

Ballina Coastline Interim Measures and Action Plan

Prepared For: Ballina Shire Council

Prepared By: WBM Oceanics Australia

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<p>WBM Oceanics Australia</p> <p>Brisbane Office:</p> <p>WBM Pty Ltd Level 11, 490 Upper Edward Street SPRING HILL QLD 4004 Australia</p> <p>PO Box 203 Spring Hill QLD 4004</p> <p>Telephone (07) 3831 6744 Facsimile (07) 3832 3627 www.wbmpl.com.au</p> <p>ABN 54 010 830 421 002</p>	Document: R.B15177.001.03.doc
	Title: Ballina Coastline Interim Measures and Action Plan
	Project Manager: Craig Witt
	Author: Craig Witt, Mark Burgess (GeoLINK)
Client: Ballina Shire Council	
Client Contact: Paul Busmanis	
Client Reference:	
Synopsis: This report outlines interim measures and actions to be taken when dealing with the threat of erosion and oceanic inundation along the Ballina Shire coastline prior to finalisation of a Coastline Management Plan. It includes consideration of emergency response actions, interim development controls and interim protection measures.	

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1 INTRODUCTION

1.1 Background

The Ballina Shire coastline has experienced periods of erosion and accretion over many decades under the natural influences of winds and waves. Various developments and structural works have also occurred along the coastline, some of which have been threatened by erosion and exacerbated the erosion problem.

In recognition of the erosion threat and the need for appropriate management of the coastline, the Ballina Shire Council is working towards preparation of a Coastline Management Plan for the Shire. This is in accordance with the NSW Government's Coastline Management Process as set out in the NSW Coastal Policy (1997) and the Coastline Management Manual (1990).

The nature and behaviour of the coastal processes have been the subject of various studies over the years. The most severe erosion has occurred at Lennox Head where a long history of erosion has threatened development and led to various protection works being carried out. In 1993, a Beach Management Plan was implemented for the southern section of the beach which incorporated seawalls, a constructed dune/levee system and development controls.

The Coastline Hazard Definition Study (WBM Oceanics Australia, 2003) forms the first major stage of the overall coastal management process and this has now been completed for the Shire's coastline. That report identifies erosion hazard zones and other coastal hazards including inundation potential along the coastline. The erosion hazard zones include areas under immediate threat from severe storm erosion as well as other areas under threat from longer term erosion trends. Both private and public land and facilities have been identified as being under threat in certain areas.

The next stages of the overall process involve undertaking a Coastline Management Study to identify options to address the hazards followed by preparation of a final Coastline Management Plan setting out preferred strategies and works. The overall aim is to achieve a sustainable future for the coastline while providing a balance between long term utilisation and conservation. The Coastline Management Plan will be developed after consideration of all feasible options for dealing with the issues coming out of the Hazard Definition Study whilst also addressing the social, economic, aesthetic, recreational, cultural, heritage and ecological issues associated with land uses of the area. Community consultation will be a key component in formulating the Plan.

However, this process is likely to take a number of years. In the interim period, Council may be faced with having to deal with:

- a threat to development from short term erosion and inundation in the event of a severe storm; and
- development applications for land within the identified erosion hazard zones.

Accordingly, Council has commissioned this study to identify appropriate strategies and actions and prepare a Ballina Coastline Interim Measures and Action Plan (BCIMAP) for dealing with such issues in this interim period.

1.2 Objectives of Interim Plan

It is important that any actions taken in the intervening period until the final Coastline Management Plan is completed are appropriate and give due consideration to a range of factors including coastal processes, potential impacts to the beach environment and amenity, 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). The objectives of the BCIMAP study cover three main components:

- preparation of a Coastal Erosion and Inundation Emergency Action Plan;
- preparation of an Interim Development Control Plan for properties affected by coastal erosion hazards; and
- assessment of the need and feasibility of temporary protection measures.

Specifically, the Coastal Erosion and Inundation Emergency Action Plan is to develop considered emergency response actions for that period which:

- support those faced with emergencies;
- ensure needed resources are identified and available;
- are consistent with the NSW Coastal Council Policy of ensuring emergency actions are compatible with the coastal environment;
- are in accordance with all requisite approvals (where possible); and
- are consistent with anticipated options of the final Coastline Management Plan.

The Interim Development Control Plan or Policy is to:

- ensure that interim planning policy provisions take into consideration and do not significantly compromise longer term management strategies that will result from a Coastline Management Plan;
- ensure that the type, scale and/or location of new developments reflect the level of risk posed by coastal hazards in the interim term;
- provide development controls that seek to minimise the damage potential to existing and proposed developments posed by specific coastline threats; and
- minimise amenity, social, economic and environmental impacts associated with coastal hazards and their management in the interim period.

Furthermore, the BCIMAP is to assess the need and feasibility of temporary protection measures until the final Coastline Management Plan is completed which:

- are considered necessary to address immediate threats and provide protection to property and beach amenity;
- are consistent with the NSW Coastal Council Policy of ensuring works are compatible with the coastal environment;

2 OVERVIEW OF HAZARDS AND THREATS

A number of coastline hazards have been identified in the Ballina Coastline Hazard Definition Study. Specific hazards identified as requiring consideration with respect to emergency response and interim planning relate primarily to:

- beach erosion;
- seawall stability; and
- coastal inundation.

These are discussed below.

2.1 Beach Erosion

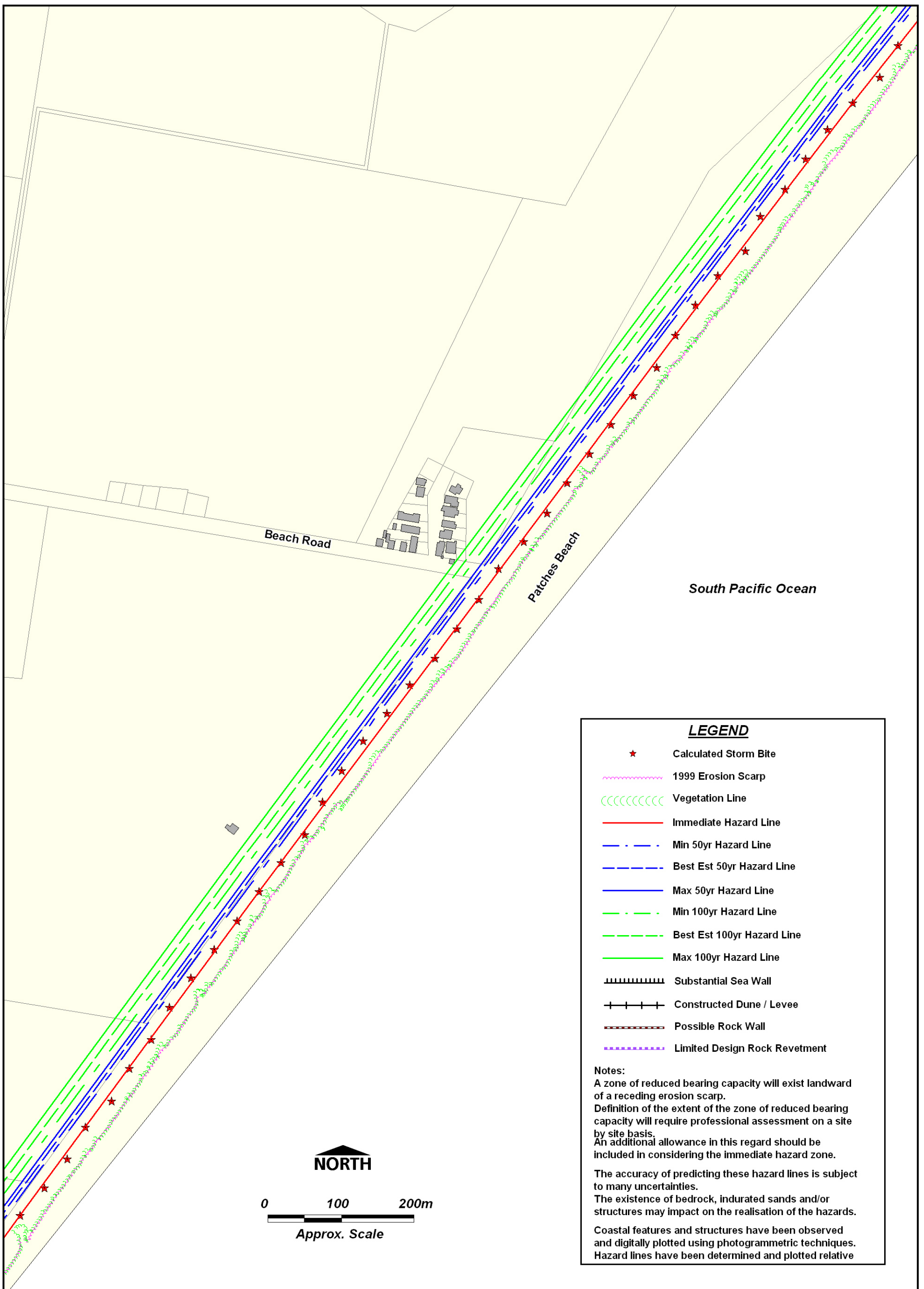
Erosion of the foreshore can occur as result of short term storm demand and/or longer term shoreline recession. Often these influences occur together and are difficult to separate. During major storm events, high waves and elevated water levels lead to rapid erosion of the upper beach and dune.

