation options available, and, with vital input from the community and the Pittwater Joint Coastal, Estuary and Floodplain Management Committee, the most appropriate floodplain risk management measures for Newport Beach catchment were identified.

Once the management options that were considered to have potentially beneficial impacts were identified, a detailed assessment of the social, economic and environmental implications of each option was undertaken. This investigation is reported in Section 8 of the FRMS and **Table 4.1** provides a summary of the Management Measures to be implemented as part of the FRMP. This table identifies the management measures to be undertaken, the timeframe, responsibility and indicative costs. While these are recommended priorities, implementation will be dependant on the availability of Council resources and funding, particularly State Government funding assistance.



## 4 IMPLEMENTATION SCHEDULE

---

To encompass all the items discussed in this Plan and identified and assessed in the FRMS, an implementation schedule has been prepared, **Table 4.1**. This table identifies the management measures to be undertaken, the timeframe, responsibility and indicative costs. While these are recommended priorities, implementation will be dependant on the availability of Council resources and funding, particularly State Government funding assistance.

### 4.1 FUNDING

Under the NSW Government's Floodplain Management Program, financial assistance is provided to Councils for the implementation of floodplain management measures. It is understood that current arrangements are that funds are provided on a 2:1 (State: Council) basis. The provision of state funds under the program is dependent on statewide priorities and the availability of funds. Demand for funding to undertake flood mitigation works including voluntary purchase and house raising schemes is strong and funding may need to be extended over some years. Funding under the program is provided on the basis of Council committing their one-third contribution.

If this Floodplain Risk Management Plan is adopted, Council will need to make an application for financial assistance to the Department of Infrastructure, Planning and Natural Resources which administers the Government's Floodplain Management Program.

It should be noted that the standard practices need to be followed for any floodplain management works - the works should be investigated, designed, assessed environmentally and appropriate approvals obtained by Council prior to proceeding to the calling of construction tenders.

**Table 4.1 - Summary of Recommended Floodplain Management Measures**

Option/ Combined Options	Advantages/ Reduction in Flood Risk	Disadvantages/Impacts	Financial Assessment	Priority	FRMS Ref.
Retarding Basin Howell Close	<ul style="list-style-type: none"> <li>- slower rate of rise of flood waters through Howell Close properties</li> <li>- some reduction in flood levels along entire north branch</li> </ul>	<ul style="list-style-type: none"> <li>- visual impact of basin (although this could be minimised through appropriate design and landscaping)</li> <li>- properties downstream still exposed to high hazard flows in events such as the 1% AEP</li> </ul>	estimated cost \$322,600	High	8.2.2 NB Fig. 8.2 Also see 8.2.5 (i) or 8.2.5 (ii)
Regrading and Split Flows plus Retarding Basin Howell Close	<ul style="list-style-type: none"> <li>- reduction in flood levels over these properties in 1% AEP event</li> <li>- for regrading/split flows - low hazard flood flows through properties</li> </ul>	<ul style="list-style-type: none"> <li>- works on private property</li> <li>- two properties still affected by overfloor flooding in 1% AEP</li> <li>- high hazard flows through upstream section of public access way in 1% AEP event</li> </ul>	estimated cost \$70,600 plus Retarding Basin \$322,600	High	8.2.3 (i) NB Fig. 8.2 8.2.5 (i) or 8.2.5 (ii)
Pit Upgrades - Foamcrest Avenue in unit driveway Alternative in drainage reserve	- increased inlet capacity to utilise pipe capacity downstream of where open channel is converted to piped drainage system and surcharging of system impacts on units	- for alternative option additional pipe across road therefore higher cost	estimated cost \$5,000  alternative option not costed	Medium	8.2.3 (vii) Fig. 8.7
Flowpaths through Barrenjoey Road units	<ul style="list-style-type: none"> <li>- significant reduction in ponding between Foamcrest Avenue and Barrenjoey Road</li> <li>- flood levels reduced by up to 0.4 m for two Foamcrest Avenue properties in 1% AEP event</li> </ul>	<ul style="list-style-type: none"> <li>- works on private property</li> <li>- possible security concerns with removal of solid boundary walls and replacement with open style fences</li> <li>- increased flows through grounds of Barrenjoey Road units in 1% AEP event (garage not affected)</li> </ul>	estimated cost \$62,500	Medium	8.2.3 (viii) Fig. 8.7

