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1 BACKGROUND

1.1 FLOODPLAIN MANAGEMENT SETTING

The Moruya River drains a catchment of some 1,500 square kilometres. In the main, the catchment is rugged and steep, rising to 1,000 metres above sea level only 40 kilometres inland. As a consequence, catchment runoff is swift and the Moruya River develops large flood flows in a relatively short space of time. The 1% flood discharge of the Moruya River is almost as great as that of the Hunter River, despite the latter having a catchment nearly fifteen times greater!

The lower catchment of the Moruya River extends from the coast to Wamban, a distance of 22 kilometres. It comprises the urban centres of Moruya, Mynora, Garlandtown, Moruya Heads and scattered rural communities of Yarragee, Kiora and Wamban - refer Figure 1.

The floodplain of the Lower Moruya River represents low lying land which varies in width from a few hundred metres, upstream of Yarragee, to several kilometres, across Mullenderee flats (Figure 1). The floodplain has a typical elevation of 2 metres above sea level which is to be compared with flood levels which can reach a maximum of almost 7 metres above sea level.

Because the flood flows of the Moruya River debouch rapidly from the steep upper catchment, the great depth of flood water, during major floods, can be relatively fast moving. This makes flood conditions on the lower Moruya River amongst the most hazardous on the coast. It is imperative that living with this natural hazard is properly managed.

It has been estimated by computer modelling, utilising collected field data, that if the Flood of Record *(ie. May 1925)* occurred today, a total of more than 220 residential, rural, business and industrial properties would be flooded to an average depth of 1.5 metres above floor level. The flood damage would exceed \$12 million. This does not include the trauma such an event would create and the consequential health problems that would stay with the community long after the flood waters had subsided.

Urban growth on the South Coast is increasing pressure for expansion of the residential, industrial and commercial areas of Moruya. The low lying areas of the floodplain, particularly east of the CBD and North Moruya, despite the risk of flooding, are sought for future development. Indiscriminate development however, would cause the flood damage potential to grow alarmingly.

1.2 PREVIOUS STUDIES AND THE FLOODPLAIN MANAGEMENT PROCESS

In 1981, a floodplain management study¹ of the Moruya Valley was completed as part of the NSW coastal rivers floodplain management series. This study proposed a series of flood mitigation measures aimed at reducing the hazards associated with flooding.

¹ Gutteridge, Haskins & Davey (1981) Moruya Valley: Floodplain Management Study Unpublished report prepared for NSW Coastal Rivers Floodplain Management Studies Steering Committee

With the introduction of the NSW Floodplain Management Policy, a Floodplain Management Committee (FMC) was established with the aim of preparing a Floodplain Management Plan, which addressed the management of floodprone land within the valley, and could be implemented by Council under the conditions set out in the Environmental Planning and Assessment Act, 1979. In preparing such a Floodplain Management Plan, a number of steps was first required, as outlined in the Floodplain Management Manual².

The following diagram illustrates the floodplain management process.



In 1992, a flood study³ was prepared to determine the design flood levels through the use of hydrologic and hydraulic computer models. The results of this flood study provided the basis for hydraulic and hazard classification throughout the floodplain. Following on from the flood study, a floodplain management study was carried out by Patterson Britton & Partners⁴. The central task of the floodplain management study was to reduce the impact of floods on the existing floodprone communities and to identify development strategies which would allow Moruya, and its surrounding urban centres, to grow in a manner wholly consistent with the local flood hazard. To meet this objective, the floodplain management study first needed to define the nature of the flood hazard, examine the economic and social impacts of flooding, and develop structural and non-structural measures for mitigating the effects of the flood hazard.

Based on the information provided in the floodplain management study, a comprehensive floodplain management plan has be prepared which meets with the overall objectives of the NSW Government's Floodplain Management Policy.

1.3 OBJECTIVES OF THE FLOODPLAIN MANAGEMENT PLAN

In accordance with the NSW Government's Floodplain Management Manual², the object of a Floodplain Management Plan is to reduce the impact of flooding and flood liability on individual owners or occupiers, and to reduce private and public losses resulting from flooding. With particular reference to the Moruya Valley, the objectives of this Floodplain Management Plan are:

To ensure the use of flood liable land is planned and managed in a manner compatible with the assessed frequency and severity of flooding;

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² NSW Government (1999) Floodplain Management Manual - Draft

³NSW Public Works (1992) Moruya River Flood Study

⁴ Patterson Britton & Partners (1996) Moruya River Floodplain Management Study Prepared for NSW Public Works and Eurobodalla Council

- To ensure flood liable land is planned and managed, having regard to social, economic and ecological costs and benefits, to individuals as well as the community;
- To ensure floodplain management matters are dealt with having regard to community safety, health and welfare requirements;
- To ensure information on the nature of possible future flooding is available to the public and emergency services personnel;
- To ensure all reasonable measures are taken to alleviate the hazard and damage potential resulting from new development on the floodplains; and
- To ensure there is no significant growth in hazard and damage potential resulting from new development on floodplains.

This Floodplain Management Plan addresses the above, in an manner which corresponds with the Floodplain Management Manual. The following chapters have been set-out to describe:

- The nature of flooding, including hydraulic and hazard categorisation and impacts of flooding (*Chapter 2*);
- □ Hazard management strategies, including flood mitigation and egress works, development constraints and contingency planning (*Chapter 3*);
- Implementation of the Plan and adopted strategies (Chapter 4); and
- A revised Development Control Plan (DCP) for the floodprone areas (Chapter 5).

2 NATURE OF FLOODING IN THE MORUYA VALLEY

2.1 DESIGN FLOODS

The Moruya River Flood Study (*PWD*, 1992) investigated four (4) design flood events, viz: 5%, 2% 1% AEP⁵ events and an extreme probability event. The study used calibrated computational hydrologic and hydraulic models to predict flood flows, velocities and water levels throughout the floodplain for these different design events. **Table 2.1** shows predicted water levels at Moruya Bridge for the design flood events.

Dialgir Plora	$($ ovel $(\mathbf{m}, \Delta \mathbf{P}(\mathbf{t}))$
Extreme ⁷	6.9
1% AEP	5.1
2% AEP	4.7
5% AEP	4.2

Table 2.1Design Flood Levels at Moruya Bridge
(Source: PWD, 1992)

A sound understanding of the behaviour of flooding in the valley was obtained from these computational models. The hydraulic model clearly demonstrates that the flow patterns associated with more frequent floods was significantly different than from more extreme probable events. Based on the different behaviour patterns, flood events in the valley were broadly categorised into either frequent floods, or severe floods. The behaviours for these flood events are described below.

2.1.1 Frequent Flood Behaviour

"Frequent" floods are those which have an annual exceedence probability (AEP) greater than 5% to 10%, ie generally results in peak flood levels at Moruya Bridge of less than

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⁵ Average Exceedence Probability (AEP) represents the odds of a particular flood level being exceeded in any year, ie a 1% AEP event has a 1 in 100 chance of being exceeded in any year.

⁶ Australian Height Datum (AHD): Standard survey datum. 0 m AHD approximately represents mean sea level.

⁷ The extreme level is an <u>estimate</u> of the probable maximum flood (PMF) and is not based on a rigorous assessment of probable maximum precipitation.

Moruya River Floodplain Management Plan

approximately 4 metres AHD. The flood behaviour of frequent events is summarised in Figure 2.

In the initial stages of flooding, flows are confined by the height of the river banks. Inundation of the northern and southern floodplains begins as floodwaters backup Malabar Lagoon and Racecourse/Gundary Creeks, respectively.

As the floodwaters rise further, the southern river bank is overtopped along the low fluvial terrace immediately downstream of the caravan park. The southern floodplain becomes fully inundated as water spills over the river bank, at the back of the terrace, and as well as the river bank further upstream at Rotary Park.

The northern river banks are first overtopped opposite Yarragee. Initially flow is concentrated into relic channels *(swales)* in the floodplain. Increasing flow across the northern floodplain combines with water backing-up from Malabar Lagoon to drown the Highway, up to 1 metre depth, over the full width of Mullenderee flat.

Because flow onto the floodplain during frequent events is controlled by the height of the river banks, 90% of the total flood discharge is confined to the main river channel. Only 2% is conveyed across the northern floodplain and 8% is conveyed across the southern floodplain.

Peak flow depths and velocities on the southern floodplain reach up to 0.5 m and 0.5 m/sec, respectively. Flow depths and velocities on the northern floodplain reach up to 1 metre and 0.1 m/sec, respectively.

2.1.2 Severe Flood Behaviour

Severe floods have an annual exceedence probability (AEP) greater than 5%. The last severe flood to occur in the Moruya Valley was the Flood of Record in 1925 and there have only been three severe floods since settlement of the valley last century. The general flood behaviour for severe flood events is shown in Figure 3.

During severe floods, the depth of flow over the river banks can be as much as three metres. The flood discharge is no longer concentrated in the main river channel.

Approximately 40% of the total discharge is conveyed across the northern floodplain at depths of 1 to 3 metres and a velocity of 1 metre/second. It is possible for the entire northern floodplain to develop such deep, and swiftly flowing floodwaters, in only 1¹/₂ hours from the time of initial overtopping of the upstream bank.

The southern floodplain conveys approximately 15% of the total flood discharge. The flood pattern does not change greatly from that established early in the flood. Flood depths reach two metres, or more, with velocities between 0.5 and 1.0 m/sec.

An additional computer model was set-up to specifically investigate the flood behaviour around the mostly commercial and industrial buildings on the CBD (southern) floodplain, Moruya River Floodplain Management Plan

in more detail during a severe flood event. A description of this flood behaviour is given below.

As the river rises and breaks its banks, flow penetrates into the CBD floodplain, with the thrust from the main channel expanding south to Shore Street. The majority of the CBD area, though, lies in the lee of this expanding flow and is flooded through backwater inundation of the floodplain.

While velocities in the expanding flow zone, across the park and around the swimming pool, reach 1.5 m/s, the velocities within the CBD generally remain below about 0.3 m/s. Higher velocities in the CBD built up area are experienced through wide gaps between the buildings, particularly the Adelaide Hotel parking lot and Ford Street, where velocities can reach up to about 1 m/s during the rising stage of a major flood. The actual hazard associated with the flooding in the CBD East area, as defined by the product of velocity and depth, is shown in **Figure 4**. Significant sections of the commercial area of Moruya has a hazard which exceeds 1.0 (refer Figure 4), which indicates a high hazard (refer Section 2.3.2).

2.2 HISTORICAL FLOODS

Moruya River flood levels have been recorded since european settlement of the valley some 150 years ago. During this time, flood levels at Moruya Bridge have exceeded 4 metres AHD seven times, and 5 metres AHD three times⁸. It is very important to note, however, that all these severe flood events occurred prior to 1935. The flood of record occurred during May 1925, when flood levels reached approximately 5.4 metres AHD at Moruya Bridge. In comparison, the 1% AEP flood event would reach approximately 5.1 metres AHD at the bridge. Reports of the 1925 event describe extensive flooding in and around the township of Moruya, with flood depths in excess of 2 metres over the Mullenderee (northern) and Moruya CBD (southern) floodplains.

The lower valley has not been subjected to a severe flood for over 60 years, ie <u>ALL</u> floods in the last 60 years can be classified as frequent flood events. There have been approximately twenty floods in the last 60 years with peak flood levels varying between 2 and 4 metres above mean sea level - refer Figure 5. Such floods have inundated only a few premises and whilst they may have cut roads for extended periods, they can be generally classified as "nuisance" floods only. The highest flood event during the past 60 years was 3.7 metres at Moruya Bridge in 1975. It is important to note that the predicted extreme flood event reaches a level of approximately 6.9 metres at the bridge; 3.2 metres higher than floods of recent experience, and 1.5 metres higher than the largest flood recorded in the Lower Moruya River.

The community, therefore, has little experience of severe flooding. Hence, as devastating as a repeat of the Flood of Record would be, the general community is unaware that such an event, or worse, could occur. Floodplain management strategies and measures aimed at minimising the damage and trauma caused by such floods are likely to be met with disbelief and scepticism. A community which is unprepared for the consequences of a severe flood is all the more difficult to mobilise and more likely to suffer greater damage in such an event.