The short term storm demand for a single storm or a series of closely spaced storms has been assessed as typically around 200m³/m in terms of the beach/dune erosion quantity above mean sea level(MSL). The actual recession distance is dependent on the height of the dune and the status of the beach /nearshore profile with respect to recent erosion or accretion in the form of a beach berm. For a beach with a dune crest height of 6m above MSL and little or no berm, this equates to a recession distance of about 35m.

The beaches of Ballina Shire are also subject to potential longer term trends of recession to varying degrees as a result of differentials in the rate of longshore transport and the predicted impacts of climate change including sea level rise. The highest rates of long term recession of between 0.3 and 0.7m/yr have been assessed for the southern and central sections of Lennox Head. Recession due to sea level rise ranges from 10m for the year 2050 to 25m for the year 2100.

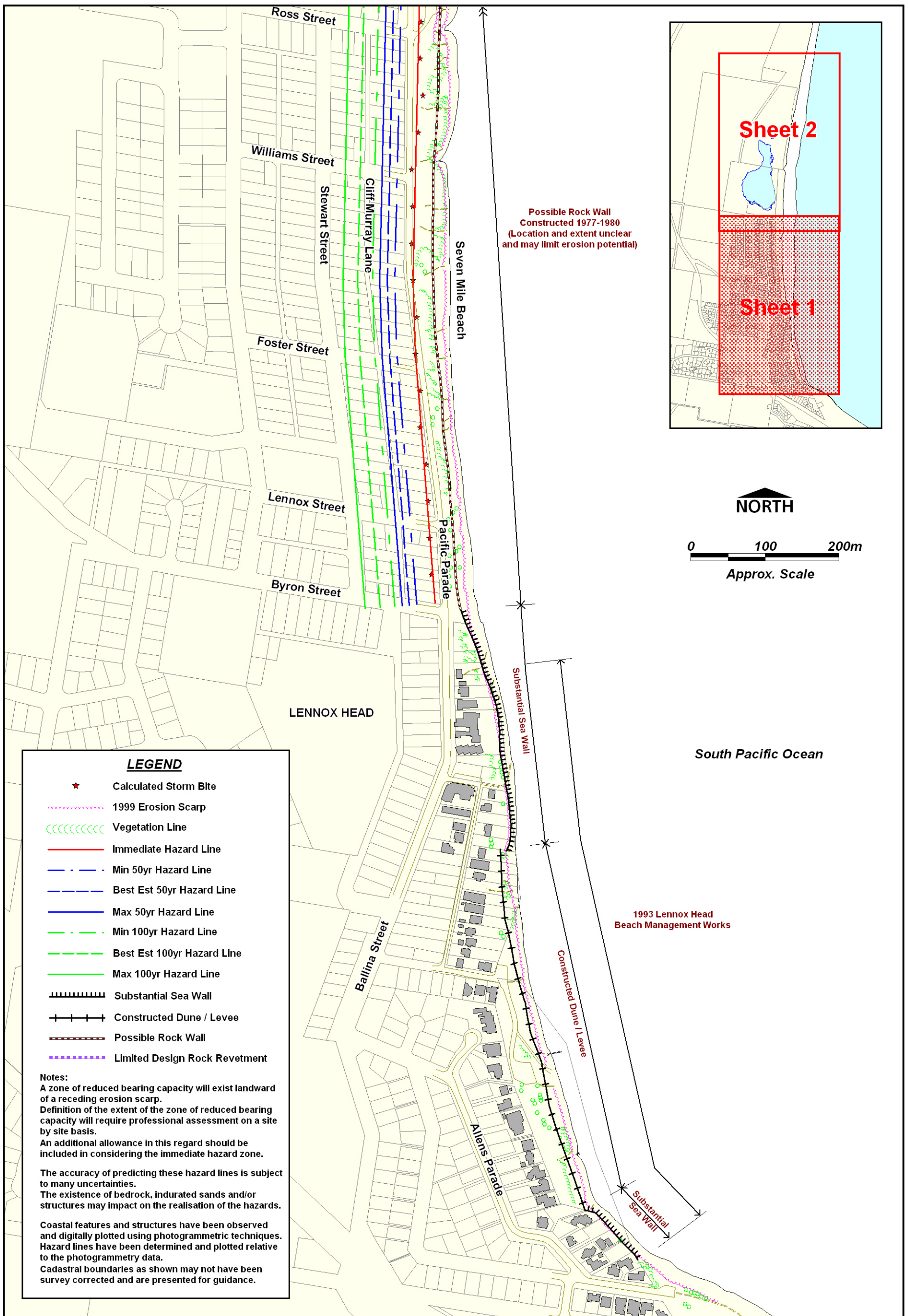
As part of the Coastline Hazard Definition Study, erosion hazard zone maps combining the above components were prepared for two priority areas of Patches Beach and Lennox Head-Seven Mile Beach. These Hazard Zone Maps are reproduced here as Figure 2-1 to Figure 2-3. While the individual erosion hazard components were assessed for the other beaches as well, the hazard zones did not extend into developed areas and maps were not produced.

The hazard zone maps include an immediate hazard line which depicts the potential position of the top of the erosion scarp following a severe storm or a series of closely spaced storms. It should be recognised that a zone of reduced bearing capacity will exist landward of a receding erosion scarp. The stability of foundations located within a zone of reduced bearing capacity will be compromised if adequate measures have not been considered in their design to withstand such conditions.



