7 SUMMARY

7.1 Objectives

The Coastline Hazard Definition Study has identified certain threats which will be addressed as part of the final Coastline Management Plan. However, preparation and implementation of that Plan may take a number of years. This study has therefore been undertaken to establish appropriate interim measures and actions for dealing with those threats and the associated consequences until the final Plan is implemented.

Specifically this included three main components:

- preparation of a Coastal Erosion and Inundation Emergency Action Plan for dealing with the emergency situations which may arise during severe coastal storms;
- preparation of an Interim Development Control Policy for properties affected by coastal erosion hazard zones so that development applications can be dealt with; and
- assessment of the need and requirements of Interim Protection Measures to reduce the threats and/or consequences of erosion or inundation.

Consideration has been given to the prevailing processes, potential impacts to the beach amenity and environment, the level of risk and consequences of actions or non-actions and likely future coastline management measures. In this regard, the BCIMAP aims to be in accordance with the framework set out in the Coastline Management Manual (1990) and the NSW Coastal Policy (1997).

7.2 Overview of Threats

The principal threats relate primarily to:

- beach erosion and associated stability of existing seawalls providing protection to property and infrastructure; and
- oceanic inundation caused by wave overtopping or breaching of dunes and/or seawalls.

Apart from an isolated property at Skennars Head where there is a risk of inundation from wave overtopping, the threats to development are all located at Lennox Head.

At the southern end of the beach, the 1993 Lennox Head Beach Management Plan has been implemented to provide protection to property and development in this area. This includes seawalls, a constructed dune and development controls. These measures should provide protection if they are maintained appropriately.

North of the Lennox Head village (north of Byron Street) a buried seawall provides some protection against erosion. However, there is a risk that it may fail in severe conditions. The Coastline Hazard Definition Study assessed the immediate risk of storm erosion in the absence of the wall. This zone extends across Pacific Parade and slightly into private property between Byron and Foster Streets. Further north it remains within the reserve seaward of Pacific Parade but cuts through the Surf Club building at Lake Ainsworth. The immediate hazard zone is seaward of all structures at the Lake Ainsworth Sports and Recreation Centre.

In a severe storm, the buried seawall will be exposed and may prevent further erosion. However, if it fails, Pacific Parade will be threatened first (between Byron and Foster Streets). Only in extreme conditions is the erosion likely to reach private property and the Surf Club building.

Longer term erosion threats have also been identified north of Byron Street. These extend into the developed area although it is recognised that realisation of this threat is dependent on the level of protection provided by the buried seawall and future coastal management strategies.

Limited oceanic inundation may occur as a result of waves running up and overtopping low dunes and seawalls. This may result in episodic or infrequent overland flow of a limited depth and for a limited time (several hours) at high tide. Extensive inundation of the swale behind the constructed dune at the southern end of the beach could occur if that dune is breached.

7.3 Future Coastline Management Considerations

In dealing with the threat of coastal erosion, the fundamental management alternatives relate to:

- holding the coastline via protection works in one of many ways; or
- retreating and letting natural erosion take its course.

Assessment of such options will be considered as part of the future Coastal Management Study and Plan which will include community consultation. While the outcomes from that process can not be pre-empted, it is unlikely that planned retreat will be adopted for a range of reasons but primarily the high cost associated with acquiring the land.

7.4 Emergency Response Planning

The primary components of a Coastal Erosion and Inundation Emergency Action Plan have been compiled in tabular form (Appendix A) summarising appropriate actions, measures and responses for dealing with emergency issues. It is recommended that this be incorporated as part of Council's DISPLAN and co-ordinated under the auspices of the Ballina Shire Coastline Management Committee.

The actions have been divided into periods relating to storm activity as follows:

1. Before the Storm
2. During the Storm – Low Alert
3. During the Storm – High Alert
4. Recovery after the storm

Prime responsibilities and other responsibilities are also noted although contact details will need to be completed.

Emergency situations are most likely to arise when severe storm conditions (cyclones or low pressure systems) generating strong onshore winds and large waves coincide with high spring tides. Such conditions should be monitored and warnings issued as necessary.

Required emergency actions are most likely to be related to blocking roads under threat and providing assistance where wave overtopping may inundate low floors. Sand bagging or lifting of items in-situ may assist in this regard. Given the presence of seawalls, it is unlikely that buildings will be threatened by erosion.

It is not recommended that emergency protection works (e.g. dumping additional rock) be carried out during the storm. If Council considers that such works may be necessary/desired, further prior actions will be needed with respect to design and approvals as well as identifying and documenting availability of materials, equipment and personnel to implement the works during the storm. Such details will need to be included in the Plan in this case

In the unlikely event that evacuation is required, adequate landward access is available to evacuation centres.

Following the event, certain works may be required to repair damage and mitigate threats associated with steep erosion scarps and debris.