Option/ Combined Options	Advantages/ Reduction in Flood Risk	Disadvantages/Impacts	Financial Assessment	Priority	FRMS Ref.
Overland Bypass Floodways – Foamcrest Avenue to Coles Parade and Ross Street to Ocean outfall	<ul style="list-style-type: none"> <li>- diversion of a portion of floodwaters from areas at risk</li> <li>- improve passage of floodwaters through defining specific flowpaths using major/minor floodway approach</li> </ul>	<ul style="list-style-type: none"> <li>- very specific survey data required,</li> <li>- hydraulic implications not assessed, investigation required</li> <li>- may be assessed with overland flow issues</li> </ul>	total estimated \$80,000	Medium	8.2.4
Neptune Road Piped Flood Bypass plus Howell Close Retarding Basin, Regrading and Split Flows Howell Close and Flowpaths through Barrenjoey Road units	<ul style="list-style-type: none"> <li>- all flows from McMahon's Creek bypass to new Neptune Road piped system in 1% AEP event</li> <li>- no flow in outlet channel/public accessway adjacent to Howell Close in 1% AEP event</li> <li>- reduction in flood levels and velocities along the entire north branch in 1% AEP event</li> <li>- reduction in flood levels and velocities in PMF</li> <li>- reduction in ponding between Foamcrest Avenue and Barrenjoey Road</li> <li>- small reduction in flood levels in Barrenjoey Road/Bramley Avenue carpark and Ross Street area</li> <li>- 27 fewer residential properties affected by overfloor flooding in 1% AEP event</li> <li>- 42 fewer residential properties affected by overfloor flooding in PMF</li> <li>- 8 fewer commercial properties affected by overfloor flooding in 1% AEP event</li> <li>- 19 fewer commercial properties affected by overfloor flooding in PMF</li> <li>-</li> </ul>	<ul style="list-style-type: none"> <li>- visual impact of retarding basin</li> <li>- works on private property for split flows at Howell Close and flowpath through Barrenjoey Road units</li> <li>- easement required through two Howell Close properties for bypass pipe</li> <li>- redirection of McMahon's Creek flows from ocean outfall at centre of Newport Beach to outlet at northern end of beach (ponding and scour would need to be addressed at design phase)</li> <li>- flows from other sources still affect some properties, i.e. in the 1% AEP event, one property in Ismona Avenue and one Neptune Road garage is still affected by overfloor flooding, and there is potential overfloor flooding at one Neptune Road property and two properties in Howell Close</li> <li>- flows down basin outlet channel/public accessway and over spillway in PMF</li> </ul>	estimated cost \$6,712,500  total reduction in AAD \$451,040  associated benefit/ cost ratio = 0.95	High (subject to further investigations in conjunction with Bypass Tunnel option)	8.2.5 (ii) Fig. 8.9 - 8.12

Option/ Combined Options	Advantages/ Reduction in Flood Risk	Disadvantages/Impacts	Financial Assessment	Priority	FRMS Ref.
Bypass Tunnel Howell Close to Newport Headland plus Howell Close Retarding Basin, Regrading and Split Flows Howell Close and Flowpaths through Barrenjoey Road units	<ul style="list-style-type: none"> <li>- all flows from McMahon's Creek bypass to new Neptune Road piped system in 1% AEP event</li> <li>- no flow in outlet channel adjacent to Howell Close in 1% AEP event</li> <li>- reduction in flood levels and velocities along north branch in 1% AEP event</li> <li>- reduction in flood levels and velocities in PMF</li> <li>- reduction in ponding between Foamcrest Avenue and Barrenjoey Road</li> <li>- small reduction in flood levels in Barrenjoey Road/Bramley Avenue carpark and Ross Street area</li> <li>- 27 fewer residential properties affected by overfloor flooding in 1% AEP</li> <li>- 42 fewer residential properties affected by overfloor flooding in PMF</li> <li>- 8 fewer commercial properties affected by overfloor flooding in 1% AEP event</li> <li>- 19 fewer commercial properties affected by overfloor flooding in PMF</li> </ul>	<ul style="list-style-type: none"> <li>- visual impact of retarding basin</li> <li>- works on private property for split flows at Howell Close and flowpath through Barrenjoey Road units</li> <li>- redirection of flows from McMahon's Creek from ocean outfall at centre of Newport Beach to new cliff face outfall at northern headland (possible visual, ecological and recreation/access impacts)</li> <li>- flows from other sources still affect some properties, i.e. in the 1% AEP event, one property in Ismona Avenue and one Neptune Road garage is still affected by overfloor flooding, and there is potential overfloor flooding at one Neptune Road property and two properties in Howell Close</li> <li>- flows down basin outlet channel/public accessway and over spillway in PMF</li> </ul>	estimated cost \$14,079,000 reduction in total AAD \$451,040 associated benefit/ cost ratio = 0.45 (residential, commercial and infrastructure damages)	High (subject to further investigations in conjunction with Bypass Tunnel option)	8.2.5 (i) Fig. 8.8
Channel Maintenance	<ul style="list-style-type: none"> <li>- may increase capacity of stormwater system to convey flows</li> </ul>	<ul style="list-style-type: none"> <li>- may have positive impact through removal of weeds</li> </ul>	estimated initial cost \$10,000 ongoing cost \$5,000 per annum	High	8.2.9
Overland Flooding and Flow Assessment	<ul style="list-style-type: none"> <li>- reduction in flooding impacts from local drainage</li> </ul>	<ul style="list-style-type: none"> <li>- not assessed, investigation required</li> </ul>	estimated cost of investigations \$120,000	Medium	8.2.10