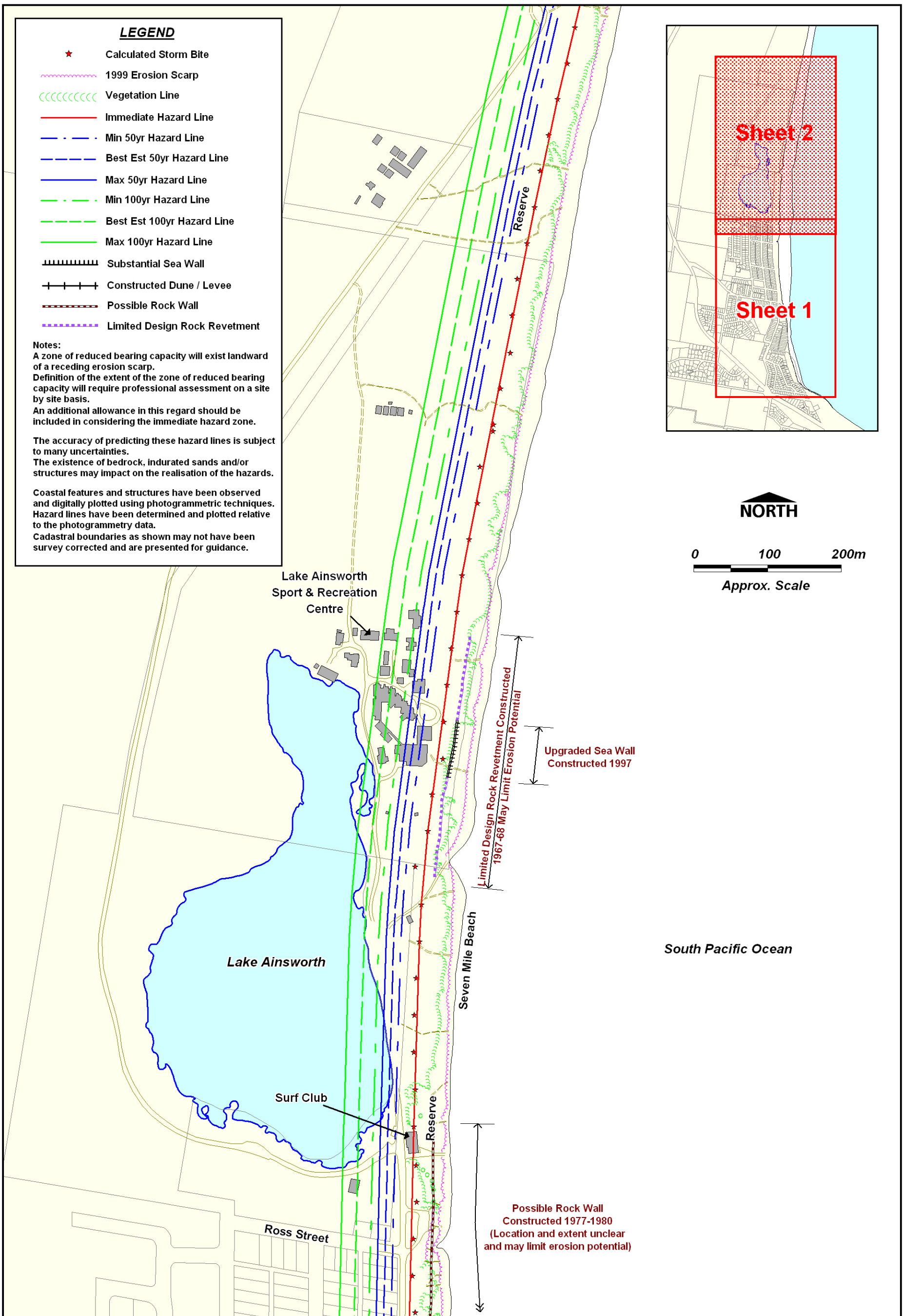
Patches Beach Erosion Hazard Zones

Figure 2-1



Lennox Head Erosion Hazard Zones - Sheet 1

Figure 2-2



Lennox Head Erosion Hazard Zones - Sheet 2

Figure 2-3

Figure 2-4 illustrates the principle dune instability zones. Stability factors relating to these zones have been defined by extensive studies (Nielsen et al 1992). Amongst other factors, the width of the zone of reduced bearing capacity is dependent on a range of factors including the natural angle of repose of the sand and the height of the dune. Definition of this width will require professional assessment on a site by site basis but could typically be in the range of 10m to 15m, for dunes up to 8m in height. An additional allowance in this regard should be made when considering the immediate hazard threat.

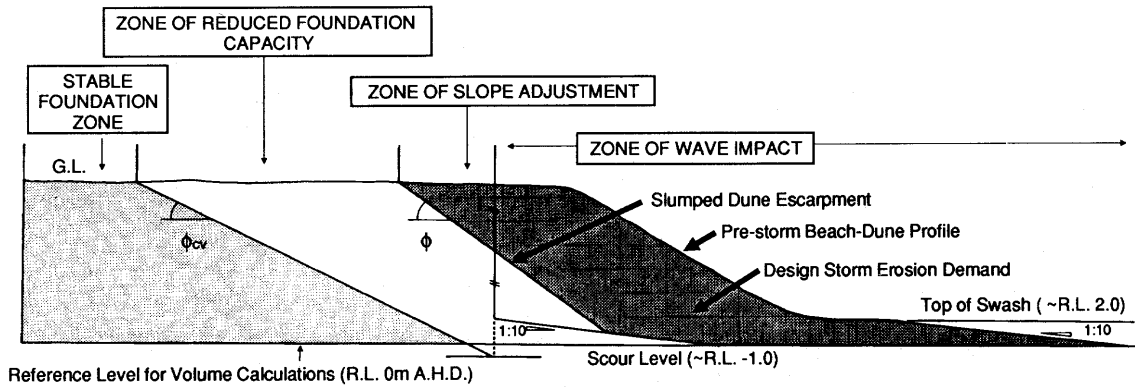


Figure 2-4 Dune Instability Zones

The hazard zone maps also include hazard lines for 50 year and 100 year planning periods taking into account predicted shoreline recession due to regional sediment budget deficits as well as predicted sea level rise recession. They have been shown as bands with minimum, maximum and best estimate lines due to uncertainties and natural variability with respect to ongoing recession. The lines also reflect the potential position of the shoreline following severe storm erosion at the end of the planning period. That is, they include the storm bite component as well.

It should be recognised that if extensive bedrock, indurated sand and/or protective structures are encountered in the beach face within these predicted zones, then this may reduce the shoreline recession. Furthermore, future recession rates may be influenced by the nature of coastline management options adopted. In particular, whether existing coastal structures are upgraded and retained or removed will have a bearing on the location and extent of erosion.

At Lennox Head, hazard lines have only been drawn north of Byron Street. South of this point, works have been implemented as part of the Lennox Head Beach Management Plan to manage coastal erosion. These works include a substantial seawall at the northern and southern ends with a constructed dune in the central section where development is set back slightly. It is understood that these works have been designed to withstand storm wave attack.

The hazard lines north of Byron Street have been drawn on the basis of no outcropping bedrock or seawalls, which are known to exist but are presently buried beneath the sand. It is likely that these walls will be exposed during a major storm event and it is recognised that such features may limit the potential for erosion. However, as their capacity in this regard is unclear, and whether they will be upgraded or maintained in the long term is unknown, the hazard lines were drawn on the basis that they do not provide any protection (i.e. worst case scenario).

2.2 Seawall Stability

At Lennox Head, a number of rubble mound seawalls have been built in response to previous erosion threats. These include substantial seawalls in the 1993 Lennox Head Beach Management Works area and in the central section of the Lake Ainsworth Sport and Recreation Centre (refer Figure 2-2 and Figure 2-3). Walls of limited design remain buried elsewhere seaward of the above Centre and Pacific Parade.

The effectiveness of those walls to withstand severe storm wave attack and hence protect property and development behind from erosion is dependent on:

- the initial design and construction; and
- maintenance following exposure to storm wave conditions.

Such walls are typically designed to have some damage in major storms, and by their nature and exposure, are subject to some slumping. Accordingly maintenance is required to ensure they retain their integrity.

It is understood that the substantial seawalls discussed above have been designed to withstand severe storm wave attack. Furthermore, they have not been exposed to severe wave attack since construction. Accordingly their integrity should be in tact at present with a limited threat of failure and exposure of the land behind to erosion.

The remaining buried seawalls are understood to be of limited design. Discussion with Council engineers at the time the walls were built, indicate that the walls should be sufficient to provide protection against modest storm conditions (eg 1 in 5 year to 1 in 10 year average recurrence interval (ARI) type events). However, available information suggests that they may not withstand severe design storm conditions. As such, there is some erosion threat to property landward of these walls. It is difficult to quantify the extent of that threat. However, the immediate hazard line as discussed above, which has been assessed on the basis of no walls, is the upper limit.

If the seawalls are damaged during a storm event and not repaired, the risk of future failure and erosion threat are enhanced.

2.3 Coastal Inundation

Coastal inundation is the flooding of coastal lands by oceanic waters. Low lying coastal lands behind barriers such as dune systems and seawalls tend to remain completely protected until a certain critical combination of waves, elevated water level (storm surge) and possibly beach erosion occurs during major storm events. This is often a gradual process with limited overland flow immediately behind. However, if the barrier is completely overtopped or breached by erosion, inundation of low lying back areas can be rapid.

Severe coastal inundation is an infrequent event and is normally of short duration (peak flooding usually persists for several hours around high tide). The extent is dependant on the height of the barrier and the land behind. If back beach areas are poorly drained, flooding behind a breached or overtopped barrier may persist for some time after coastal water levels fall.

It is generally accepted that wave runup on exposed NSW open coast beaches will exceed RL 5.0m AHD under extreme conditions. Runup levels will be potentially higher on seawalls. During these extreme events, the highly random wave energy dissipation at the shoreline could result in episodic or infrequent overtopping of barriers crested above that level for limited time.

2.4 Specific Issues and Threats

The final Coastline Management Plan will put in place strategies and/or works to address coastal hazards in the longer term. Specific issues and threats to be considered as part of this interim Plan and prior the final Plan being implemented relate primarily to:

- The risk of coastal erosion and/or inundation threatening existing development or facilities in the short term and how to manage that threat during emergency situations; and
- The presence of private and public land within designated short and longer term erosion hazard zones and how to manage applications for future development or use of that land in the interim period.

Specific areas of the Shire affected in this regard are outlined below.

2.4.1 Short Term Erosion Threat

During severe storm events, development in close proximity, to the coastline may be threatened by direct erosion of the dune system and/or failure of seawalls. The Coastline Hazard Definition Study has identified that such threat exists only at Lennox Head.

At the southern end of the township, the 1993 Lennox Head Beach Management Plan has been implemented to provide protection to property and development in this area. This Plan included:

- construction of rock revetment walls at Lennox Head Village and at the southern corner of Seven Mile Beach;
- construction of a dune levee linking the rock revetment walls; and
- planning controls for new building and redevelopment of properties (setback distances, minimum finished floor levels and requirements for piled foundations below new dwellings).