7.5 Interim Development Control

Existing planning controls and development consents are generally appropriate for the interim period apart from the central section of Lennox Head (Byron Street to the southern boundary of the Lake Ainsworth Sport and Recreation Centre). It is recommended that an Interim Development Control Policy or Plan be prepared for this area with strategies for dealing with development applications until the Coastline Management Plan is finalised. Recommended components have been formulated giving consideration to the level of risk and the fact that future coastline management strategies are likely to be centred around providing protection to the developed areas. However, it is recognised that this is not guaranteed and the timeframe for implementation and ongoing commitment to protection are unknown.

The recommended key components include:

- no development on public land within the immediate hazard zone apart from minor community facilities, improvements and renovations as long as they are able to be removed or sacrificed if threatened;
- development is permitted on private land within the immediate hazard zone between Byron and Foster Streets subject to design by an appropriately qualified engineer to accommodate future short term storm erosion and the zone of reduced bearing capacity landward of the resultant erosion scarp;
- development is permitted on all land in the 50 year hazard zone (landward of the immediate hazard zone) with that development seaward of an adopted interim planning line being subject to design by an appropriately qualified engineer to accommodate short term erosion and future long term erosion including sea level rise over a specified (10 year) planning period as well as the zone of reduced bearing capacity landward of the resultant scarp;
- minimum floor levels to apply where there is a threat of inundation.

There are certain legal and indemnity implications associated with such policies, particularly given the uncertainty of future coastline management strategies, and Council should give consideration to these in adopting an interim policy.

There remains a risk that development could be damaged by coastal hazards. Furthermore, the recommended options may compromise planned retreat as a future coastline management option. Therefore, Council should also give consideration to including provisions which:

- seek an indemnity in relation to any damage suffered as a result of coastal hazards; and
- limit future liability for the increased value of approved developments and the associated cost of acquisition if planned retreat is adopted as a future coastline management option.

Where development is permitted subject to design by an appropriately qualified engineer to accommodate erosion and inundation potential, the specified design criteria in this regard are set out in Appendix B. The areas where such conditions apply have been based on available information from the Coastline Hazard Definition Study (WBM Oceanics Australia, 2003) and an adopted interim planning period of 10 years. If conditions change (eg following a major storm) and/or new information comes to hand, these areas and the associated conditions should be reviewed by Council and changes made to the Policy as necessary.

7.6 Interim Protection Measures

Interim protection measures should be implemented to reduce the threat of erosion or inundation where this threat and associated consequences are assessed to be high. Existing seawalls should be sufficient to provide interim protection against moderate storm erosion. However, it is recognised that the buried seawalls may not provide ultimate protection in extreme events. The performance and capacity of these walls should be reassessed as they are exposed by erosion and upgrade works undertaken as necessary (after the storm) if further interim protection is needed.

Such works would be subject to all requisite approvals being obtained. In this regard it should be noted that the Coastal Protection Regulation 2004 (under the provisions of the Coastal Protection Act 1979) requires the concurrence of the Minister (for Natural Resources) prior to undertaking any works or development seaward of the open coast mean high water mark. The object of the Regulation is to minimise any adverse environmental consequences resulting from the impact of coastal processes on and from such works.

All seawalls should be monitored (particularly after storms) and maintained as necessary to ensure their structural stability is sufficient.

The levels of the constructed dune at the southern end of the beach and the dune seaward of the southern end of Pacific Parade should be surveyed and maintained as necessary to minimise the risk of substantial overtopping. Appropriate dune management practices should also be implemented to protect dune vegetation and prevent wind blown sand losses thereby maintaining the integrity and level of the dunes.

8 REFERENCES

Nielsen, A.F., Lord, D.B. and Poulos, H.G., 1992. *Dune Stability Considerations for Building Foundations*. Engineers Australia, Vol. CE34 No. 2 June.

WBM Oceanics Australia, 2003. *Ballina Shire Coastline Hazard Definition Study*. Final report prepared for Ballina Shire Council, October.