⁸ NSW Public Works (1983) Moruya River Flood History 1841 - 1978

2.3 CATEGORISATION OF FLOODPRONE AREAS

In accordance with the Floodplain Development Manual, different areas within the floodplain have been identified as having different hydraulic and hazard characteristics. Categorisation of these flood characteristics is outlined below.

2.3.1 Hydraulic Categorisation

Flood liable land can be characterised into three main categories:

<u>Floodways</u> – areas where a significant volume of water flows during floods – typically the product of velocity and depth (V*D) is greater than 1.0;

<u>Flood storage</u> – areas that are important for the temporary storage of floodwaters during the passage of the flood – ie, would result in significantly increased flood levels (> 0.1 m) and / or significantly increased peak discharges (>10%), if removed from the floodplain;

Flood fringe - remaining area affected by flooding.

2.3.1.1 Frequent Floods

The main river channel remains the primary *floodway* during frequent flood events. Although the vast majority of the Mullenderee (northern) and Moruya CBD (southern) floodplains are inundated by up to 0.5 metres, these areas do not convey any significant proportion of river flow. As there is little flood storage in the Lower Moruya valley, the northern and southern floodplain areas can be considered as *flood fringe*.

Hydraulic categorisation of the floodprone land for frequent floods is shown in Figure 6.

2.3.1.2 Severe Floods

As outlined previously in Section 2.1.2, approximately 40% of river flow is conveyed across the northern floodplain at depths of 1 to 3 metres and a velocity of 1 metre/second during severe flood events. Clearly, the northern floodplain is a major *floodway* in a severe flood.

Similarly, the southern floodplain conveys approximately 15% of the total river flood flows during severe flood events, with flood depths reaching two metres, or more, and velocities between 0.5 and 1.0 m/sec. Therefore, the southern floodplain is also a *floodway* during a severe flood.

The lack of effective storage area in the lower valley means that once floodplains are inundated by a substantial depth, they become major routes for flood flows. Areas of the floodplains which do not allow for throughflow of flood discharges, such as Gundary, can be considered as areas of *flood fringe*, despite flood depths well in excess of 2 metres.

Hydraulic categorisation of the floodprone land for severe floods is shown in Figure 7.

2.3.2 Hazard Categorisation

Flood hazard is a measure of the adverse impacts of flooding. It incorporates the immediate threat to life and limb, the difficulty and danger of evacuating people and their property, the potential structural damage and damage to contents of buildings, social disruption, loss of production, damage to public property, and so on.

The Floodplain Development Manual identifies two hazard categories:

<u>Low Hazard</u>, where people and their possessions can be evacuated by trucks, able bodied adults would have little difficulty in wading, and damage potential and the risk to life and limb is low. Typically, low hazard areas are associated with flood depths of less than 1 metre, and an approximate velocity times depth product (V*D) of less than 1.

<u>High Hazard</u>, where floodwaters could cause structural damage to buildings, evacuation by trucks is difficult, and danger to life and limb, social disruptions, and financial losses, could be high. Typically, high hazard areas are associated with flood depths in excess of 1 metre, or an approximate velocity times depth product (V*D) of greater than 1.

On initial review of hazards associated with severe flooding in Moruya, it was considered that two additional categories would assist in definition of hazards in the floodplain areas:

Very High Hazard, where flood depths exceed 1 metre, and V*D is between 1 and 2.

Extreme Hazard, where flood depths exceed 1 metre, and V*D is greater than 2.

2.3.2.1 Frequent Floods

For frequent floods, inundation over the floodplains is generally less than 0.5 metres, with velocities of less than 0.5 m/s. Under these conditions, there is little danger to life and limb, and although some services can be disrupted for several days, the potential for damages is low. Consequently, the floodplains during frequent flood events can be categorised as *low hazard*.

Hazards within the floodprone area for frequent flood events is shown in Figure 8.

2.3.2.2 Severe Floods

Severe floods result in significant hazards across the entire lower Moruya floodplain, as shown in Figure 9.

In the vicinity of North Moruya, high velocities and large inundation depths result in an *extreme hazard* categorisation. Across Mullenderee Flats, and the Moruya CBD (southern) floodplain, slightly lower flood velocities result in a *very high hazard*. General backwaters

of the floodplain, due to inundation depths of generally greater than 1 metre, still result in a *high hazard* categorisation.

2.3.3 Limits of Flooding

The limits of flooding depend on the maximum water level for the flood event, and the ground topography of the floodplain. The maximum limit of flooding in the lower valley is based on an extreme probability event. The peak flood level for such an event results in the inundation pattern shown in Figure 10. Also shown in Figure 10 are limits of flooding for the 1%, 2% and 5% AEP events. The flood levels through the valley, which generated these limits of flooding, were derived from the river flood model (*PWD*, 1992). The limits of flooding are also derived from the ground topography, which has been adopted from orthophoto and topographic contours. Ground-truthing of the peripheral areas of the floodplain has not been carried out, and as such, the limits of flooding are approximately located, only.

2.4 IMPACTS OF FLOODING

Damages associated with flooding can be categorised as either tangible or intangible. Tangible damages are the financial costs of flooding, and are quantified in dollar terms. Intangible damages are the social costs of flooding, and are reflected in increased levels of emotional, mental, and physical stress.

2.4.1 Tangible Damages

Total actual damages associated with flooding in the whole of the Moruya floodprone area are summarised in **Table 2.2**.

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5% AEP	193	7.2
2% AEP	233	10.5
1% AEP	273	12.9
extreme	338	20.3

Table 2.2Total Actual Damages Across Moruya Floodplain(Source: Moruya River Floodplain Management Study, 1996)

⁹ 1997 dollars based on 1993 dollars, as quoted in Floodplain Management Study Report, and a CPI index of 10.9% (July '93 to Jan. '97)

The average annual damage, or long-term average cost of flooding to the community per year, is approximately \$1.6 million. This value is based on calculated damages associated with flood events, and the annual probability of occurrence of these events.

The majority of flood damages in the Moruya floodprone area are associated with the commercial and industrial properties in the Moruya CBD area (accounts for average annual damage of \$1.05 million). The only other areas where significant damages could result from flooding is North Moruya (average annual damage of \$190,000), and Mullenderee Flats (average annual damage of \$240,000).

2.4.2 Intangible Damages and Social Disruption

Intangible damages impose considerable emotional 'costs' on flood victims, with likely increased incidences of mental stress and psychological disturbances, such as irritability, nervous tension, and depression. A flood aware community would suffer considerably less intangible damage, as it is aware of the threat and consequences of flooding, and knows how to respond in an effective fashion when a flood threat arises.

As well as flood awareness, intangible damages are dependent on the level of tangible damages, the level of social disruption, and the number of people affected.

As a severe flood has not occurred in the Moruya Valley for over 60 years, the community would have a relatively low flood awareness. Social disruption would be high, as all major routes out of Moruya would be affected, and as such, the flooding would significantly affect the vast majority of residents. Based on these factors, intangible damages for flooding in Moruya is likely to be high.

3 FLOOD HAZARD MANAGEMENT STRATEGY

3.1 GENERAL

A strategy has been developed by the Floodplain Management Committee which addresses the management of flood hazards in the Moruya valley. This strategy includes a variety of structural options, such as flood mitigation and egress works, and non-structural options, such as restricting future development, increasing flood awareness of the community, and formalised contingency planning. The strategy recognises the differing nature of the flood hazard in each floodplain area, and the scope for, and cost of, potential hazard reduction measures. The various components of the strategy are summarised below:

- Development Controls;
- Contingency Planning; and
- Flood Mitigation and Flood Egress Works.

3.2 DEVELOPMENT CONTROLS

Planning controls, or development constraints, are non-structural floodplain management measures that can be adopted within Council's LEP to provide direction for future development. By their nature they effectively act as restrictions on development. However, the enforcement of planning controls in flood liable areas has far greater capacity to reduce flood damages than traditionally applied structural measures. Planning controls are focussed toward minimising future flood damages by reducing the risk of damage during floods. They can be applied in two ways:

- 1. to provide a mechanism for a blanket prohibition of development on flood liable lands; or,
- to provide a series of "tests" to which any development proposal must be subjected prior to granting consent.

Appropriate floodplain management needs to relate to the whole of the floodplain, not just components of the floodplain which may relate to a particular flood occurrence (traditionally the 1% AEP flood). This is not to say that there should be restrictions on development within the whole of the floodplain, but that there should be a holistic approach to the management of the floodplain commencing from its broadest extent and progressively focusing inwards to more critical aspects of the use of the floodplain, such as development on land frequently affected by flood events. This holistic approach may in some cases, reveal the capacity for more intense development for certain types of uses, as opposed to the rigid application of a global flood standard.

From a town planning perspective, flooding is one factor which should be taken into consideration when determining the opportunities and constraints which apply to the formulation of an

appropriate planning strategy for an area. A number of planing controls are currently in place in the Moruya Valley which restrict the development of land, including:

- Moruya Urban Local Environmental Plan 1999;
- Eurobodalla Rural Local Environmental Plan 1987;
- Development Control Plan No 123 Floodplain Management Policy
- Development Control Plan No 182 Urban Expansion Zones;
- Development Control Plan No 156 Rural Subdivision; and
- Development Control Plan No 1 17 Yarragee.

Clause 8.2 of DCP No 123 states that future residential development is not permitted within floodprone land, as defined by the 1 in 100 year (1% AEP) flood level. Flooding is possible, however, up to the extreme flood level, which is on average 1.8 metres higher than the 1% AEP level. A Development Control Plan (DCP) which addresses floodplain development and management on a merits-based assessment has been prepared as part of this Moruya Valley Floodplain Management Plan, and is presented in Section 5 of this document.

The fundamental principle in constraining future development in the floodplain is to ensure that risks to life and property are not increased unnecessarily. This does not mean that all development within flood liable land will not be permitted, however, it does mean that future development may be restricted in order to minimise risks during future flood events.

The essential features of the development controls, as set out in the DCP (refer Section 5), are:

- Development restrictions associated with the DCP apply to all flood liable lands in the Moruya Valley, that is, all lands up to the limit of flooding as defined by the extreme flood event. At Moruya Bridge, the limit of flooding is RL 6.9m AHD, which is 1.5 metres higher than the highest flood recorded on the river (May 1925), and 3.2 metres higher than floods of recent memory.
- 2. Restrictions aim to minimise the future risk to life and risk to property over the full range of flood events through the provision of safe (ie, upwardly sloping) evacuation routes leading to high ground which is accessible to community refuges and essential services.
- 3. More stringent restrictions on those types of development which would require the assistance of emergency response services personnel during an evacuation, such as homes for the aged or infirm.
- 4. Restrictions to be consistent with previously adopted guidelines, however, future developments would be considered more on a merits approach, rather than a blanket flood standard.

While a DCP would address all future development within flood liable lands in the Moruya Valley, there are also some existing developments which pose a significant risk to life, and would require considerable assistance from emergency response personnel during the event of an

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evacuation. Council may wish to consider changing existing controls in order to significantly reduce the risk to life and property, and free-up valuable emergency service resources.

Of most concern is the Permissive Occupancies located near the river at Garlandtown. Flood behaviour analysis determined by the Floodplain Management Study⁴ shows that access to and from the Permissive Occupancies is cut early during a flood event. As such, any emergency response personnel assisting with the evacuation of residents or protection of property may become isolated from other areas of need within the valley. Council may wish to consider seeking approval from the Department of Land and Water Conservation to phase out or relocate the Permissive Occupancies located at Garlandtown in order to significantly reduce the potential risk to life and risk to property during flood events.

3.3 CONTINGENCY PLANNING

Effective contingency planning is often the key to a successful management plan, especially for major floods affecting a majority of the community. While formal regional emergency plans are the domain of the State Emergency Services *(SES)*, complementary works, measures and programs can be implemented by Council to facilitate and augment regional emergency response plans.