These measures should provide adequate protection if they are implemented and maintained appropriately. Consequently there is a very low risk of erosion threat associated with failure of the works. Nevertheless, the performance of the works should be monitored during severe storm conditions.

In the central section of Lennox Head, immediately north of the village (ie north of Byron Street), the immediate erosion hazard zone extends across Pacific Parade and into the private property between Foster Street and Byron Streets (refer Figure 2.2). As discussed in Section 2.1, this hazard zone has been assessed on the basis of no outcropping bedrock or seawalls.

It is recognised that a rock wall remains buried below the dune system in this area. During a major storm event, this wall will be exposed. Depending on the severity of the storm and the status of the wall, it may be sufficient to prevent any further erosion.

Should extreme storm conditions occur, there is a risk that the wall could fail with a subsequent erosion threat to the southern end of Pacific Parade in the first instance. Again depending on the severity of the storm, the status of the buried wall and any actions Council may or may not be able to take to protect Pacific Parade, the erosion threat may extend to the private property behind.

If Council is able to implement sufficient works to protect Pacific Parade, this will also provide protection to the private property behind. In the event of an extreme storm and Council not undertaking any further protection works, there is a risk that erosion may threaten private property between Foster Street and Byron Street. However, the presence of the buried seawall is likely to provide some resistance to erosion and hence the risk of a direct erosion threat to private property is very low.

Further north, the immediate erosion hazard zone remains within the reserve seaward of Pacific Parade. However, the surf club building at Lake Ainsworth and the car park to the south may be threatened by erosion in a severe storm event. This threat is again dependent on the severity of the storm and the ability of the buried seawall to prevent or limit further erosion. Given that these facilities are at the rear of the immediate hazard zone (determined on the basis of no walls), it is considered that there is a very low risk that they will be threatened during the interim period covered by the BCIMAP.

While the buried seawalls seaward of the Lake Ainsworth Sport and Recreation Centre are likely to be exposed during a severe storm event, all facilities are landward of the immediate erosion hazard zone as assessed without walls. Therefore facilities at this Centre are unlikely to be threatened in the short term irrespective of the degree of protection provided by the walls.

It should be recognised that a zone of reduced bearing capacity with a potential width of around 10 to 15m will exist landward of any receding erosion scarp.

2.4.2 Short Term Inundation Threat

Specific threat from oceanic inundation occurs where development is located close to the coastline behind dunes or barriers which may be overtopped or breached during severe storm conditions.

To the South of the Richmond River, development is limited and set well back behind dunes which are sufficient to prevent overtopping. Accordingly, oceanic inundation in this area is unlikely.

The Ballina Pocket Beaches between the Richmond River and Lennox Head contain a number of low dune areas where there is a risk of wave runup overtopping the dunes under extreme oceanic conditions. However, the only development under threat from such processes is an isolated property at Boulder Beach near Skennars Head. Individual waves at the peak of the storm may runup and overtop the beach ridge causing overland flow of limited depth. Major inundation is unlikely apart from low-lying land behind which may also be influenced by rainfall runoff.

At Lennox Head the heights of the dunes and seawalls in some parts are such that wave runup and overtopping may occur during extreme oceanic conditions. Again this may result in episodic or infrequent overland flow of a limited depth and for a limited time (several hours) at high tide.

The average ocean water level at the beach, during severe storm events could be around RL 2.1m AHD including an allowance for wave set up. Wave runup on the dunes or seawalls, from individual waves will occur to a much higher level.

In the Lennox Head Beach Management Works area, the seawalls generally have a crest level of around RL 5.2m AHD at the southern end and between RL 5.5m and 6.0m AHD at the northern end. The land behind typically slopes down away from the crest such that any water from waves running up and overtopping the walls will flow inland. This will be of limited depth and over a limited distance. Under DCP 3, new developments have had minimum floor levels established to cater for such potential (RL 5.25m AHD at southern end and RL 6.0m AHD at the northern end) but older structures with low floors may be at risk from inundation.

In the central section of the Beach Management Works, the constructed dune has a crest level which is as low as RL 4.8m AHD in places but is generally at least RL 5.0m to 5.5m AHD as determined from photogrammetry. It is noted that the DCP 3 design works plan indicates a dune crest level of 5.5m AHD. Accordingly there may be an enhanced risk of overtopping in this area. Landward of this dune there is a low swale with levels between about RL 2.5m to 3.3m AHD. Development behind also drains through this swale to stormwater outlets across the beach.

Minimum floor levels in this area have been set at RL 3.4m AHD (under DCP 3). While it is assumed that the drainage system and floor levels of properties have been designed to accommodate stormwater runoff, any overtopping of the dune system may contribute to additional ponding. Again, such overtopping is likely to be limited provided the crest level and integrity of the dune is maintained. In the event that the dune system is breached, extensive inundation of the swale behind could occur. Further investigation would be required to determine the potential consequences associated with such inundation.

At the southern end of Pacific Parade, immediately north of Lennox Head Village, the dunes have a crest level of less than RL 6.0m AHD with general land levels behind being around RL 4.5m to 4.8m AHD. Episodic wave runup and overtopping may again occur during extreme oceanic conditions and particularly if the dune crest is eroded away. However, the extent of inundation will be limited to some minor overland flow.

At the northern end of Lennox Head, the crest level of the dunes is such that overtopping and oceanic inundation is unlikely.

2.4.3 Longer Term Erosion Threat

The Coastline Hazard Definition Study has also identified zones subject to potential longer-term erosion threat as described in Section 2.1. While not being important with respect to dealing with immediate threats, the fact that this land has been identified as prone to erosion has implications with respect to how this threat will be managed in the longer term.

Options to manage this threat will be considered as part of the future Coastline Management Study as discussed further in Section 3 below. However, in the interim period, consideration needs to be given to how applications made now or in the near future for development or usage of the land will be handled, as discussed further in Section 5 below.

Apart from a slight incursion of the 100-year hazard zone at Patches Beach (refer Figure 2-1), the only developed areas within longer-term hazard zones are at Lennox Head. North of Byron Street, the 50-year hazard zone extends into all property seaward of Cliff Murray Lane to varying degrees while the 100 year hazard zone, extends into the properties landward of Cliff Murray Lane (refer Figure 2-2 and Figure 2-3). The longer-term hazard zones also extend into the Lake Ainsworth Sport and Recreation Centre.

Again the potential for this recession to be realised is dependent on the structural capacity and maintenance of existing seawalls. However, more importantly it is dependent on what future coastline management strategies are adopted.

3 FUTURE COASTLINE MANAGEMENT CONSIDERATIONS

3.1 General Considerations

Beach erosion related issues are associated primarily with a direct threat to property or structures as a result of erosion during a storm event and/or longer-term recession trends. Regional and longer-term Coastline Management Plan strategic options to deal with beach erosion depend on a range of physical, social and economic factors including:

- the erosion hazard issues;
- practical effectiveness;
- cost effectiveness; and
- social acceptability.

Options for dealing with the erosion threat will be considered as part of the future Coastline Management Plan. At this stage of the process, it is important that any emergency response actions, interim works and planning controls do not unduly compromise future coastline management options.

In particular, consideration needs to be given to the goals of the NSW Coastal Policy and the Coastline Management Manual to achieve a sustainable future for the coast while balancing environmental, economic, cultural and recreational needs. In this regard, the interim actions should also be consistent with anticipated options of the final Coastline Management Plan and thereby substantially in accordance with the principles of the Coastline Management Manual (1990) and the NSW Coastal Policy (1997).

The Coastal Policy recognises human occupation and use of the coastline as an essential part of the coastal environment. It places emphasis on:

- ecologically sustainable development and use of resources;
- ecologically sustainable human settlement (to minimise impacts of present and planned urban settlements);
- provision of appropriate public access and use;
- information for effective management; and
- integrated planning and management.

The NSW Coastal Policy also seeks to ensure all emergency actions are compatible with the coastal environment.

3.2 Coastline Management Options

In considering the threat of immediate and/or longer-term erosion, the fundamental management alternatives are to:

- hold the coastal alignment via protection works in one of many ways; or
- retreat and let natural erosion take its course.

There are alternative approaches within these two categories. Variations in the retreat options relate primarily to the nature of ownership of the land and the mechanisms/time frames for removal of structures and transfer of ownership. The intent of the retreat options is to remove the development under threat and allow the natural character and amenity of the beach to be retained as the shoreline recedes. Protection options to hold the present coastal alignment fall into two sub categories:

- purely structural measures such as seawalls, groynes or offshore breakwaters/reefs to either directly protect the property or trap sand to rebuild the beach in front; and
- beach nourishment to rebuild the beach with imported sand from outside the active beach system to make up the deficit, either alone or with other control structures to improve the longevity and give added protection.