APPENDIX A: COASTAL EROSION AND INUNDATION EMERGENCY ACTION PLAN

COASTAL EROSION AND INUNDATION EMERGENCY ACTION PLAN			
ACTION		**PRIME RESPONSIBILITY**	**OTHER RESPONSIBILITY**
1.	**BEFORE THE STORM**		
1.1	Implement interim measures as necessary to reduce the threat of erosion and/or inundation (review and reinstate dune crest level as necessary).	Ballina Shire Council (BSC)	Department of Lands, DIPNR
1.2	Monitor maintenance and structural integrity of interim measures following implementation (monitor seawalls and dunes and maintain as necessary).	BSC	DIPNR
1.3	Identify and gain prior approval for potential emergency protection works during the storm (if decision made to pursue emergency works).	BSC	DIPNR
1.4	Identify and plan availability of materials, equipment and personnel for emergency protection works during the storm (if being implemented).	BSC	
1.5	Monitor potential coastal storms and tropical cyclones. Monitor pressure systems (analysis charts), wave heights and direction, tides, wind speed and direction, rainfall, and creek levels.	Bureau of Meteorology (BOM)	State Emergency Service (SES), DIPNR, BSC
2.	**DURING THE STORM – LOW ALERT**		
2.1	Issue storm warning for strong winds, gales and storms, large waves and storm surges, tropical cyclones and floods.	BOM	
2.2	Monitor beach state including beach / dune erosion, wave runup, tides and ocean levels and adequacy of existing protection.	SES	DIPNR, BSC
2.3	Issue warning, door-knocking or other means.	SES	
2.4	Monitor erosion at Lennox Head particularly the threat to Pacific Parade between Byron Street and Foster Street and the Surf Club at Lake Ainsworth and the constructed dune at the southern end of the beach.	BSC	
2.5	Monitor structural integrity of seawalls at Lennox Head including old walls which may become exposed during the storm.	BSC	
2.6	Initiate approved protection works to facilities under imminent threat from existing or continued erosion or failure of existing walls. These works are contingent on legislative approval; no danger to people undertaking the works (OH&S considerations); and no obstruction to any other emergency operations.	BSC	DIPNR, SES, Police, Department of Lands
3.	**DURING THE STORM – HIGH ALERT**		
3.1	Issue Standard Emergency Warning Signal (SEWS) or door-knock where alert is limited to a small area	SES	
3.2	Decision made to block threatened roads and evacuate threatened properties. This is based on: ▪ Continued or strengthening storm activity; ▪ Severe erosion of dunes, wave overtopping dunes and anticipated oceanic inundation of hind dune areas; ▪ Collapse of existing protection works.	SES Controller	
3.3	Halt and prevent further protection works where there is a danger or obstruction to evacuation operations.	SES, Police	
3.4	Erect barriers and implement traffic control into emergency area.	SES, Police	
3.5	Place sand bags to prevent inundation of low floors from wave overtopping where possible.	SES	
3.6	Evacuate people at risk via determined routes to evacuation centre.	SES, Police.	

COASTAL EROSION AND INUNDATION EMERGENCY ACTION PLAN			
ACTION		**PRIME RESPONSIBILITY**	**OTHER RESPONSIBILITY**
3.7	Co-ordinate removal of evacuated people's belongings to safety.	SES	Police
3.8	Arrange for management of domestic pets and companion animals from evacuated areas.	DPI	Police
3.9	Register evacuated people.	Police	
3.10	Provide welfare support to evacuated people.	Disaster Welfare Service (DWS)	
3.11	Manage traffic and control evacuation routes.	Police	
3.12	Provide security to evacuated properties.	Police	
3.13	Provide accommodation and welfare.	DWS	
3.14	Re-supply any areas isolated by coastal storms and / or floods.	SES	
4.	**RECOVERY AFTER THE STORM**		
4.1	Assess damage to properties, roads, coastal protection works, services, and beach accesses and dune systems.	BSC	DIPNR
4.2	Establish Recovery Committees as required.	BSC	SES
4.3	Co-ordinate return of evacuated people.	SES	Dept. of Community Services (DOCS)
4.4	Provide assistance to residents who have suffered damage to their homes and properties (eg fallen trees, damaged roofs, etc).	SES	Rural Fire Service, BSC
4.5	Repair and re-connect services water, sewerage, power, roads and drainage and telecommunications.	BSC, Country Energy, Telstra/Optus	
4.6	Assess houses in imminent danger of collapse because of proximity to eroded dune escarpment.	Residents, BSC, SES.	DIPNR
4.7	Remove any exposed hazardous material from the beach.	BSC	
4.8	Erect relevant safety warning signs where unstable dune escarpments present a public safety hazard. In high use areas, the erosion escarpment may be collapsed to a more stable slope by machinery.	BSC	
4.9	Repair and re-establish interim measures as needed.	BSC	DIPNR
4.10	Re-instate damaged beach accesses.	BSC	
4.11	Repair and re-establish damaged beachfront and continue with ongoing monitoring and maintenance.	BSC	DIPNR
4.12	Review emergency protection works installed during the storm concerning adequacy; impact on beach amenity and access; and compliance with interim measures objectives.	BSC	DIPNR
4.13	Review and amend the Coastal Erosion and Inundation Emergency Action Plan in light of performance during the storm.	SES	Police, BSC, DIPNR

Coastal Erosion and Inundation Emergency Action Plan – Contact List

Organisation	Role/Responsibility	Name	Work Contact	AH Contact	Alternate Name	Work Contact	AH Contact
SES	Controller						
NSW Police							
BSC							
DIPNR							
BOM							
DWS							

APPENDIX B: DESIGN CRITERIA TO ACCOMMODATE EROSION AND INUNDATION POTENTIAL

The following design criteria are to apply and information to be supplied when engineering design is required to accommodate erosion and inundation potential.

1. Building foundations are to comprise piling supporting a suspended floor with a minimum clearance of 0.3 metres above natural ground surface to the underside of the floor system, and designed to support the building for the condition of removal of soil to RL two (2) metres AHD including any lateral loadings imposed by a soil mass failure to this level.

2. Piling referred to in (1) above is to be designed to fully support the building, by a competent and qualified engineer practising in the field of civil design.

3. Plans, sections and elevations submitted should identify:

    - Floor levels and natural and finished ground levels; and
    - Top and bottom levels of foundations, footings or piles.