Option/ Combined Options	Advantages/ Reduction in Flood Risk	Disadvantages/Impacts	Financial Assessment	Priority	FRMS Ref.
DCP 30 be applied to development in the floodplain	<ul style="list-style-type: none"> <li>- over time floor levels of all affected properties raised to at least the FPL</li> <li>- new development designed to address the flood risk</li> <li>- no adverse flooding impacts on existing development from new development</li> </ul>	<ul style="list-style-type: none"> <li>- would be assessed on individual property basis</li> </ul>	n/a	High	8.3.1
Pittwater 21 incorporate specific development controls for flood prone land	<ul style="list-style-type: none"> <li>- essentially as for DCP 30</li> </ul>	<ul style="list-style-type: none"> <li>- would be assessed on individual property basis</li> </ul>	n/a	High	8.3.1
Retain FPL of 1% AEP event level plus 0.5 m freeboard	<ul style="list-style-type: none"> <li>- over time floor levels of all affected properties raised to FPL</li> </ul>	<ul style="list-style-type: none"> <li>- would be assessed on individual property basis</li> </ul>	n/a	High	
Retain current wording of S149 Certificates	<ul style="list-style-type: none"> <li>- property buyers and property developers informed of flood risk</li> </ul>	<ul style="list-style-type: none"> <li>- n/a</li> </ul>	n/a	High	8.3.2
Pursue exemption of SEPP 5 development within LGA	<ul style="list-style-type: none"> <li>- eliminates risks associated with protecting/evacuating multi-unit/group housing for the elderly and disabled in flood event</li> </ul>	<ul style="list-style-type: none"> <li>- n/a</li> </ul>	n/a	High	8.3.3
Voluntary House Raising through redevelopment	<ul style="list-style-type: none"> <li>- gradual reduction in properties affected by overfloor flooding in 1% AEP event and some larger events</li> <li>- in the long-term 30 fewer properties affected by overfloor flooding in 1% AEP event</li> <li>- may be implemented through policy of redevelopment subject to FPL</li> </ul>	<ul style="list-style-type: none"> <li>- possible visual, streetscape impacts</li> <li>- possible access impacts for less able</li> <li>- does not address safety issues relating to high hazard flows</li> <li>- would take many years to implement</li> <li>- not all houses suitable for raising</li> </ul>	estimated cost \$1,350,000 reduction in residential AAD \$77,576 associated benefit/ cost ratio = 1.02	High	8.3.5

Option/ Combined Options	Advantages/ Reduction in Flood Risk	Disadvantages/Impacts	Financial Assessment	Priority	FRMS Ref.
Property Owners to check flood insurance cover	<ul style="list-style-type: none"> <li>- reduction in the financial impacts of flooding</li> </ul>	<ul style="list-style-type: none"> <li>- flood insurance may be unavailable where flood risk is assessed as high or premiums may be prohibitive</li> <li>- does not reduce social impacts of flooding</li> </ul>	n/a	High	8.3.6
Community Flood Awareness and Preparedness Program	<ul style="list-style-type: none"> <li>- reduction in loss or damage to possessions as a result of flooding</li> </ul>	<ul style="list-style-type: none"> <li>- needs to be ongoing to maintain consciousness of hazard and inform newcomers to the area</li> <li>- benefits of being prepared are reduced by short flood warning times</li> <li>- population turnover requires vigilance in Flood Awareness Program</li> </ul>	n/a	High	8.4.1
Update SES 'Flood Intelligence' for Newport	<ul style="list-style-type: none"> <li>- improved response to flood events</li> </ul>	<ul style="list-style-type: none"> <li>- benefits are reduced due to short flood warning times and possible flooding of main access routes</li> </ul>	n/a	High	8.4.2
Assess arrangements for SES to respond to full range of events across peninsula	<ul style="list-style-type: none"> <li>- improved response to flood events through community awareness, community knowledge of response measures and access/evacuation procedures</li> </ul>	<ul style="list-style-type: none"> <li>- benefits are restricted due to short flood warning times</li> <li>- population turnover requires vigilance in Flood Awareness Program</li> </ul>	n/a	High	8.4.2