There are various advantages and disadvantages of such options, which need to be considered in determining the most appropriate course of action and this will be undertaken as part of the future Coastline Management Study and Plan.

The NSW Coastal Policy gives preference to options which retain the natural beach character and have a low impact on beach amenity. Options which have the ability to achieve this are planned retreat and protection options which incorporate beach nourishment. Purely structural options such as seawalls may be effective in protecting the property behind but this is generally at the expense of beach amenity. Accordingly, future coastline management options are unlikely to include seawalls alone.

3.3 Specific Considerations

The likely nature of future coastline management options at Lennox Head needs to be considered in determining potential emergency and interim works as well as interim planning measures. This relates essentially to the likelihood of either implementing protection works or a long term retreat policy.

If planned retreat is preferred in the long term, further interim protection works such as enhanced seawalls will add to the ultimate cost by having to be removed in the future. Similarly, if further development is allowed to occur in longer-term hazard zones, this may increase the pressure for protection strategies and compromise the ability for planned retreat to be implemented. There will also be added cost either to the Government and/or private landowners to remove structures and acquire the land depending on the mechanism adopted for planned retreat.

Conversely, if protection strategies are preferred in the future, interim works may be consistent with these. Furthermore, the implementation of successful protection works or strategies will effectively remove the erosion threat and constraints to development within existing erosion hazard zones. However, there may remain some uncertainty with respect to the timeframe of protection measures being implemented and a commitment to ongoing maintenance to ensure adequate protection is provided.

Future coastline management options will be subject to detailed investigation and community consultation and cannot be pre-empted. However at this stage, it is considered unlikely that a planned retreat policy will be implemented given:

- the extremely high cost to remove structures and acquire the land as a result of the length of foreshore, the number of properties involved, and the present value of coastal land;
- once implemented, there will be an ongoing need to address the erosion threat to development behind and commit further funds which may be prohibitive;
- the consequences of a break-through to Lake Ainsworth;
- the social dislocation associated with residents having to relocate;
- unanswered questions about the legal enforceability of planned retreat; and
- potential inequity with the existing Lennox Head Beach Management Plan and Lake Ainsworth Sport and Recreation Centre development approval, which provide for protection.

It is therefore likely that some form of protection will be adopted as a long-term strategy. To satisfy the goals of the NSW Coastal Policy, protection works would need to have a low impact on beach amenity and natural processes. Purely structural measures such as seawalls are likely to be least favoured in terms of satisfying the goals of the Coastal Policy. However, they can be incorporated as a 'last line of defence' with other alternatives used to maintain a sandy beach.

4 EMERGENCY RESPONSE PLANNING

4.1 Intent of Emergency Response Plan

As outlined in Section 2, there are a number of areas where during severe storms it is possible that erosion and oceanic inundation may place public and private property, facilities and potentially life at various levels of risk. The Coastline Management Plan will put in place strategies for dealing with this threat. Until such strategies are implemented, the need for emergency action may arise during a major storm event.

Recent storm events in other areas have highlighted the potential need for emergency works and difficulties which can arise without a clear understanding of the processes, responsibilities and consequences of certain actions. It is therefore imperative to have appropriate procedures, strategies and actions in place to deal with such situations. This will be in the form of a Coastal Erosion and Inundation Emergency Action Plan (CEIEAP).

The intent of the CEIEAP is to have in place appropriate actions, measures and responses for dealing with emergency issues associated with the impacts prior to, during and following a coastal storm. It is to support those faced with dealing with emergencies. In particular, it is to make provision for actions carried out under the Stage Emergency and Rescue Management Act, 1989 including consideration of:

- public education;
- storm warning; and
- evacuation;

as well as works deemed necessary for the protection of property and infrastructure affected by the storm.

The CEIEAP is also intended to:

- clearly identify responsibilities, and
- ensure needed resources are identified and available.

Furthermore, it is to ensure that emergency actions are:

- compatible with the coastal environment as per the objectives of the NSW Coastal Policy and the Coastal Protection Regulation 2004;
- in accordance with all requisite approvals; and
- consistent with and not prejudicial to potential provisions of the future Coastline Management Plan.

It is recommended that the Coastal Erosion and Inundation Emergency Action Plan (CEIEAP) be included as a local sub-plan in the overall Ballina Shire Local Disaster Plan (DISPLAN). It should also be noted that the object of the Coastal Protection Regulation 2004 is to minimise any adverse environmental consequences resulting from the impact of coastal processes on and from works or

development proposed for the offshore marine waters of the state. The Regulation (under 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.

4.2 Key Stakeholders

The key stakeholders responsible for preparation and implementation of the Plan include:

- State Emergency Service (SES);
- NSW Police;
- Ballina Shire Council (BSC); and
- Department of Infrastructure, Planning and Natural Resources (DIPNR), with co-ordination being under the auspices of the Ballina Shire Coastline Management Committee.

As well as local residents, other organisations likely to be involved with various activities include:

- Bureau of Meteorology (BOM);
- Disaster Welfare Service (DWS);
- Department of Community Services (DOCS);
- Department of Lands;
- Rural Fire Service;
- Country Energy; and
- Telstra/Optus.

4.3 Key Issues

The key emergency response issues are discussed in Section 2 and summarised in Table 4.1.

Table 4-1 Summary of Short Term Threats

Hazard	Threat	Probability	Consequences
Lennox Head Southern Section (Existing Beach Management Works)			
Failure of existing seawalls	Erosion threat to property behind (approx. 15 properties)	Very Low	High (threat to close buildings)
Wave runoff/overtopping of wall	Limited overflow and inundation of low floors (approx. 15 properties)	Very Low	Low (inundation of low floors)
Erosion/overtopping of constructed dune	Inundation of swale behind and adjacent low floors (approx. 14 properties)	Low	Low (inundation of low floors)
Lennox Head Central Section			
Erosion and failure of old seawall	Erosion threat to Pacific Parade (approx. 4km at southern end)	Low	High (loss of beach front access)
Erosion and failure of old seawall	Erosion threat to properties between Foster & Byron Sts (approx. 12 properties)	Very Low	High (threat to building)
Wave runoff/overtopping of dune/wall	Limited overflow and inundation of low floors (approx. 12 properties)	Low	Low (inundation of low floors)
Lennox Head Northern Section			
Erosion and failure of old seawall	Erosion threat to Surf Club Building and Car Park	Very Low	High (loss of building)
Boulder Beach/Skennars Head			
Wave runoff/overtopping of beach ridge	Limited overflow and inundation threat to one property	Low	Low (inundation of low floors)

While certain erosion and inundation threats exist, the risks and probability of occurrence are generally low to very low. However, should the threat of erosion eventuate, the consequences are generally high in relation to the potential loss or damage to structures or facilities.

The most severe problems of coastal erosion and inundation occur as a result of oceanic storm conditions associated with the passage of cyclones and temperate-zone low-pressure systems. These storms may cause temporary sea level rises with large associated waves. The worst erosion is likely when severe weather conditions occur in conjunction with onshore winds and high spring tides. This was the case in June/July 1967 and February 1974 when coastal storms occurred in conjunction with very high spring tides.

The water level is often a critical factor affecting the extent of erosion and inundation by governing the level at which waves attack the dunes. Severe wave attack in conjunction with moderate or low tide levels may not result in significant erosion. Conversely, smaller storm waves occurring at the time of high spring tides may result in substantial erosion. The worst erosion is likely when large waves coincide with high spring tide levels.

Storm activity which causes coastal erosion and inundation is often accompanied by heavy regional rainfall and local flooding. As such, emergency resources and access may be restricted.

The area at greatest risk is Pacific Parade immediately north of Lennox Village (i.e. north of Bryon Street). The buried seawall is likely to be exposed first. Depending on the severity of the storm and the status of the wall, it may be sufficient to prevent further recession. However, failure of the wall would first threaten Pacific Parade. Only in extreme conditions is it likely that erosion would then reach private property behind. In such conditions, it may not be feasible to either identify that the wall is likely to fail or take any ameliorative action.

In extreme conditions, erosion may also threaten the Surf Club building at Lake Ainsworth and the car park to the south if the buried seawall fails. It is understood that the Beach Management Works at the southern end of Lennox Head have been designed to withstand severe storm conditions and, on this basis, there would be only a very low risk of failure with subsequent threat to property behind.

Oceanic inundation in the above areas is most likely to be in the form of low overland flow from episodic and infrequent wave overtopping which may occur for a few hours around high tide. Inundation to a substantial depth is only likely to occur in the swale behind the constructed dune at the southern end of the beach should this be breached.