Comprehensive works and measures are required to promote flood awareness and preparedness across the entire community and to facilitate regional emergency response plans. Contingency planning initiatives are required in the following "program" areas, ie. areas of distinct need:

- flood forecasting and alerts;
- flood warnings;
- evacuation access and support;
- flood awareness; and
- flood recovery.

3.3.1 Flood Forecasting and Alerts

Regional flood forecasting is undertaken by the Bureau of Meteorology (BOM) who have the facilities to monitor storm development, rainfall intensities and river levels, and to predict likely flood level outcomes for affected catchments. Catchment gauging and rainfall/runoff predictive capabilities vary with geographic location and catchment response. Well gauged, large catchments with long response times, provide reasonable opportunity for predicting flood outcomes, however, for small steep catchments, such as the Moruya River catchment, the speed at which floods are generated provides little opportunity for flood forecasting or for providing adequate warning times.

At present, flood forecasting in the Moruya Valley is based on rainfall recorded by telephone telemetry pluviograph stations in the northern Deua River catchment, at Araluen and Major's Creek, and by telemetry water level recording stations at Wamban and Moruya Bridge. An additional pluviograph station is located in the southern Deua River

catchment at the Plumwood Fire Tower, however, telephone communications with this station are unreliable, particularly during storm events.

Based on the recorded rainfall information, as well as the likely rainfall to occur during the storm event, BOM will run hydrologic models to predict water levels at the Wamban gauge. Correlations are drawn from previous flood events to provide flood level estimates for the township of Moruya. Predicted flood level information is sent to the local SES controller.

In addition to real-time flood forecasting, BOM may also precede a flood event with a general "flood alert". Flood alerts are issued to areas where significant rainfall is predicted by BOM's long term meteorological modelling. In general, flood alerts are issued to local SES controllers so that resources can be mobilised, and volunteer members prepared for an emergency response. In recent times, up to 80% of major floods in NSW have been preceded by a flood alert issued by BOM. Depending on the size and flood behaviour of the catchment, these flood alerts are typically between 12 and 48 hours in advance of the flood peak.

The predictive capability for flood levels can be improved with an appropriate gauging network capable of automatically reporting rainfall and river water levels as they occur via radio telemetry *(real time event monitoring)*, coupled with a calibrated rainfall/runoff model of the catchment. The BOM are currently promoting the application of this technology using the ALERT system. Such a system has been set-up in the adjacent Upper Shoalhaven River catchment, and also recently in the Bega and Cooma Regions. The application of an ALERT system in the Moruya-Deua River catchment would certainly be viable, and would significantly improve flood predictions in the valley. The installation of radio telemetry rainfall and river gauging stations, along with base stations and necessary repeater towers, would cost in the order of \$75,000 - \$85,000.

Funding for an ALERT system in the Moruya – Deua River catchment may be possible through the Flood Warning Consultative Committee (FWCC). FWCC is a co-operative arrangement between Commonwealth, State and Local Governments to advise respective government agencies on the development of flood warning services in NSW. Unfortunately, funding through FWCC is already committed for the next couple of years, and after this time, the Moruya catchment would have to compete for funding against other valleys also in need of improved flood forecasting.

As an alternative to a full ALERT system, only the "bare bones" of a radio telemetry network could be installed, which would still provide a significant improvement in flood forecasting in the Moruya-Deua valley. Establishment of the "bare-bones" of the radio telemetry system, which would involve the installation of a number of key rainfall and river gauging stations only, would cost in the order of \$40,000. Additional components may be added to the system as the funding becomes available.

Council, and the Moruya River Floodplain Management Committee, could make a submission to the FWCC for possible funding in the future for installation of the full ALERT system. Alternatively, Council could investigate other possible funding sources to install only the "bare bones" of the system, which would still significantly improve flood

forecasting within the valley. If only very limited funding can be secured by Council, preference should be given to installing a radio telemetry communications link with the Plumwood Fire Tower pluviograph station, so that a more accurate description of the areal distribution of rainfall in the catchment can be used in BOM's predictive models. Second preference should be given to re-establishing the McGregor's Creek water level recording station with radio telemetric communications, so that flood behaviour is monitored further up the valley, which would ultimately lead to increased flood warning times (potentially up to 2 hours). Note however, that the runoff from a significant portion of the Moruya-Deua catchment enters the river below McGregor's Creek gauging station. This means that this additional warning time would not be available for those floods which emanate from local flooding in the Burra Creek, Wamban Creek and Mogendoura Creek catchments.

As flooding in the valley occurs quickly, and flood warning times are limited, every effort should be made to ensure that the Moruya Valley communities are informed of pending flood hazards as early as possible.

3.3.2 Flood Warnings

Flood warnings are only issued by the BOM and State Emergency Services (SES). They contain information on predicted river water levels, and likely times to the peak of the flood. Flood warning information is disseminated at the discretion of the local SES Controller and at present, they rely on operational systems developed within the SES. Nonetheless, the short duration of floods in the Moruya River, typically 1 to 2 days, does not allow for lengthy warning times once the storm is evident.

To improve the warning times, predictions of potential rainfall from storm cloud patterns and densities would be required. While such predictions are technically feasible by combining weather radar and ground data (ie ALERT system, refer Section 3.3.1), they are costly. As a minimum, the provision of flood warnings for a flashy catchment such as Moruya includes limited rainfall gauging, and more importantly, river water level monitoring at strategic locations along the river.

An informal network of farmers along the Moruya and Deua Rivers and larger tributaries already pass-on water level information to each other during flood events, so that stock and mobile equipment can be moved to higher ground when necessary. Such a system could be formalised to provide valuable flood information to the wider Moruya Valley communities, and the emergency services personnel responsible for the safe evacuation of residents in the flood affected regions of the valley. An outline of a flood warning program, which incorporates volunteer water level recording, is presented below.

Flood Warning Program

 Establish a network of land owners along the river who are willing to co-operate in the flood warning program. A standard flood recording staff should be placed at convenient locations beside the river or creek for easy reading during flood events. A sufficient number of recording stations should be placed along the main rivers and tributaries in the upper catchment of the Moruya River to derive an adequate picture of flooding behaviour during storm events.

Water level recording stations could be established along the Deua River, Wamban Creek, Burra Creek, Mogendoura Creek and Majors Creek. A number of stations would be required to provide sufficient duplication of data to allow for the inevitable vacations and illness which would prevent some stations being monitored during storm events. For more critical sites, or sites where volunteer readers cannot be used, automatic water level recorders could be established, with direct communication links to Council or Emergency Services headquarters.

As a start, water level recording stations could be established at Bendethera, Woolla, Merncumbene, Halfway House, Deua Park, The Burra, River View and Durham Farm on the Deua River, Araluen and Apple Tree Flat on Majors Creek, Nenngla on Nenngla Creek, Mogendoura on Mogendoura Creek, and readily accessible creekside locations on Dwyers Creek, Wamban Creek and the lower Burra Creek.

2. Establish a storm event protocol for reading the recording staffs, and relaying of flood level information. Telephone would be the quickest and easiest means for relaying flood levels to a central facility. Volunteer readers would be provided with standard flood level recording sheets, which would be filled out during the event. As new levels are recorded, this information would be telephoned through to Council or the Emergency Services to piece together a picture of the flood behaviour.

As a start, water levels in the rivers and creeks should be monitored every 1 to 2 hours, however, it is recognised that during a storm events, a farmers first priority is for the well-being of his or her own livelihood, and hence such frequent records may not be possible.

At the central facility, flood level information would be continually coming in from the volunteer recorders. A computer-based system needs to be established whereby the updated information can be easily entered, and revised predictions of downstream water levels would be generated. These predictions would be based on upstream water levels (and hence flows), and rates of water level nise, as well as companisons with previously recorded flood events. As more water level recorder information becomes available from a range of different flood events, the downstream flood level predictions would become more reliable.

3. Once a reasonable prediction of downstream water levels has been made, this information can then be broadcasted to the communities. A procedure needs to be established which clearly identifies to whom the predicted flood level information is to be given, along with any other important flood related information, such as which areas are likely to be affected, self evacuation routes, and established communal refuge centres for evacuated people. Likely recipients of the broadcasted flood information would be all Emergency Services, local radio and TV stations, and proprietors of larger facilities located in the floodplain who are responsible for the welfare of many people, such as caravan parks, hotels, and larger industrial premises.

The broadcasted information would be succinct, and would correspond to information previously given to all households and other premises in the Moruya Valley. The information would include the predicted peak flood level, the predicted time to the peak of the flood, the areas requining evacuations, routes for evacuation, locations of refuge centres for the evacuated people, the present flood levels along the river, the predicted rate of rise of flood waters, and any road closures as a result of flood inundation. Residents could use this information, along with additional information provided as part of a community awareness and education program (*refer* **Section 3.3.5**), to determine an expected time to inundation, and hence, time available to carry out measures which would minimise the damage to their properties. The additional information provided as part of the community awareness and education program would need to be customised for each different area within the Moruya Valley, as the flooding behaviour and evacuation requirements are different for each.

4. Considerable quantities of information would be collected by the volunteer recorders during each flood event. Once collected and analysed, the various water level records would be analysed and interpreted and entered into a central database. The information would be combined with all previous flood record data to improve upon the system for predicting future flood levels.

A procedure needs to be established within Council whereby all the water level data at the various locations along the rivers and creeks needs to be analysed and interpreted. This would entail adding data points to a series of empirical charts for water level predictions. The computer based system would be a custom-designed package, and would need to be developed by appropriate software engineers working in close collaboration with Emergency Services personnel and Council officers.

- 5. The key to accurate and effective flood warnings will be the quantity and frequency of upstream water levels provided by the volunteer recorders. As such, it is very important to keep these volunteers interested in the data collection program. To do this, regular communication with the volunteers needs to be established. Also, the communication should acknowledge the efforts of the volunteer recorders, and provide feedback as to the benefits that their effort are providing. A regular newsletter and/or periodic meeting with the volunteers would serve the purpose adequately for keeping the volunteers abreast of any important information.
- 6. Council should appoint a central co-ordinator for the flood warning program. This person would be a point of contact for any queries from the volunteers, and would be responsible for maintaining the water level staffs. This person would also chair any penodic meetings with the volunteer recorders and/or prepare regular newsletters updating the volunteers of recent flood related information. The co-ordinator would also be responsible for updating of the flood level database after each flood event to improve future flood level predictions.

Management of the flood warning program should be seen to involve the community both in the wet and the dry to instil a sense of ownership and community spirit. Awareness of the program and the level of community involvement and control should form part of the community awareness and education program (*refer Section 3.3.5*).

3.3.3 Evacuation Access and Support

The evacuation of residents during the event of a flood is the responsibility of the State Emergency Service *(SES)* groups. SES also have a critical role in the co-ordination and management of the overall emergency response.

SES's evacuation and emergency response plans are based on the demographics of each community and the infrastructure and resources available to meet evacuation needs. SES undertake to do the best that can be achieved with available facilities and resources.

While the evacuation and emergency response co-ordination would remain the responsibility of the SES, there are a number of initiatives which can be carried out by Council and the Moruya Valley communities to assist SES in their duties. Evacuation access and evacuation support are two avenues whereby the SES can be assisted by Council and the communities.

An evacuation access and support program needs to be established whereby a series of protocols are followed during the event of a flood to ensure that adequate service is provided to those in need. Council can establish initiatives to improve the facilities which are required during a flood event, and ensure adequate support services are available at short notice to provide for the needs of the community. An outline for an evacuation access and support program is presented below:

Evacuation Access and Evacuation Support Program

 The timing for evacuation of residents is not only dependent on the timing for inundation of properties, but also on the timing for inundation of access routes to flood-free refuges. Depending on the size of the flood, some properties in the floodplain may not be inundated, however, inundation of surrounding roads may mean that access to basic emergency services, such as hospital, is cut for several days. Such isolation is considered just as hazardous to a community as inundation of individual properties.

Emergency access along principal thoroughfares can be optimised by raising low sections in roads, protecting low sections from early flooding or creating local emergency flow detours to bypass low sections. Such works would increase the time available to SES and the communities to evacuate to flood-free lands with necessary support services. The specific approach to improving emergency flood access would depend on site details and technical and economic feasibility of the works. As a start, specific locations to be considered in the Moruya Valley are:

- North Head Drive near Malabar Lagoon crossing,
- South Head Road near the highway intersection,
- South Head Road west of 'The Anchorage',
- Princes Highway at Racecourse Creek crossing.

Details of the works required to improve evacuation access at these locations are provided in **Section 3.4.2** of this document.

2. Establish a *Flood Intelligence Map* to assist with optimising and executing emergency response. The map would typically indicate the areas affected by incremental flooding of commercial, industrial and public facilities, residential zones, access routes and infrastructure. The map could be either computensed, or based on a large scale layout, with different colour infills representing the different areas affected by incremental flooding. The map would be used by the SES controller to direct on-ground resources with regard to evacuation access routes, and prioritisation of areas for the on-ground resources.

The map would also be used in combination with the computer-based database system for predicting flood levels and flood warning times, to provide important self-evacuation information, such as evacuation routes and locations of refuge and support centres, for general broadcast.

3. Establish a central location for the *Evacuation Refuge Centre* (or Communal Refuge Centre). The venue for the centre should be above the limits of flooding *(ie extreme flood level)*, should be accessible from a number of different routes, and should be large enough to temporarily house and provide support services for a large number of people. During an extreme flooding event, up to 1,000 people may seek refuge or support services at the centre. The centre would be operational for the duration of the flooding, as well as some time after, to continue providing support for those residents who have been affected significantly by the event. The centre would also need to have a number of essential facilities, such as toilets, showers, cooking facilities and heating. Possible locations for the evacuation refuge centre are Moruya High School, Moruya Primary School, St Mary's Catholic Convent School, the Church of England facilities, the old Council Chambers, or the Council Community Centre and adjacent RSL Hall in Page Street. The location of the evacuation refuge centre would need to be decided in close consultation with SES.

Procedures would need to be established to provide the Evacuation Refuge Centre with necessary equipment to service the temporarily relocated residents. Essential equipment and facilities would include bedding, clothes, food, and medical supplies. These would need to be provided from existing resources within the community. Sufficient duplication of potential resources for essential equipment and facilities would be required to ensure that the centre is satisfactorily equipped during an emergency event.

Volunteers would be needed to initially set-up the Evacuation Refuge Centre, and then to cater for the on-going needs of the temporary evacuees, such as meal preparation and counselling. A list of volunteers who can be called upon at short notice needs to be established. Potential volunteers could come from existing community volunteer programs, such as Apex, Lioris Club and CWA.

4. The relocation of residents and the potential damage to properties would generate significant trauma within the community. A counselling support group would need to be established to support these needs of the community. The group would be made up from appropriate community organisations such as churches and Department of Community Services sponsored groups. Follow-on support for affected residents would be needed for some time after the flood event. Moruya River Floodplain Management Plan

- 5. The key to an effective and supportive evacuation refuge centre will be the volunteers and support groups providing assistance in the setting-up and manning of the centre, and their level of preparedness for an emergency situation. As such, it is very important to keep the volunteer sand support groups informed about the emergency support program. To do this, regular communication with the volunteers needs to be established. Also, the communication should acknowledge the efforts of the volunteers, and provide feedback on the benefits of their efforts. A regular newsletter and/or periodic meeting with the volunteers (or representative members) would serve the purpose adequately for keeping the volunteers abreast of any important information. A meeting would also provide an opportunity for volunteers to share concerns, address issues and engender a high level of preparedness for responding to floods.
- 6. Council should appoint a central co-ordinator for the evacuation support program. This Council officer would be responsible for maintaining the availability of 'at call' resources, and would chair any periodic meetings concerning the support program. The co-ordinator would also be responsible for the establishment and management of the centre during a flood event. The co-ordinator would liaise directly with SES regarding the establishment of the centre, and would provide on-going assistance to SES wherever required.

3.3.4 Flood Recovery

Flood recovery encompasses the physical clean-up of private and public facilities, restoration of services and infrastructure and the social support and health recovery of flood victims.

Although flood recovery is generally an active exercise, proactive planning and preparation can lead to improved efficiencies, ensure appropriate resources are available, and in combination with the education program, ensure needs are appropriately prioritised, resources are effectively allocated and conflicts minimised.

Council should carry out initiatives to ensure that flood recovery is suitable addressed as part of the overall management of a flood event. These initiatives are outlined in the following flood recovery program:

Flood Recovery Program

 Identify resources available to assist with flood recovery, such as equipment, manpower, technical knowledge and professional assistance. A register of resources, along with relevant contact details, would need to be established by Council. Regular contact with appropriate community members would also be required to ensure that the resources register is up to date.

SES generally provide considerable resources for the physical clean-up and restoration of services after a flood event. As such, co-ordination of the actual recovery processes would be the domain of SES, however, Council can adopt

initiatives to assist SES by identifying additional resources and providing other skills apart from equipment and manpower.

- 2. Establish procedures for physical clean-up of private and public facilities with resources, support and technical information available to assist individual owners in private clean-up operations, and groups such as SES or other community based organisations for the clean-up and restoration of public facilities, infrastructure and local and regional services. Although some of these services, such as the restoration of electricity and water, are outside Council's jurisdiction, Council can act on the community's behalf to optimise the recovery by providing assistance and additional resources on an 'as needed' basis.
- 3. As well as the physical recovery, the effected communities would require an emotional or social recovery, to help them with the distress and trauma associated with potential losses. Council needs to identify the additional, longer term, resource needs of the effected communities associated with social recovery, and means for establishing these resources.

Similar resources would be utilised at the emergency refuge centre to help evacuees with their immediate emotional and welfare needs. However, a facility needs to be established whereby affected residents can seek this type of help on an on-going basis for a longer time after the event. Also, a procedure needs to be established where residents likely to be affected are sought out and provided with assistance rather than waiting for requested help. Unfortunately, not all residents who would benefit from professional counselling would volunteer themselves for such help after a flood event.

Significant merit would be gained if the welfare counsellors involved in the immediate trauma recovery at the emergency refuge centre were also involved in the longer term on-going social recovery of the community.

4. Establish a structure and procedures for social support and health recovery through trauma counselling, medical attention for individuals, identifying and addressing potential community health problems, providing support for families and individuals not able to effect their own recovery through financial or medical constraints, and support for families or individuals whose residences are destroyed or structurally damaged.

3.3.5 Flood Awareness

Flood awareness refers to the ability of the community to know what to do and how to do it effectively with respect to minimising risk to life and saving goods and possessions at the immediate onset of flooding.

To be aware, the population needs to be educated in:

- □ the nature of the hazard and risk;
- how they will be affected;
- what information will be available and how it can be accessed;

u what support services and facilities are available;

what can be done in the dry in preparation for a flood; and

how to prepare in the likely event of a flood.

In their regular dealings with the community, Councils are in an ideal position to establish and operate a flood awareness program, aimed at educating the community about the abovementioned issues. An outline of a flood awareness and education program for the communities of Moruya is presented below.

Flood Awareness and Education Program

- Prepare an information booklet or leaflet for public distribution to present relevant aspects of Council's flood management strategy in a clear and concise manner. The documentation distributed to the community would also provide information which relates to the broadcasted flood details during a flood event. This information can then be used by individuals to plan their self-evacuation, or arrange for assistance if required. Regular seminars could also be organised to help inform the community, and to cater for new members of the community. Specific topics to be covered by the documentation and seminars would include:
 - The nature and behaviour of the flood hazard and the associated risk in living in the floodplain, as well as a clearly defined map of the area potentially affected by flooding,
 - The practices and programs established by Council to manage the hazard in concert with other agencies, eg. SES's emergency response role, the flood warning program, the evacuation access and support program, the flood recovery program, and the availability of flood status information,
 - · The resources and infrastructure available for assisting the community,
 - What can be done by individuals, residents and businesses in the dry season, to minimise the risk and potential damage in the event of a flood, and
 - Procedures to follow if flooding is predicted. Individual residents, businesses and groups need to be specifically targeted with details addressing aspects such as self evacuation procedures for residents who have adjacent access to high land and can make their way to a refuge centre, group evacuation procedures for businesses and public institutions, how personal and business effects and valuables can be protected or removed, and special provisions available for the sick and infirm.

Self-directed evacuation, where feasible, enables SES's field resource personnel to concentrate on those residents who cannot help themselves, and most importantly instils a sense of community spirit in coping with the flood hazard and identifying ownership and control over the problem.

Commercial and industrial businesses located within the floodplain need to be provided with assistance on how stock losses can be minimised during the event of a flood. A procedure can be established where all new, and existing,

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businesses have to provide evidence of a commercial stock and equipment management plan, and an employee evacuation plan.

Other tourist-oriented developments within the floodplain, such as the caravan parks and the motel, pose a significant risk, as the residents at the sites would be unfamiliar with the risks associated with flooding of the Moruya River, and also would be unfamiliar with contingency and evacuation plans in place to minimise the risks to life and property. Detailed education of the proprietors of such developments would be necessary, to ensure that the welfare of the itinerant residents is addressed.

Developments which cater for the aged and infirm also need to be specifically targeted for flood awareness and education. An evacuation management plan should be established for each development where the welfare of many is the responsibility of a few, such as retirement villages, hospitals and hotels / motels. Such plans would need to be approved by Council and/or SES to ensure that the proposed evacuation routes and refuge centres are practical / feasible, and that the risk to life would be minimised during the operation.

- Establish a means of distributing the information to urban and rural residents, institutions and businesses. Consider both passive means, such as mailing, and active means, such as a flood awareness campaign with presentations to community groups, institutions and businesses.
- 3. Prepare a frequent, (eg. annual) update or refresher leaflet to maintain the awareness and identify any changes or additions to programs and practices. The update could be issued with rates notices, for example. An entire re-issue of the information package may be required on a less frequent basis.

Due to the lack of significant flood events in the Moruya River in recent times, the present community has little knowledge and understanding of the possible impacts that major flooding would have on the town. Despite the best efforts of a flood awareness and education program which is carried out "in the dry", there will still be an element of disbelief within the communities. In consideration of this residual disbelief of flood hazard, Council should also consider a "last minute" education campaign, which is triggered by a general Flood Alert, as issued by BOM, prior to more detailed flood warnings.

This "last minute" education campaign should focus solely on what to do to minimise personal damages, and how to minimise the risk to life during a flood event. The distribution of the "last minute" education material should also be closely considered by Council. General broadcasting of such information prior to any flooding may be confusing for some members of the community, and may result in some hysteria amongst the illinformed. On the other hand, Council must ensure that the education material is freely available to all that require it at short notice. If sufficient notice is provided, local newspapers would provide an ideal medium for distributing the necessary evacuation and damage reduction information. An alternative could be radio broadcasts, indicating that necessary information can be obtained from Council offices and local community centres.

3.4 FLOOD MITIGATION AND FLOOD EGRESS WORKS

The detrimental impacts of floods can be reduced by constructing physical barriers which mitigate or divert flood waters. In 1974, a report was prepared by Sinclair Knight and Partners¹⁰ which outlined a number of works in the Mullenderee area in order to mitigate the impacts of flooding. These works have been reviewed in light of the revised flood height and flood behaviour information determined during this floodplain management process (*refer Section 3.4.1*).

Also, a number of other structural works have been formulated to minimise potential flood hazards on the Moruya River floodplain (refer Section 3.4.2).

3.4.1 Review of 1974 Mullenderee Flood Mitigation Scheme

The 1974 flood mitigation scheme proposed by Sinclair Knight¹⁰ involved constructing four levees, two drains, three culverts, two outlet structures, improvements to an existing drain, and rock walling along the river bank. The scheme focussed on preventing flood waters entering the Mullenderee flats area of the floodplain through low swales or ditches, and also, rapid drainage of the flats once they are inundated. As such, the works aimed to minimise the loss to agricultural lands during flood events.