4.4 Emergency Response Plan Components

The primary Coastal Erosion and Inundation Emergency Action Plan components have been prepared in the form of a summary table which is attached as Appendix A. The actions have been divided into periods relating to the 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 with a generic contact list as outlined in Appendix A. This list will need to be completed and reviewed on a regular (at least annual) basis. Details of the actions and responsibilities are discussed below. It should be recognised that some of the actions identified may not eventuate and are dependent on the outcomes of other investigations, Council's position on implementing emergency protection works, or how events occur during the storm. As such, the plan may need to incorporate additional details as noted.

4.5 Public Awareness

Public awareness of the risks and likely actions in the event of threats being realised is a key consideration.

The SES/Council should conduct educational activities to ensure that people in locations potentially threatened by coastal erosion and/or oceanic inundation are aware of the threat and management actions. This should include (as necessary):

- public seminars involving residents and community groups;
- publicity in local newspapers and over local radio stations; and
- provision of printed material to residents.

4.6 Response Preparedness (Before The Storm)

In order to prepare for and/or reduce the threats associated with coastal storms, a number of actions should be undertaken before any storm as outlined below.

4.6.1 Implement and Monitor Interim Measures

Any measures identified as being necessary to reduce the threat or consequences of erosion or inundation should be implemented as soon as possible. These are discussed further in Section 6. The majority of the areas under immediate threat from erosion have a seawall of some form seaward of them. The Lennox Head Beach Management Works include substantial seawalls while the area north of Byron Street has a buried seawall believed to be of a lower standard.

Interim protection works are generally designed to a lower standard (e.g. 1 in 5 year to 1 in 10 year ARI) given the limited timeframe for exposure until final strategies are decided and implemented. The existing seawalls are understood to provide such a level of protection while recognising that there is a risk of a severe storm occurring and the limited design walls failing.

Therefore it is considered that no further interim protection seawalls are necessary at this stage. However, the structural integrity of all seawalls should be monitored and maintenance carried out as necessary, particularly following any exposure to storm conditions during the interim period.

To reduce the threat of inundation (and erosion) it is important to maintain the crest elevation and volume of sand within the dune system. It is noted that the design level of the constructed dune in the Lennox Head Beach Management works was RL 5.5m AHD (as indicated on Plan CP20 attached to DCP 3). Photogrammetric survey profiles analysed as part of the Coastline Hazard Definition Study indicate that the crest level is as low as RL 4.8m AHD in places. Design levels and existing levels

should be confirmed and any necessary works carried out to reinstate the design crest level and thereby reduce the threat of inundation.

Similarly, available survey information along Pacific Parade indicates that the crest elevation of the dune at the southern end is less than RL 6.0m AHD. Again, it is recommended that existing levels be confirmed and works carried out as necessary to maintain a dune crest elevation of at least RL 6.0m AHD in this area to minimise the risk of overtopping.

Maintenance of frontal dunes through the protection of vegetation and prevention of wind erosion is a key coastal management action that should be included in ongoing works programmes. Appropriate dune management is important to retain the volume of sand available to accommodate storm erosion and maintain crest elevations to reduce the risk of overtopping.

4.6.2 Identify Potential Emergency Protection Works

The status of the buried seawall north of Byron Street is unclear at present. It has been identified that this wall will be exposed during storm events and there is a risk that it may fail leading to the threat of erosion to Pacific Parade and in extreme conditions, private property landward of the road. Depending on the nature of the storm, the progression of the erosion and the performance of the wall, there may be an opportunity for and benefit in carrying out emergency works to strengthen the wall if failure becomes imminent. This would most effectively be achieved by placing additional rock.

If such works were able to be successfully implemented, they would:

- provide protection to the road and private property landward;
- maintain access to the properties and foreshore; and
- prevent the need to reinstate the roadway.

However, there are risks that such works:

- may not be consistent with future coastal management options;
- may not be successful in preventing erosion; and
- may be difficult to implement in an emergency storm situation.

If such works are not implemented:

- there will be a risk of erosion damage to the roadway and possibly private land behind;
- future coastline management options will not be compromised; and
- personnel will not be put at risk implementing the works during the emergency.

Should loss of the roadway eventuate:

- beach front access would be lost although alternative rear access is available to the properties behind and to the north; and
- the roadway and access may be reinstated after the event subject to planning controls and consideration of future coastline management options.

The actual cost to carry out the emergency protection works is likely to be substantially less than the damage and reinstatement costs. However, disaster relief funding may also be available.

Council needs to consider the various advantages, disadvantages, risks and consequences of such works as outlined above in deciding whether to implement such emergency works.

On balance, it is recommended that such works not be carried out given:

- the limited risk to private property;
- alternative access is available;
- difficulties and potential risks to the workers themselves associated with sourcing material and implementing works in an emergency situation;
- the potential for the works to not be successful;
- future coastline management options will not be compromised;
- reinstatement and/or other protection works may be implemented following the storm subject to planning and approval considerations; and
- disaster relief funding may be available.

However, should Council decide to pursue such emergency protection works, there will be a need for prior actions including:

- establishment of design considerations and implementation triggers;
- obtaining approvals for the works as outlined in Section 4.1; and
- identifying and planning availability of materials, equipment and personnel to implement the works during the storm.

The sources of materials (if any) to be used in an emergency situation should be clearly identified and the location of same articulated in the plan. It is imperative that pre-determined stockpiles or source sites of all necessary materials are clearly identified in the plan along with the protocol for accessing necessary plant and labour. Council will therefore need to consider and decide if specific emergency works are likely to be implemented and incorporate the above actions into the plan as necessary.

4.6.3 Monitoring Coastal Storms

Early warning of potential emergency situations is an important factor. Therefore potential coastal storms and cyclones should be monitored in terms of pressure systems, wave heights and direction, tide levels, wind speed and direction and rainfall.

As discussed in Section 4.3, critical conditions are likely to be associated with low pressure systems (or cyclones), strong onshore winds/waves and high spring tides.

4.7 Storm Warning and Monitoring (During Storm – Low Alert)

4.7.1 Issue Initial Warnings

When the Bureau of Meteorology issues a warning of large waves or storm surge conditions for the NSW north coast, and when in the judgement of the SES Local Controller, severe storm activity occurs off the coast (e.g. in the form of a large and intense low pressure system), the SES will seek technical advice from DIPNR (with the assistance of Ballina Shire Council) concerning the state of the beach, dune erosion and adequacy of existing protection.

The SES will then co-ordinate the provision of warnings, information and advice to occupiers of properties at threat as necessary.

4.7.2 Continue Monitoring

Monitoring is to continue of the prevailing conditions and beach state including beach/dune erosion, wave runup, tides and ocean levels and adequacy of existing protection. In particular, potential areas of threat at Lennox Head should be monitored, namely:

- Pacific Parade between Byron Street and Foster Street;
- the Surf Club at Lake Ainsworth;
- the constructed dune/levee at the southern end of the beach; and
- the seawalls at Lennox Village and the southern end of the beach.

4.7.3 Initiate Approved Protection Works

Should Council have decided to pursue emergency protection works along the Pacific Parade, these should be initiated if the road is under imminent threat from continued erosion and failure of the existing wall. These works are contingent on:

- legislation approval being in place;
- no danger to people undertaking the works (OH&S considerations); and
- no obstruction to any other emergency operations.

4.8 Emergency Operations (During Storm – High Alert)

4.8.1 Initiate Emergency Operations

In the event of:

- continued or strengthening storm activity;
- severe erosion of dunes;
- wave overtopping and anticipated oceanic inundation; and/or
- collapse of existing protection works;

the SES Controller may decide to:

- block threatened roads;
- evacuate threatened properties;
- halt further protection works where there is a danger or obstruction to evacuation operations; and/or
- place sand bags to prevent inundation of low floors.

Pacific Parade, between Byron and Foster Streets, is likely to be the focus of threats initially and there may be a need to block this section of road. Adjoining properties have alternative rear access. Oceanic inundation (if at all) is likely to be mainly in the form of overland flow at low depths from wave overtopping. Sand bagging may help prevent inundation of low floors in such instances. Lifting household contents and commercial stock in-situ is another alternative. Such activities may be necessary at the southern end of Pacific Parade and in the Lennox Village area.

Should the constructed dune/levee at the southern end of the beach be breached, inundation of the swale behind may occur. Any dwellings with low floors adjoining this swale (seaward of Allens Parade) may be potentially inundated.

4.8.2 Evacuation Considerations

Evacuation is to be carried out where there is an imminent threat of building collapse or deep over-floor inundation although either occurrence is unlikely. There should be sufficient warning of potential building collapse due to gradual erosion processes. While seawall failure may occur rapidly, most structures are still set back from the seawalls. The closest structures are those at the very southern end of the beach where wave heights are likely to be the lowest.