These works, although currently in varying states of disrepair, would still facilitate the drainage of agricultural lands and prevent floodplain inundation through the low swales, however, the benefits of the works to the non-farming community of the Moruya Valley would be very limited.

3.4.2 Additional Structural Works for Flood Hazard Mitigation

Other structural measures were identified by the Committee to mitigate the impacts of flooding on the Moruya Valley communities, particularly during the more frequent floods. These structural measures predominantly involve raising road levels to maintain access during frequent flood events, and to increase flood warning times during larger flood events.

The structural measures which form part of the overall flood hazard management strategy are shown in Figure 11, and are outlined below:

- Raise the level of the Princes Highway for approximately 300 metres across Mullenderee Flats
- □ Raise the level of North Head Drive through the swale just upstream of the Malabar Lagoon crossing
- □ Construct low level levees along approximately 700 metres of the riverbank at Gundary, and repair or replace the floodgates at Gundary Creek outlet

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¹⁰ Sinclair Knight and Partners (1974) Mullenderee Flats Flood Mitigation Works Prepared for Eurobodalla Shire Council, Contract No 1375

- Raise Murray Street by approximately 0.15 metres at Gundary Creek crossing
- □ Raise the level of the Princes Highway for approximately 260 metres at Racecourse Creek crossing
- Construct a low level levee for approximately 300 metres next to Racecourse Creek in the golf course
- Raise the level of South Head Road for approximately 180 metres from Princes Highway intersection

Raise Princes Highway across Mullenderee Flats

A 350 metre long section of the Princes Highway, located between approximately 1270 metres and 920 metres north of the northern end of Moruya Bridge can to be raised by approximately 0.5 metres to a level of RL 2.0 metres AHD, which roughly corresponds to the level of the remainder of the road across the floodplain. By raising the road level over this section of the road, the Princes Highway should remain traffickable for an additional two hours or so during a major flood event. This additional time would be beneficial to the reduction of damages and the evacuation of residents from the Mullenderee area.

Council has already raised approximately 350 metres of the highway across Mullenderee Flats for a cost of approximately \$372,000.

Raise North Head Drive at the Swale

A 150 metre long section of North Head Drive, located approximately 400 metres upstream of the Malabar Lagoon crossing can be raised by approximately 1 metre to a level of RL 2.2 metres AHD. Infilling the swale to this level would prevent the road from becoming inundated during frequent flood events.

Council has already raised the level of the road at the swale in North Head Drive for a cost of approximately \$115,000.

Low Level Riverbank Levee at Gundary

A low level levee can be constructed along the riverbank at Gundary. The levee would involve raising the level of River Street by an average of 1.1 metres, to a level of approximately RL 4.0 metres AHD, over a distance of approximately 700 metres.

Combined with the levee, the floodgates at the end of Gundary Creek would need to be repaired or replaced to stop flood water ingress into the lower lying grounds during frequent flood events.

The estimated cost of the levee is approximately \$250,000, while the approximate cost of the floodgates would be about \$20,000.

Raise Murray Street at Gundary Creek Crossing

Murray Street is to be raise by an average of 0.15 metres to a level of approximately RL 5.0 metres over a length of about 40 metres at the Gundary Creek crossing. Raising the road will enable vehicular access to the hospital to be maintained up to the 1% AEP event, with overtopping depths across the road of only 0.25 to 0.3 metres.

New culverts would also be required to satisfactorily convey the 1% AEP Gundary Creek flow without causing unnecessary local flooding. The approximate cost of the raised road, and the new culverts would be about \$60,000.

Raise Princes Highway at Racecourse Creek Crossing

The Princes Highway can be raised over a distance of approximately 260 metres at the South Head Road and Racecourse Creek intersections, on the Moruya CBD (southern) floodplain. The highway is to be raised by an average of 0.6 metres, to a level of about RL 2.8 metres AHD.

New culverts would also be required at the Racecourse Creek crossing to avoid backwater flooding from local catchment runoff.

Council has already carried out works to raise the Princes Highway at Racecourse Creek, as well as the first 200 metres or so of South Head Road (refer below for details) for a total cost of approximately \$565,000.

Construct Low Level Levee in Golf Course

A low level levee could be constructed on the CBD side of Racecourse Creek within the golf course to prevent local Racecourse Creek floodwaters from flowing into the commercial and industrial areas on the floodplain. The levee would be approximately 300 metres long, and about 1 metre high, and could be incorporated into the golf course as a landscaping "feature".

The cost of construction of the levee would be approximately \$60,000.

Raise South Head Road near Highway Intersection

South Head Road could be raised for approximately 180 metres from the intersection with the Princes Highway to provide flood-free access to Mynora during frequent flood events, only. The road would need to be raised by an average of about 0.5 metres, to a level of approximately RL 2.8 metres AHD, which is consistent with the proposed road elevation works on the adjacent Princes Highway.

As outlined above, these mitigation works have already been carried out by Council.

Raise South Head Road to west of The Anchorage

South Head Road could be raised for approximately 80 metres to the west of "The Anchorage Estate" access road (Dress Circle) and Halyard Drive to provide evacuation access to these downstream rural / residential properties during frequent flood events. The road would need to be raised by about 0.9 metres to a level of approximately RL 1.3 metres AHD to be consistent with other lower lying sections along South Head Road.

The approximate cost of raising South Head Road near the Anchorage is about \$100,000.

4 IMPLEMENTATION OF STRATEGY

Implementation of the Flood Hazard Management Strategy (refer Section 3) is largely the responsibility of Council. However, it is strongly recommended that Council liaise closely with SES during the implementation of the strategy so that programs can be developed which will maximise the benefits to SES and other emergency response groups during the event of a flood.

Many of the tasks which make up the management strategy are simply formalisation of duties which would normally be carried out by Council officers during the event of a flood. As such, their implementation should be straight forward and would not require financial support. Other tasks, however, particularly the structural works, would require considerable funding. Council could seek alternative sources for funding of these particular tasks, including both State and Commonwealth Governments.

An outline of the strategy implementation is shown in **Table 4.1**, including relative priorities for the different tasks, as well as indicative costs for the tasks, and the organisations responsible for their implementation.

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Development Constraints	finglementmew/DCP ((ຕ່ອຍໄປກ່ອງ)	(File (1999))	ESC+	agy at t	
Contingency Planning					
Flood forecasting and alerts	Install additional automated pluviographs in upper catchment	Medium (2000 – 2001)	ESC SES BOM	\$20,000	
· · · · · · · · · · · · · · · · · · ·	Install additional automatic water level recorders in upper catchment	Medium (2000 – 2001)	ESC SES DLWC	\$20,000	
Flood warnings	Remblish recording stations and ananal recording stations	(hite (999))	EISIC ST	52,000	
	Resemblish according providents	(hto 1999)	ESIC.	10	
	Baaldaaning warnings	18846781 (Into 1999)	ElSC SES		

Table 4.1 Details of Tasks to Implement Flood Hazard Management Strategy

	Establish database of flood level information to predict future floods	Medium (2000 – 2001)	ESC SES	\$2,000
	Establish regular communication with volunteer recorders	Medium (2000 – 2001)	ESC	neg.
	Appoint co-ordinator for flood warning program	HIGH (late 1999)	1 ESC	, iiil
Evacuation access and evacuation support	Address access problems for outlying communities Nth Head Di neardagoon South Head Rd neardagoon Sth Head Rd West of Anch Princes Hvy at Race (Ck)	HIGH HIGH HIGH HIGH	RTA	stae Oloopt Mitigation Saud Byress Works Motow
	Establish Flood Intelligence Map	Medium (2000 – 2001)	ESC SES	\$5,000
	Determine an appropriate	HIGH (late 1999)	ESC SES 200	ueg (
	Establish volunteers to set-up and man centre, and resources required in centre	HIGH (late 1999)	ESCA SES DOCS	103. N
	Establish sai call atrauma counselling service	HIGH (late 1999)	ESC AND DOCS	ntog.
	Establish regular communication with all volunteers and potential service and resource providers	Medium (2000 – 2001)	ESC	neg.
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	Identify social recovery needs of the community	Medium (2000 – 2001)	ESC DOCS	neg.

Table 4.2 Details of Tasks to Implement Flood Hazard Management Strategy cont'd.

MINUTE NO 04/377

S04/6 MORUYA RIVER FLOOD PLAIN RISK MANAGEMENT PLAN 80.0310

04/377 MOTION Councillor Kowal/Councillor Rafferty

THAT:

- 1. Members of the Moruya River Floodplain Risk Management Committee be thanked for their contribution to the review of the draft Moruya Floodplain Risk Management Plan.
- 2. The draft Moruya River Floodplain Risk Management Plan and accompanying Development Control Plan as tabled at the Ordinary Meeting of Council held on 23 November 2004 be adopted.

AMENDMENT Councillor Brown /Councillor Cairney

THAT the exhibition of the draft Moruya River Floodplain Risk Management Plan be extended to 15 December 2005 to allow further public consultation and a further report to Council.

(The Amendment on being put was declared **LOST**. Councillors Thomson, Mumme, Pollock, McGillivray, Rafferty, Corbin and Kowal voted against the Amendment.)

(The Motion on being put was declared **CARRIED**. Councillors Brown and Cairney voted against the Motion.)

MINUTE NO 04/378

A04/88 PRESENTATION OF FINANCIAL STATEMENTS AND AUDIT REPORTS FOR THE YEAR ENDED 30 JUNE 2004. 04.8016

04/378 MOTION Councillor Mumme/Councillor Pollock

THAT the Annual Financial Statements and Auditors Reports for the year ended 30 June 2004 be deferred until later in the meeting following the Auditor's presentation.

(The Motion on being put was declared CARRIED.)

REFER MINUTE NO 04/396.

STRATEGIC PLANNING REPORT TO ORDINARY MEETING OF COUNCILPage 29HELD ON TUESDAY 23 NOVEMBER 2004Page 29

S04/6MORUYA RIVER FLOOD PLAIN RISK MANAGEMENT PLAN80.0310

RECOMMENDED

THAT:

- 1. Members of the Moruya River Floodplain Risk Management Committee be thanked for their contribution to the review of the draft Moruya Floodplain Risk Management Plan; and
- 2. The draft Moruya River Floodplain Risk Management Plan and accompanying Development Control Plan as tabled at the Ordinary Meeting of Council held on 23 November 2004 be adopted.

PETER TEGART DIRECTOR ENVIRONMENT PLANNING & ADMINISTRATIVE SERVICES

DEVELOPMENT CONTROL PLAN MORUYA VALLEY FLOODPLAIN DEVELOPMENT GUIDELINES

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EUROBODALLA SHIRE COUNCIL

DEVELOPMENT CONTROL PLAN MORUYA VALLEY FLOODPLAIN DEVELOPMENT GUIDELINES

1. INTRODUCTION

This Plan provides more detailed controls to assist developers to achieve the aims and objectives of the Urban Local Environmental Plan 1999 (LEP), and the Rural LEP 1987, in relation to development in and around lands affected by flooding of the Moruya River. This Plan forms part of the planning framework for Eurobodalla Shire and should be read in conjunction with the Urban LEP and the Rural LEP.

Compliance with the provisions of this Plan does not imply any obligation upon Council to approve Development Applications as all applications will be assessed and determined in accordance with Section 79C of the Environmental Planning and Assessment Act, 1979.

1.1. Name of the Plan

This Development Control Plan is called Moruya Valley Floodplain Development Guidelines. The Plan consists of this written statement and associated maps.

1.2. Land to Which This Plan Applies

This Plan applies to the land outlined in DCP Map 4, which includes all flood liable land (up to an extreme flood event) and some adjacent lands which become isolated during flooding of the Moruya River.

1.3. The Aim of Floodplain Management

Flooding in the Moruya Valley has been well documented since European settlement in the mid 1800s. During periods of frequent flooding, the local communities within and around the valley are disrupted by road closures and inundation of low-lying land. During major and extreme flooding, however, residential and commercial areas can be inundated, while fringing communities can become isolated from the town of Moruya and the services it has to offer, possibly for several days.

Floods in the Moruya River, over the last 60 years, is limited to relatively minor flooding, with a maximum flood level of approximately RL 3.8m at Moruya Bridge. The flood of record in the Moruya River occurred in May 1925, and reached a level of approximately RL 5.4m at the bridge. An extreme flood, which has not been experienced in the valley since European settlement, could have a flood level up to 1.5 metres higher than the 1925 flood, which is up to 3 metres higher than the majority of the present community's experience of flooding.

It is essential that new developments within the Moruya Valley be designed and constructed in a manner that minimises the risks to life and property associated with flooding, and does not exacerbate flood conditions on neighbouring properties. As such, an integrated approach to future land management is required which takes into consideration the extent and severity of flooding, the risks associated with isolation due to road closures, and the demands required on emergency services during floods.

1.4. Objectives

The objectives of the Plan are:

- a. To advise the community of Council's approach to considering future development proposals on flood liable land in the Moruya River valley.
- b. To ensure that acceptable standards of safety to life and property are applied when considering future proposals.
- c. To ensure that development, which is approved in flood liable areas, is structurally capable of withstanding the effects of flooding.
- d. To ensure that development is not permitted in flood liable areas where that development would result in unnecessary risk to life of occupants or rescuers, or in unwarranted public costs.
- e. To ensure that development on flood liable land does not adversely affect flood behaviour.

1.5. Procedures for Processing Applications

In processing building, development and subdivision applications, Council will apply the principles outlined in the Floodplain Management Manual (1999). In addition, Council will apply the provisions of this document, following identification of the appropriate flood hazard category for the proposed development site, as defined in DCP Map 4, and described in Section 4 of this document.

2. **DEFINITIONS**

Australian Height Datum (AHD): a common national plane of level corresponding approximately to mean sea level.

Average Exceedance Probability (AEP): the chance of a flood of a given or larger size occurring in any one year. For example, a 1% AEP flood has a 1% chance of occurring in any one year.

Communal Flood Refuge: means a flood free area capable of providing communal flood refuge facilities, shelter, and emergency assistance for occupants of surrounding flood bound areas and capable of being practically provided with basic needs such as food and clothing from outside the flood affected area.

Consulting Engineer: means a person holding qualifications acceptable for membership of the Institution of Engineers, Australia.

Development: includes the erection of a building or the carrying out of a work; or the use of land or a building or work; or the subdivision of land.

Discharge: the rate of water measured in terms of volume per unit time, eg, cubic metres per second. Discharge is different from speed (or velocity) of flow, which is a measure of how fast the water is moving, eg metres per second.

Extreme Flood Event: a flood event which has a very low probability of occurring, and is approximated by the probable maximum flood (PMF) as defined by predicted probable maximum rainfall.

Farm House: a residential dwelling situated on land zoned for agricultural purposes.

Flood Awareness: an appreciation of the likely effects of flooding and a knowledge of the relevant flood warning, response and evacuation procedures. In communities with a high degree of flood awareness, the response to flood warning is prompt and efficient. In communities with low degree of flood awareness, flood warnings are liable to be ignored or misunderstood, and residents are often confused about what they should do, when to evacuate, what to take and where it should be taken.

Flood Behaviour: refers to the characteristics of flooding at a particular location, and includes the level of flooding, flood flow velocity, and the direction of flood flow.

Flood Inundation: means the area of interest is covered by flood waters.

Flood Liable Land: Land which can be inundated by flooding, up to and including an extreme flood event.

Flood Proofing: a combination of measures incorporated in the design, construction and alteration of individual buildings or structures subject to flooding, to reduce or eliminate flood damages.

Floodplain Management Manual (1999): a manual published under the authority of the NSW Government which provides guidelines to assist Councils to address flood liable land, in accordance with the Government's Policy.

Flood Warning Time: the time available after receiving advice of an impending flood before the floodwaters diable damage reduction activities. The effective warning time is typically used to move farm equipment, raise furniture and evacuate people.

Habitable Room: a living area, such as a lounge room, dining room, rumpus room, kitchen, bedroom or the like.

Minor Development: refers to swimming pools, fencing, storage areas, sheds, carports, domestic garages, repairs to existing structures and the like.
Resident Capacity: The number of people who can reside at a dwelling. Can generally be related to the number of bedrooms within a dwelling.

3. FACTORS GOVERNING DEVELOPMENT CONTROL

3.1 Flow Hazard

The Moruya River Floodplain Management Study (PBP, 1995) delineates the Moruya River floodplain into areas of either extreme hazard, very high hazard or high flow hazard. The area of extreme flow hazard is susceptible to large flood depths (in excess of about 3 metres), with flows travelling quite rapidly (ie about 1 metre per second). Under these conditions, the flood poses a significant risk to life and limb, as well as a significant risk of property damage. The area of extreme flow hazard approximately corresponds to the area defined as 'high hazard - floodway' in *Appendix G* of the NSW Government's Floodplain Management Manual (1999).

The areas of very high flow hazard covers those areas where the depth of flooding is still great (ie greater than 2 metres or so), but with reduced flow velocities (ie the product of velocity and depth is between 1 and 2: $1 \le V^*D \ge 2$).

Areas of high hazard are the remaining sections of the floodplain where the depth of flooding is still high (ie greater than about 1.5 metres) but the flood waters are relatively still (ie backwater areas). Although not subjected to flowing floodwaters, these areas are still hazardous due to the depth of inundation, and the associated risks to life and limb, and the potential for damage (mostly non-structural) to property.

Flow hazard areas in the Moruya Valley are presented in DCP Map 1.

3.2 Isolation Hazard

There are a number of small and medium sized rural, semi-rural and urban communities that are located within the environs of Moruya. During floods, access roads to and from these communities can become impassable for up to several days. There is considerable risk associated with people who become stranded from the essential services provided by a larger urban centre, such as health and community services.

DCP Map 2 shows the areas around Moruya which are at risk of being isolated by flooding. Other areas around Moruya become isolated from the township of Moruya itself, however, vehicular access from these areas to alternative nearby centres, such as Mogo, Araluen or Batemans Bay, should be available.

3.3 Existing Plans for Future Development

The Moruya Urban LEP (1999) and Rural LEP (1987) identify areas which are zoned for potential future development. Where these areas coincide with areas affected either by direct flood inundation,

and/or by isolation during flooding, the future development of the area must consider the relevant flood hazards, as outlined in this DCP.

Areas identified for potential future development are shown in DCP Map 3.

4. FLOOD HAZARD CATEGORIES OF THE MORUYA VALLEY

Based on the flow and isolation hazards and areas identified for future development (refer Section 3 of this Plan), the Moruya River floodplain and selected surrounding areas have been categorised as follows:

- 4.1. *Floodway:* all land (rural and non-rural) where a combination of flood velocities and depths can result in a significant risk to life and limb, and possible structural damage of dwellings, during a severe flood event.
- **4.2. Rural Floodplain:** rural lands (*predominantly zone 1(a*)) inundated by floodwaters, up to and including an extreme flood event. Although flow velocities would be relatively slow, flood depths could be up to 3 metres, resulting in risk to life and limb, and possible structural damage of dwellings.
- **4.3. Isolated Rural:** rural lands not inundated by floodwaters, but which are isolated from Moruya, or other urban centres, during floods up to and including the extreme flood event. Isolation from community centres is considered a significant risk to existing rural residents.
- 4.4. Non-Rural Floodplain: all lands presently zoned as non-rural (excluding Zones 1(c) and 10), which are inundated by flooding up to and including the extreme flood event. Although flow velocities would be relatively slow, flood depths could be up to 3 metres, resulting in risk to life and limb, and possible structural damage of dwellings.
- 4.5. Isolated Non-Rural: all lands presently zoned as non-rural (excluding Zones 1(c) and 10), which are not inundated by floodwaters, but which are isolated from Moruya, or other urban centres, during floods up to and including the extreme flood event. Isolation from community centres is considered a significant risk to existing non-rural residents.
- **4.6.** *Future Development Floodplain:* land identified for future development (ie Zoned 1(c) or 10), and is inundated by flooding up to and including the extreme flood event. Although flow velocities would be relatively slow, flood depths could be up to 3 metres, resulting in potential future risk to life and limb, and possible structural damage of future dwellings.
- 4.7. Isolated Future Development: land identified for future development (ie Zones 1(c) or 10), which is not inundated by floodwaters, but which is isolated from Moruya, or other urban centres, during floods up to and including the extreme flood event. Isolation from community centres is considered a significant potential risk associated with the future development areas.
- **4.8.** Isolated Future Development Floodplain: land identified for future development (ie Zoned 1(c) or 10), is inundated by floodwaters, and is isolated from Moruya, or other urban centres, during floods up to and including the extreme flood event. The hazards in this areas are

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compounded, as not only are properties physically inundated, but they become isolated from the main community centres during a flood event. The potential risks to life and limb, as well as potential structural damage to dwellings, is significant.

The break-down of the Moruya floodplain into these eight categories is shown in DCP Map 4.

5. REQUIREMENTS FOR DEVELOPMENT AND BUILDING APPLICATIONS

All applications for development within the area to which this Plan applies shall be accompanied by information which enables Council to assess the extent to which the application conforms to the existing planning controls and policies. Specific information required by Council may include:

- a. a plan showing levels of the subject site and the access thereto, relative to Australian Height Datum (AHD).
- b. evidence to demonstrate that the proposal will not significantly increase flood levels of neighbouring properties. If the development would cause a significant increase in flood levels, the applicant will be required to offset the increase. A detailed report by an appropriate consulting engineer will be required in support of a development or building application prior to determination of the application by Council.
- c. evidence to demonstrate that the development will not increase the hazard or flood damage to other properties or adversely affect flood behaviour, for developments within a floodway area. A detailed report by an appropriate consulting engineer will be required in support of a development or building application prior to determination of the application by Council.
- d. evidence to demonstrate that a permanent, fail safe and maintenance free evacuation route is available. This route is to be continually rising to flood free land, where access to a communal refuge would be available. In addition, applicants may be required to demonstrate that the evacuation of people from the development will not add to the existing demands on rescue services. A detailed report by an appropriate consulting engineer will be required in support of a development or building application prior to determination of the application by Council.
- e. evidence to demonstrate that any building or structure can withstand the force of flowing floodwaters, including debris and buoyancy forces as appropriate. A detailed report by an appropriate consulting engineer will be required in support of a development or building application prior to determination of the application by Council.
- f. additional information prepared by an appropriate consulting engineer, in support of a development or building application.

6. FUTURE RESIDENTIAL AREAS – NEW DWELLINGS, EXTENSIONS AND ALTERATIONS

6.1 Floodway Areas

Floodway areas are shown in DCP Map 4. Existing residential development is located in the floodway area at North Moruya only.

- a. New residential dwellings will not be permitted.
- b. Dual occupancy development will not be permitted.
- c. Existing residential dwellings may be extended or altered providing there is no increase in resident capacity.
- d. There should be no expansion of existing Caravan Parks located in floodway areas.

6.2 Rural Floodplain Areas

Rural Floodplain areas are shown in DCP Map 4. No formal residential development is present within these areas because they have predominantly been utilised for rural purposes. Some existing farm houses may be present within these areas.

- a. New residential dwellings will be permitted only where the dwelling is to be a farm house, and where no flood-free land is available within the property.
- b. Council will require the floor level of all habitable rooms for new developments or extensions to existing developments, to be at least 300mm above the 1% Average Exceedance Probability (AEP) flood level at that location.
- c. Council will require submission of a certificate from a Registered Surveyor certifying that the levels referred to have been complied with before proceeding beyond habitable floor level.
- d. Council will require all new developments and existing development extensions to be designed to withstand flood velocities which are 10% higher than those predicted for a 1% AEP flood event, and flood inundation levels which are 500mm above the 1% AEP flood level, with no significant structural damage. This includes using flood compatible materials in accordance with Council's flood-proofing code. Council will supply flood velocity and depth information suitable for structural engineering design. Council will require submission of a certificate from a suitable consulting structural engineer certifying that any building or structure associated with the development can withstand the force of flowing floodwaters, including debris and buoyancy forces as appropriate.
- e. Council will require a permanent, fail safe and maintenance free evacuation route from each new development. This route is to be continually rising to flood free land, where access to a communal refuge would be available.

f. A permanent, fail safe and maintenance free evacuation route is required from each extension or alteration of an existing development where the resident capacity of the dwelling is to be increased.