The only area of potential deep over-floor inundation is the area adjoining the swale seaward of Allens Parade (approx. 14 properties). As discussed above, inundation of this area may occur if the dune/levee in front is breached. This process would be rapid but the depth of inundation not excessive.

In the unlikely event of the need to evacuate, landward routes from threatened properties are available to the nearest accessible evacuation centre. Co-ordination of belongings, management of domestic pets/companion animals and welfare support are to be provided as well as management of traffic and provision of security.

4.9 Recovery (After Storm)

4.9.1 Assess Damage

Immediately following the storm, the damage to properties, roads, coastal protection works, services, beach accesses and dune systems is to be assessed. The threat of collapse of any houses in close proximity to the dune escarpment is also to be assessed. Any necessary recovery committees are to be established and the return of evacuated people co-ordinated when conditions are safe.

4.9.2 Repair Damage and Clean-up

Roads and services are to be repaired and reconnected as necessary and support given to residents who have suffered damage to their houses. Any hazardous material exposed on the beach should be removed.

High and steep dune escarpments may exist following the storm presenting a public safety hazard. Barriers and relevant safety warning signs are to be erected as necessary. In high use areas, the erosion escarpment may be artificially collapsed by machinery to a more stable slope and damaged beach accesses reinstated.

Interim protection measures are to be repaired and re-established as necessary giving consideration to the timeframe remaining to likely implementation of the final Coastline Management Plan and the necessary approvals for such works.

4.9.3 Review Plan and Works

If emergency protection works were implemented during the storm, a review should be carried out concerning their:

- adequacy in terms of providing protection;
- impact on beach amenity and access; and
- compliance with interim measures objectives.

The performance of the Coastal Erosion and Inundation Emergency Action Plan during the storm should be reviewed and amended as necessary. The Ballina Shire Coastline Management Committee should also endeavour to review the CEIEAP annually, throughout the interim period, to ensure its relevance and that contact details are adequately updated.

5 INTERIM DEVELOPMENT CONTROL

5.1 Background Considerations

As outlined in Section 2.4.3, the Coastline Hazard Definition Study has identified zones which are subject to immediate and longer term threats from coastal erosion. Existing land zoned for development occurs within these areas, particularly at Lennox Head north of Byron Street.

While the future Coastline Management Plan will put in place strategies for dealing with these threats, the presence of the hazard zones (which is noted on Planning Certificates issued under Section 149 of the Environmental Planning and Assessment Act 1979) has immediate implications for landowners. Therefore, there is a need to establish a policy for dealing with applications for development in the interim period prior to finalisation of the Coastline Management Plan. This policy needs to take into consideration likely future coastline management strategies as well as the associated risks of development.

All land identified as being affected by coastal hazards is included within the 'coastal zone', as defined in the NSW Coastal Policy. Development on land within the coastal zone will predominantly be dealt with by Ballina Shire Council as the consent authority. Along with the primary local environmental planning instruments (i.e. Ballina Local Environmental Plan 1987 and Development Control Plan No. 1) development must be assessed against the provisions of State Environmental Planning Policy No. 71 – Coastal Protection (SEPP 71). SEPP 71 requires that the likely impact of coastal processes and coastal hazards on development and any likely impacts of development on coastal processes and coastal hazards, are considered for all developments within the coastal zone.

For 'significant coastal development' (such as two storey residential buildings within 100 metres of the high tide mark) and 'state significant development' (such as tourist developments), DIPNR will have a role in the approval process, either as a referral or consent authority.

Therefore, coastal hazards are an issue that must be considered by both Council and DIPNR in assessing any development application along the Ballina coastline. Adoption of an interim policy will provide greater certainty to land owners and a consistent approach to development assessment.

5.2 Policy Development Process and Policy Basis

Comparative research was undertaken to identify various development control measures that have been implemented elsewhere on the NSW and QLD coastline in relation to coastal hazards. This research was limited to a brief internet and library search and phone discussions with DIPNR, Tweed Shire Council and Clarence Valley Shire (formerly Maclean) Council. Research findings are summarised in Sections 5.2.1 to 5.2.7.

A range of potential development control options were discussed by the project technical team and subsequently the consultant team prepared the policy options outlined in Section 5.5. During the process it was identified that interim development control policy measures may have significant legal implications.

5.2.1 Wyong Shire Council

Wyong Shire Council has adopted Development Control Plan No. 77 – Coastal Hazards, as an interim development control measure pending completion of the Wyong Shire Urban Areas Coastline Management Plan. For beach systems without existing protection, the DCP identifies hazard zones that accord with land identified as seaward of the 50 year erosion line. No development or improvements are permitted within the hazard zone. Where development is proposed landward of the hazard zone, a coastal engineers report is required to assess the threats to a site and ensure that structural loads are carried into the zone of stable foundation. In certain areas, minimum floor levels are required to be identified by the coastal engineers' assessment to reduce the threat of inundation from wave runnup.

Given that Wyong is at a similar stage in the coastal planning process and is subject to similar coastal threats, their approach is relevant.

5.2.2 Gosford City Council

Gosford City Council has adopted Development Control Plan No. 125 – Coastal Frontage, to regulate development affected by coastal hazards. The DCP follows adoption of a Coastline Management Plan. For beach systems, it designates hazard areas as being either seaward of the 50 year or 100 year erosion lines. Where protection works are proposed in the future, development is permitted within the hazard zone subject to appropriate foundation design and floor levels being incorporated into the proposed development and provision of an indemnity to Council. Renovations and maintenance activities are permitted within the hazard zone provided they do not increase the risk of loss or increase the level of coastal hazard and an indemnity is provided to Council.

Given that similar coastal threats exist, Gosford's approach is relevant to this policy development process.

5.2.3 Byron Shire Council

Byron Shire Council has adopted Part J of Development Control Plan 2002 – Coastal Erosion Lands to regulate development on land that is affected by coastal hazards. A Coastline Management Study has recently been on public exhibition but the Coastline Management Plan is yet to be prepared. The existing DCP implements development controls that reflect a planned retreat approach to addressing the threat of coastal hazards.

No new buildings or works are preferred seaward of the immediate impact line. The policy does permit, with the consent of Council, development within this zone that is of a community nature provided that the building is easily removable. Only one extension per existing building is permitted within this precinct and extensions are limited to:

- Where the gross floor area is less than 100sqm, extensions that will make the gross floor area no greater than 100sqm;
- Where the gross floor area is greater than 100sqm, 10% of the gross floor area of the existing building at the date of commencement of the policy.

Development between the immediate and 50 year erosion lines is generally permitted subject to the buildings being removable if the erosion scarp retreats to a certain distance from the buildings. There have been numerous compliance difficulties and legal proceedings associated with this policy.

Given that the future coastline management strategy at Lennox Head is not likely to be planned retreat, Byron's approach has minimal relevance.

5.2.4 Pittwater Shire Council

Pittwater Shire Council has adopted Policy 144 – Interim Geotechnical Risk Management, as a mechanism for regulating the impact of coastal hazards. The policy applies a risk management matrix to development and requires a geotechnical report with coastal engineering assessment and structural engineering design. The policy requires interim geotechnical certification during construction and post construction.

Pittwater's approach represents a geotechnical engineering approach that seeks to implement a site by site risk assessment process, rather than broad planning provisions. The approach presents a risk assessment process that is a valuable reference for the implementation of planning policy.

5.2.5 Clarence Valley Shire Council (Maclean Office)

Clarence Valley Shire Council (Maclean Office) does not have a specific DCP or policy for coastal erosion hazards but has in place a Draft Geotechnical Risk Management Policy (2004) for new coastal development on the top of a coastal escarpment at Yamba. This Policy has been based largely on Pittwater Council's Interim Geotechnical Risk Management Policy as outlined above.

The Council has also implemented certain principles in the assessment of development applications at Brooms Head that are subject to coastal erosion and storm bite. The principles were included in a Report to Council regarding a 'Proposed dwelling on Lot 10 Sec 5 DP 758167 (No. 15) Ocean Road, Brooms Head' in June 2004. Although the coastline planning process to date has identified that several private properties are subject to coastal erosion, land owners have rejected the study findings. Accordingly, no formal development control plan/policy has been adopted to deal with development within the hazard zone. Notations have been placed on Section 149 Certificates and the design principles have been applied to developments through an assessment under Section 79C. The principles include foundation and floor level design measures.