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g. Dual occupancy development will not be permitted.

6.3 Isolated Rural Areas

Isolated Rural areas are shown in DCP Map 4. No formal residential development is present within these areas because they have predominantly been utilised for rural purposes. Some existing farm houses may be present within these areas.

- a. New residential dwellings will not be permitted.
- b. Dual occupancy development will not be permitted.
- c. Existing residential dwellings may be extended or altered providing there is no increase in resident capacity.
- d. Formation of a flood-free access route to Moruya or another major urban centre may result in recategorisation of isolated non-rural areas so that they no longer fall under the provisions of this Plan.

6.4 Non-Rural Floodplain Areas

Non-Rural Floodplain areas are shown in DCP Map 4. Existing residential development is located in the Gundary, Moruya CBD, and Mynora non-rural floodplain areas.

- a. Council will require the floor level of all habitable rooms for new developments or extensions to existing developments, to be at least 300mm above the 1% Average Exceedance Probability (AEP) flood level at that location.
- b. Council will require submission of a certificate from a Registered Surveyor certifying that the levels referred to have been complied with before proceeding beyond habitable floor level.
- c. Council will require all new developments and existing development extensions to be designed to withstand flood velocities which are 10% higher than those predicted for a 1% AEP flood event, and flood inundation levels which are 500mm above the 1% AEP flood level, with no significant structural damage. This includes using flood compatible materials in accordance with Council's flood-proofing code. Council will supply flood velocity and depth information suitable for structural engineering design. Council will require submission of a certificate from a suitable consulting structural engineer certifying that any building or structure associated with the development can withstand the force of flowing floodwaters, including debris and buoyancy forces as appropriate.
- d. Council will require a permanent, fail safe and maintenance free evacuation route from each new development. This route is to be continually rising to flood free land, where access to a communal refuge would be available.

e. A permanent, fail safe and maintenance free evacuation route is required from each extension or alteration of an existing development where the resident capacity of the dwelling is to be increased.

6.5 Isolated Non-Rural Areas

Isolated Non-Rural Areas are shown in DCP Map 4. Existing residential development in isolated non-rural areas is located at Mynora and at Moruya Heads.

- a. New residential dwellings will not be permitted.
- b. Dual occupancy development will not be permitted.
- c. Existing residential dwellings may be extended or altered providing there is no increase in resident capacity.
- d. Formation of a flood-free access route to Moruya or another major urban centre may result in recategorisation of isolated non-rural areas so that they no longer fall under the provisions of this Plan.

6.6 Future Development Floodplain Areas

Future Development Floodplain Areas are shown in DCP Map 4. No formal residential development is currently present within these areas because they have predominantly been utilised for rural purposes. Some existing farm houses may be present within these areas.

- a. Council will require the floor level of all habitable rooms for new developments, or extensions / alterations to existing dwellings, to be at least 300mm above the 1% AEP flood level at that location.
- b. Council will require submission of a certificate from a Registered Surveyor certifying that the levels referred to have been complied with before proceeding beyond habitable floor level.
- c. Council will require all new developments and extensions / alterations to existing dwellings, to be designed to withstand flood velocities which are 10% higher than those predicted for a 1% AEP flood event, and flood inundation levels which are 500mm above the 1% AEP flood level, with no significant structural damage. This includes using flood compatible materials in accordance with Council's flood-proofing code. Council will supply flood velocity and depth information suitable for structural engineering design. Council will require submission of a certificate from a suitable consulting structural engineer certifying that any building or structure associated with the development can withstand the force of flowing floodwaters, including debris and buoyancy forces as appropriate.
- d. Council will require a permanent, fail safe and maintenance free evacuation route from each new development. This route is to be continually rising to flood free land, where access to a communal refuge would be available.

6.7 Isolated Future Development Areas

Isolated Future Development areas are shown in DCP Map 4. No formal residential development is currently present within these areas because they have predominantly been utilised for rural purposes. Some existing farm houses may be present within these areas.

- a. New residential dwellings will not be permitted.
- e. Dual occupancy development will not be permitted.
- f. Existing residential dwellings may be extended or altered providing there is no increase in resident capacity.
- b. Formation of a flood-free access route to Moruya or another major urban centre may result in recategorisation of isolated future development areas so that they no longer fall under the provisions of this DCP.

6.8 Isolated Future Development Floodplain Areas

Isolated Future Development Floodplain areas are shown in DCP Map 4. No existing residential development occurs within these areas.

- a. New residential dwellings will not be permitted.
- b. Formation of a flood-free access route to Moruya or another major urban centre may result in recategorisation of isolated future development floodplain areas to non-isolated future development floodplain areas, which are then governed by Section 8.4 of this DCP.

6.9 Minor Development

a. Council may exclude minor residential development, such as swimming pools, fencing, sheds etc, from the conditions set forward in Sections 6.1 to 6.8, depending on circumstances surrounding individual development applications.

7. COMMERCIAL AREAS

7.1 Floodway Areas

No commercial developments are presently located, or are planned to be located in Floodway areas.

7.2 Rural Floodplain Areas

No commercial developments are presently located, or are planned to be located in Rural Floodplain areas.

7.3 Isolated Rural Areas

No commercial developments are presently located, or are planned to be located in Isolated Rural areas.

7.4 Non-Rural Floodplain Areas

Non-Rural Floodplain areas are shown in DCP Map 4. Existing and proposed future commercial developments in non-rural floodplain areas are restricted to the Moruya CBD, and CBD East area.

- a. Council will require the minimum floor level for new developments or extensions to existing developments, to be no lower than the 5% AEP flood level, or the adjacent road level.
- b. Council will require that at least 50% of the total floor area of the development is equal to or higher than the 1% AEP flood level.
- c. Council will require submission of a certificate from a Registered Surveyor certifying that the levels referred to have been complied with before proceeding beyond ground floor level.
- d. Floor space less than the 1% AEP flood level is to be used for actual retail and daily trading stock only. Stock additional to daily requirements is to be stored at or above the 1% AEP flood level.
- e. Council will require all new developments and existing development extensions to be designed to withstand flood inundation and velocities up to the extreme flood event with no significant structural damage. This includes using flood compatible materials in accordance with Council's flood-proofing code.
- f. All electrical equipment and plant, such as electric motors, generators, air conditioners etc, shall be located no lower than 500mm above the 1% AEP flood level.
- g. Council will require a permanent, fail safe and maintenance free evacuation route from each new development and redevelopment of existing sites. This route is to be continually rising to flood free land, where access to a communal refuge would be available.
- h. Council will require the applicant to demonstrate a procedure for effective evacuation of the commercial premises in the event of a flood. This procedure must take into consideration the limited flood warning time, and alternative evacuation routes to flood free land.
- i. Residences associated with commercial developments will not be permitted.
- j. Council will require a provision for storage of employee's personal items above the 1% AEP flood level during working hours.

7.5 Isolated Non-Rural Areas

No commercial developments are presently located, or are planned to be located in Isolated Non-Rural areas.

7.6 Future Development Floodplain Areas

No commercial developments are presently located, or are planned to be located in Future Development Floodplain areas.

7.7 Isolated Future Development Areas

No commercial developments are presently located, or are planned to be located in Isolated Future Development areas.

7.8 Isolated Future Development Floodplain Areas

No commercial developments are presently located, or are planned to be located in Isolated Future Development Floodplain areas.

8. INDUSTRIAL AREAS

8.1 Floodway Areas

No industrial developments are presently located, or are planned to be located in Floodway areas.

8.2 Rural Floodplain Areas

No industrial developments are presently located, or are planned to be located in Rural Floodplain areas.

8.3 Isolated Rural Areas

No industrial developments are presently located, or are planned to be located in Isolated Rural areas.

8.4 Non-Rural Floodplain Areas

Non-Rural Floodplain areas are shown in DCP Map 4. Existing and proposed future industrial developments in non-rural floodplain areas are restricted to the Moruya CBD East, and the Malabar Creek area.

- a. Council will require the minimum floor level for new developments or extensions to existing developments, to be no lower than the 5% AEP flood level, or the adjacent road level.
- b. Council will require that at least 50% of the total floor area of the development is equal to or higher than the 1% AEP flood level
- c. Council will require submission of a certificate from a Registered Surveyor certifying that the levels referred to have been complied with before proceeding beyond ground floor level.
- d. Floor space less than the 1% AEP flood level is to be used for daily stock only. Stock additional to daily requirements is to be stored at or above the 1% AEP flood level.

- e. Council will require all new developments and existing development extensions to be designed to withstand flood inundation and velocities up to the extreme flood event with no significant structural damage. This includes using flood compatible materials in accordance with Council's flood-proofing code.
- f. All electrical equipment and plant, such as electric motors, generators, air conditioners etc, shall be located no lower than 500mm above the 1% AEP flood level.
- g. Council will require a permanent, fail safe and maintenance free evacuation route from each new development and redevelopment of existing sites. This route is to be continually rising to flood free land, where access to a communal refuge would be available. For Malabar Creek developments, this communal refuge may be located at Mogo, or Batemans Bay.
- h. Council will require the applicant to demonstrate a procedure for effective evacuation of the industrial premises in the event of a flood. This procedure must take into consideration the limited flood warning time, and alternative evacuation routes to flood free land.
- i. Residences associated with commercial developments will not be permitted.
- j. Council will require a provision for storage of employee's personal items above the 1% AEP flood level during working hours.

8.5 Isolated Non-Rural Areas

No industrial developments are presently located, or are planned to be located in Isolated Non-Rural areas.

8.6 Future Development Floodplain Areas

No industrial developments are presently located, or are planned to be located in Future Development Floodplain areas.

8.7 Isolated Future Development Areas

No industrial developments are presently located, or are planned to be located in Isolated Future Development areas.

8.8 Isolated Future Development Floodplain Areas

No industrial developments are presently located, or are planned to be located in Isolated Future Development Floodplain areas.

9. OTHER DEVELOPMENTS

The permissibility of all other developments not discussed above in flood liable land is outlined in DCP Table 1.

Type of Development	4.1 Floodway	4.2 Rural Floodplain	4.3 Isolated Rural	4.4 Non-Rural Floodplain	4.5 Isolated Non-Rural	4.6 Future Development Floodplain	4.7 Isolated Future Development	4.8 Isolated Future Development Floodplain
Aerodrome facilities	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Advertising Structures	Not Permitted	Not Permitted	Not Permitted	As per zoning	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Agriculture	Permitted only with consent of Council	Permitted without consent of Council	Permitted without consent of Council	As per zoning	Not Permitted	Not Permitted in urban expansion zones	Not Permitted in urban expansion zones	Not Permitted in urban expansion zones
Amusement parks	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Boarding houses	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Boatsheds	Permitted only with consent of Council, and subject to design constraints	Permitted only with consent of Council, and subject to design constraints	Permitted only with consent of Council, and subject to design constraints	As per zoning	Permitted only with consent of Council, and subject to design constraints	Permitted only with consent of Council, and subject to design constraints	Not applicable	Permitted only with consent of Council, and subject to design constraints
Bowling greens	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Permitted only with consent of Council	Not Permitted	Not Permitted
Bulk stores	Not Permitted	Not Permitted	Not Permitted	Permitted only with consent from Council and subject to storage constraints	Permitted only with consent of Council, and subject to early evacuation conditions	Permitted only with consent of Council, and subject to storage constraints	Permitted only with consent of Council, and subject to early evacuation conditions	Permitted only with consent of Council, and subject to storage constraints and evac. conditions

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DCP TABLE 1 PERMISSIBLE DEVELOPMENTS IN AREAS AFFECTED BY FLOOD HAZARD

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Type of Development	4.1 Floodway	4.2 Rural Floodplain	4.3 Isolated Rural	4.4 Non-Rural Floodplain	4.5 Isolated Non-Rural	4.6 Future Development Floodplain	4.7 Isolated Future Development	4.8 Isolated Future Development Floodplain
Camping	Permitted only with consent of Council	Permitted only with consent of Council	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Car repair stations	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Caravan parks	Not Permitted	Permitted only with consent of Council, and subject to early evacuation conditions	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Childcare centres	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Permitted only with consent of Council, and subject to design constraints	Not Permitted	Not Permitted
Clubs	Not Permitted	Permitted only with consent of Council, and subject to evacuation and design conditions	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Commercial premises	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Drainage	Permitted only with consent of Council	Permitted only with consent of Council	Permitted only with consent of Council	Permitted only with consent of Council	Permitted only with consent of Council	Permitted only with consent of Council	Permitted only with consent of Council	Permitted only with consent of Council

DCP TABLE 1 PERMISSIBLE DEVELOPMENTS IN AREAS AFFECTED BY FLOOD HAZARD CONT'D

PBP\RP1699-DCP-TABLE1.DOC

Type of Development	4.1 Floodway	4.2 Rural Floodplain	4.3 Isolated Rural	4.4 Non-Rural Floodplain	4.5 Isolated Non-Rural	4.6 Future Development Floodplain	4.7 Isolated Future Development	4.8 Isolated Future Development Floodplain
Drive-in takeaway shops	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Permitted only with consent of Council, and subject to early evacuation conditions	Not Permitted	Permitted only with consent of Council, and subject to early evacuation conditions	Not Permitted
Dual occupancy	Not Permitted	Not Permitted	Not Permitted	Permitted only with consent of Council	Not Permitted	Permitted only with consent of Council	Not Permitted	Not Permitted
Educational • establishments	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Extractive industries	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Forestry	Permitted only with consent of Council	Permitted only with consent of Council	Permitted only with consent of Council	Not Permitted	Not Permitted	Not Permitted in urban expansion zone	Not Permitted in urban expansion zone	Not Permitted in urban expansion zone
General stores	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Permitted only with consent of Council, and subject to early evacuation conditions	Permitted only with consent of Council and subject to design and storage constraints and evacuation access	Permitted only with consent of Council, and subject to early evacuation conditions	Permitted only with consent of Council and subject to design and storage constraints and evacuation access
Generating works	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Golf courses	Permitted only with consent of Council, providing club house is outside floodway	Permitted only with consent of Council	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted

DCP TABLE 1 PERMISSIBLE DEVELOPMENTS IN AREAS AFFECTED BY FLOOD HAZARD CONT'D

PBP\RP1699-DCP-TABLE1.DOC

Type of Development	4.1 Floodway	4.2 Rural Floodplain	4.3 Isolated Rural	4.4 Non-Rural Floodplain	4.5 Isolated Non-Rural	4.6 Future Development Floodplain	4.7 Isolated Future Development	4.8 Isolated Future Development Floodplain
Places of assembly	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Places of public worship	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Permitted only with consent of Council, and subject to early evacuation conditions	Permitted only with consent of Council and subject to design constraints and evacuation access	Permitted only with consent of Council, and subject to early evacuation conditions	Permitted only with consent of Council and subject to design constraints and evacuation access
Professional consulting rooms	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Public buildings	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Racecourses	Permitted only with consent of Council, provided building, grandstands etc are outside floodway	Permitted only with consent of Council	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Refreshment rooms	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted

DCP TABLE 1 PERMISSIBLE DEVELOPMENTS IN AREAS AFFECTED BY FLOOD HAZARD CONT'D

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Type of Development	4.1 Floodway	4,2 Rural Floodplain	4.3 Isolated Rural	4.4 Non-Rural Floodplain	4.5 Isolated Non-Rural	4.6 Future Development Floodplain	4.7 Isolated Future Development	4.8 Isolated Future Development Floodplain
Residential dwelling houses	New dwellings not permitted, existing dwellings may be renovated or extended providing no increase in no. of residents	Permitted only with consent of Council and subject to design constraints	New dwellings not permitted, existing dwellings may be renovated or extended providing no increase in no. of residents	Permitted only with consent of Council and subject to design constraints and evacuation access	New dwellings not permitted, existing dwellings may be renovated or extended providing no increase in no. of residents	Permitted only with consent of Council and subject to design constraints and evacuation access	New dwellings not permitted, existing dwellings may be renovated or extended providing no increase in no. of residents	New dwellings not permitted, existing dwellings may be renovated or extended providing no increase in no. of residents
Residential flat buildings	Not Permitted	Not Permitted	Not Permitted	Permitted as per zoning and only with consent of Council and subject to design constraints and evacuation access	Not Permitted	Not Permitted, other than flats not exceeding 2 storeys for aged persons)	Not Permitted	Not Permitted
Roads	Permitted only with consent of Council	Permitted only with consent of Council	Permitted only with consent of Council	Permitted only with consent of Council	Permitted only with consent of Council	Permitted only with consent of Council	Permitted only with consent of Council	Permitted only with consent of Council
Roadside stalls	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Rural industries	Not Permitted	Permitted only with consent of Council, and subject to design constraints	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Sawmills	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted

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MORUYA VALLEY FLOODPLAIN DEVELOPMENT GUIDELINES

DCP TABLE 1 PERMISSIBLE DEVELOPMENTS IN AREAS AFFECTED BY FLOOD HAZARD CONT'D

PBP\RP1699-DCP-TABLE1.DOC

Type of Development	4.1 Floodway	4.2 Rural Floodplain	4.3 Isolated Rural	4.4 Non-Rural Floodplain	4.5 Isolated Non-Rural	4.6 Future Development Floodplain	4.7 Isolated Future Development	4.8 Isolated Future Development Floodplain
Service stations	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Permitted only with consent of Council, and subject to early evacuation conditions	Not Permitted	Permitted only with consent of Council, and subject to early evacuation conditions	Not Permitted
Shops	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Showgrounds	Not Permitted	Permitted only with consent of Council	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Sportsgrounds	Permitted only with consent of Council, providing any assoc. buildings are outside floodway	Permitted only with consent of Council	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Permitted only with consent of Council	Not Permitted	Not Permitted
Squash courts	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Stock and saleyards	Permitted only with consent of Council, providing any assoc. buildings are outside floodway	Permitted only with consent of Council	Permitted only with consent of Council	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Subdivision	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Permitted only with consent of Council	Not Permitted	Not Permitted

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DCP TABLE 1 PERMISSIBLE DEVELOPMENTS IN AREAS AFFECTED BY FLOOD HAZARD CONT'D

PBP\RP1699-DCP-TABLE1.DOC

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Type of Development	4.1 Floodway	4.2 Rural Floodplain	4.3 Isolated Rural	4.4 Non-Rural Floodplain	4.5 Isolated Non-Rural	4.6 Future Development Floodplain	4.7 Isolated Future Development	4.8 Isolated Future Development Floodplain
Tennis courts	Permitted only with consent of Council, providing any assoc. buildings are outside floodway	Permitted only with consent of Council	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Permitted only with consent of Council	Not Permitted	Not Permitted
Timber yards	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Tourist Establishments	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Permitted only with consent of Council	Not Permitted	Not Permitted
Transport terminals	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Utility installations	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Permitted only with consent of Council, and subject to early evacuation conditions	Not Permitted	Permitted only with consent of Council, and subject to early evacuation conditions	Not Permitted
Warehouses	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Permitted only with consent of Council, and subject to early evacuation conditions	Not Permitted	Permitted only with consent of Council, and subject to early evacuation conditions	Not Permitted

DCP TABLE 1 PERMISSIBLE DEVELOPMENTS IN AREAS AFFECTED BY FLOOD HAZARD CONT'D

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	Establish procedure for providing longer term social support	Medium (2000 – 2001)	ESC DOCS	neg.
Flood awareness	Preparestinoenenconcordatere for public distribution	(http://9999)	μ Lister in εt.StC,	2 (sto),000 (s
	Babbhah means for allsinfontor of these antomation	(HIC):) (HIC):(9999))	E TC	115(2)
	Prepare a regular refresher document to keep community aware	Low (2001+)	ESC	\$10,000
Flood Mitigation and Egress Works	Raise the Princes Highway for 300 metres across Mullenderee Flats	COMPLETED	ESC RTA	\$372,000
	Raise the level of North Head Drive through the swale near Malabar Lagoon	COMPLETED	ESC RTA	\$115,000
	Construct 700 metre low level levee at Gundary	Low (2001+)	ESC	\$250,000
	Raise Murray Street at the Gundary Creek crossing	Medium (2000 – 2001)	ESC RTA	\$60,000
	Raise the Princes Hwy for 260 metres at the Racecourse Creek crossing	COMPLETED	ESC RTA	\$565,000
	Construct a 300 metre low level levee next to Racecourse Creek in the Golf Course	Low (2001+)	ESC	\$30,000
	Raise the level of South Head Road for 180 metres near the Princes Highway	COMPLETED	ESC RTA	included in highway raising cost
	Raise South Head Road for 80 metres to the west of "The Anchorage" estate	Medium (2000 2001)	ESC RTA	\$100,000

Table 4.3 Details of Tasks to Implement Flood Hazard Management Strategy cont'd.

As shown in **Table 4.1**, the majority of flood management tasks are the responsibility of Council, however, other organisations such as the SES, DOCS and RTA would provide assistance to Council wherever necessary.

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Type of Development	4.1 Floodway	4.2 Rural Floodplain	4.3 Isolated Rural	4.4 Non-Rural Floodplain	4.5 Isolated Non-Rural	4.6 Future Development Floodplain	4.7 Isolated Future Development	4.8 Isolated Future Development Floodplain
Home industries	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Permitted only with consent of Council and subject to design constraints and evacuation access	Not Permitted	Not Permitted
Hospitals	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Hotels	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Institutions	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Junkyards	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Liquid fuel depots	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Marina and port facilities	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Mines	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Motels	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Motor showrooms	Not Permitted	Not Permitted	Not Permitted	As per zoning, subject to adequate evac. procedure	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Offensive or hazardous industries	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted

DCP TABLE 1 PERMISSIBLE DEVELOPMENTS IN AREAS AFFECTED BY FLOOD HAZARD CONT'D

Table 4.2 shows a breakdown of the costs of the tasks into the three different priority categories. This breakdown provides Council with an indication for the level of funding required to implement the Plan at different stages in the future.

COMPLETED	\$1,052,000
HECHE Harst(2999))	304,000
Međium (2000 – 2001)	\$207,000
Low (2001+)	\$290,000

Total Cost

\$1,561,000

Table 4.4 Total Costs for Implementation of Flood Hazard Management Strategy

FIGURES

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Patterson Britton & Partners

J1467-05/R1699









FLOODPLAIN MANAGEMENT PLAN FLOOD BEHAVIOUR (VELOCITY * DEPTH) IN CBD EAST



FLOODPLAIN MANAGEMENT PLAN HISTORICAL FLOOD LEVELS AT MORUYA BRIDGE MORUYA VALLEY

FIGURE













5 DEVELOPMENT CONTROL PLAN

A revised Development Control Plan (DCP) has been prepared which addresses future development of land affected by flooding in the Moruya River. As well as the land directly inundated by floodwaters, the DCP considers appropriate controls on future developments in areas which are flood-free, but which are isolated from regional community centres during a flood event.

The DCP has been formulated based on:

- Hazards associated with floodwater depth and speed of flow;
- Hazards associated with areas becoming isolated during a flood events; and
- The likely future development of the Moruya Valley, as identified in the Moruya Urban LEP, 1999 and the Eurobodalla Rural LEP, 1987.

Eight different flood hazard categories have been established, which reflect different combinations of the above hazard factors. The categories are shown in DCP Map 4.

The DCP sets out guidelines for developers preparing development applications, building applications or subdivision applications to Council. These guidelines clearly indicate those developments which are permissible within the area affected by flooding of the Moruya River.

The DCP document is presented at the end of this report.


DEVELOPMENT CONTROL PLAN FLOOD HAZARD ZONES