5.2.6 Ballina Shire Council

Ballina Shire Council has adopted Development Control Plan No. 3 – Coastal Hazard Protection Lennox Head in relation to land landward of existing revetment wall and levee south of Byron Street. Although protection works have been provided in this area, minimum floor levels are required to mitigate against coastal inundation and piling is required to mitigate against failure of the protection works. Further, building lines have been set for all properties.

This DCP has relevance as it is an approach that has been adopted to coastal hazards within the study area. The format of the plan is also relevant.

5.2.7 Tweed Shire Council

Tweed Shire Council has recently exhibited a Draft Coastline Management Plan. Tweed has restricted development on land affected by coastal hazards by the application of an environmental protection zone since about 1987. A draft DCP was prepared to address coastal hazards but was not pursued. The only major area where development is under threat is in Kingscliff and protection works have been and are being implemented there (pers. Comm.. Jardine, 2004). Accordingly, Tweed does not offer any approaches that are relevant.

5.2.8 Policy Basis

Policy options have been developed for each coastline compartment based on an analysis of the:

- nature of coastal hazards,
- scale and intensity of existing and potential development,
- nature of existing and potential threats,

that currently exist or may potentially occur within each compartment.

The potential positive and negative impacts of development controls were analysed within the context of the coastline management process and likely future management strategies. General implications of each policy option are then discussed.

5.3 Future Coastline Management and Legal Considerations

As outlined in Section 3.3, it is likely that the final Coastline Management Plan will include strategies for protection of development at Lennox Head. However, there is no guarantee that this will be adopted and furthermore, the nature and timeframe for implementation are unknown. The interim development policy needs to take these matters into consideration.

Future coastline management options will not be compromised if development is prohibited on erosion prone land in the interim period and this is an option for Council. However, this may also be unduly restrictive for landowners with an as of right use, particularly if protection strategies are adopted in the future.

Permitting development on the other hand has associated risks and potential consequences which may compromise future coastline management options. It will increase the scale, extent and value of assets placing more pressure on adopting a protection strategy and making a planned retreat policy more costly to implement. While it is unlikely that planned retreat would be the preferred option, it cannot be eliminated until a full assessment of options is undertaken.

If planned retreat is preferred and is able to be adopted in the future, the consent will need to lapse and the land will have to be acquired at additional cost either to the landowner or the Government depending on the conditions imposed and mechanisms involved.

If protection strategies are adopted and successfully implemented in the future, this would effectively remove the erosion threat and constraints on development. However, a risk would remain that the

protection strategies are delayed and/or not maintained effectively such that permitted development may still be under threat in the future.

Consideration could be given to permitting development on designated erosion prone land subject to recognition and acceptance of the above risks. If planned retreat is able to be adopted ultimately, a decision would need to be made as to whether the land is acquired with or without compensation depending on who accepts the risk at this time. If the landowners accepted that risk, they could potentially be made responsible for the increased value of the new development and hence no or reduced compensation would be payable. This option therefore does not unduly compromise planned retreat from a broader community perspective. Alternatively, if the Council/State Government accepts that risk, they may be liable to pay full market value to acquire the property at additional cost to the community.

Development conditions could be included to reduce the threat of erosion or inundation to permitted development in the event of protection strategies being delayed or not maintained. However, a risk still remains that damage or loss could occur and reinstatement or removal costs would be involved. Liability for those costs also needs to be considered.

There are a number of legal and indemnity considerations associated with the implications of the various options outlined above which Council should take into account in adopting an interim policy.

5.4 Policy Aims

The following policy aims were formulated to guide option development and recommendation:

- Ensure that interim planning policy provisions do not significantly compromise longer term management strategies that will result from a Coastline Management Plan.
- Ensure that the type, scale and/or location of new developments reflect the level of risk posed by coastal hazards in the interim term.
- Provide development controls that seek to minimize the damage potential to existing and proposed developments posed by specific coastline threats.
- To minimize amenity, social, economic and environmental impacts associated with coastal hazards and their management in the interim period.

5.5 Policy Options

Policy options and recommendations are provided for several coastline compartments and areas based on the considerations outlined in Section 5.1, 5.2, 5.3 and 5.4 as well as an analysis of the threats facing existing and potential assets.

Terms used in policy option analysis

Development – as defined in Section 4 of the Environmental Planning and Assessment Act 1979, excluding *minor improvements and renovations*.

Minor improvements and renovation – are defined as development defined as ‘exempt development’ in DCP No. 7 and alterations and additions that do not result in the floor area of a building exceeding

1.2 times the floor area of that building (as measured at the date of commencement of the policy) nor cost more than 20% of the current value of the building. (The cost of the alterations and additions and the current value of the building shall be compared at equivalent current prices and identified in Development Applications, for approval by Council).

Maintenance – is defined as replacing defective, worn-out, rotten and/or damaged materials within the building with similar new materials.

Zone of reduced bearing capacity – refers to land that is located landward of a receding erosion scarp where slumping may occur. Definition of the extent of the zone of reduced bearing capacity requires professional assessment on a site by site basis.

5.5.1 Lennox Head – Southern Section

This section of the beach is covered by the existing Lennox Head Beach Management Plan and associated Development Control Plan No. 3.

Recommendation

That DCP No. 3 Coastal Hazard Protection Lennox Head continue to be implemented.

5.5.2 Lennox Head – Central Section

This section covers areas identified in the Coastline Hazard Definition Study as being subject to coastal hazards and extends north of Byron Street to the southern boundary of the Lake Ainsworth Sport and Recreation Centre.

5.5.2.1 Land Seaward of Immediate Hazard Line

The immediate hazard zone is generally within the beachfront public reserve except at the southern end where the zone, as assessed in the Hazard Definition Study, extends across Pacific Parade and slightly into private property by varying distances up to a maximum of about 10m (see Figure 2-2). Existing standard setback controls (6m) will generally ensure that any new development on the majority of the lots will not be within the designated hazard zone. However, some existing structures are partially within the designated zone. Furthermore, the zone also extends landward of the standard building line on a few lots. On these lots, any new developments which extend to the standard setback or further seaward where there is a relaxation of the standard building line would technically be within the immediate hazard zone.

As discussed in Section 2, the hazard zones have been determined on the basis of no outcropping bedrock or seawalls which are known to exist, but are presently buried beneath the sand. As further discussed in Section 2.4.1, the presence of this buried seawall which is likely to provide some resistance to erosion and the presence of the roadway seaward of the lots are such that the risk of a direct erosion threat to private property in this area is very low. It is understood that these factors have been taken into consideration by DIPNR in the recent assessment of a proposed motel which extends into the designated immediate hazard zone. The consent for this development included conditions requiring piled foundations to minimise the potential damage from coastal processes such

as erosion and inundation. These factors have also been similarly taken into consideration in the assessment of development control options below.

Table 5-1 provides a development analysis for the immediate hazard zone, while Table 5-2 sets out and assesses various development control options.

Table 5-1 Development Analysis (Immediate Hazard Zone)

Hazards	Existing development / assets / ownership	Potential future development trend (given current planning regime)	Threats
<ul style="list-style-type: none"> ▪ Storm erosion and failure of old seawall. ▪ Wave runup/ overtopping of dune/wall. 	<ul style="list-style-type: none"> ▪ Public foreshore reserves and road reserves. ▪ Minor structures and works (except for SLSC and car park) and the front of 18 private lots between Byron Street and Foster Street. Buildings are generally setback landward of the immediate hazard line – except for buildings south of Lennox Street. These lots include the hotel, a proposed motel and new single dwelling. 	<ul style="list-style-type: none"> ▪ Minor community facilities on foreshore reserves. ▪ Part of proposed motel (that involves building and structures seaward of the immediate hazard line but consent conditions require piled foundations). ▪ Redevelopment of private residential properties (although most will be setback landward of the immediate hazard line given 6 metre building line control). 	<ul style="list-style-type: none"> ▪ Storm erosion to Pacific Parade (at southern end). ▪ Storm erosion to properties between Byron and Foster Streets (although limited by the presence of a buried seawall). ▪ Limited overwash and inundation of floors ▪ Storm erosion to Surf Club building and car park (although limited by the presence of a buried seawall).

Table 5-2 Potential Development Control Options and Assessment of Implications (Immediate Hazard Zone)

Option No.	Option Controls	Positives	Negatives	General Implications
1.	<ul style="list-style-type: none"> ▪ No development, minor improvements, renovations or maintenance are permitted on any land. 	<ul style="list-style-type: none"> ▪ Does not compromise future management options. ▪ Minimizes threats to assets (except that threats may increase post storm event without public works repair). 	<ul style="list-style-type: none"> ▪ Does not enable routine maintenance of roads or services. ▪ Does not enable repair of public works post storm event. ▪ Potential limitations on access to private property and beach foreshore post storm event. ▪ Potential degradation of built environment in prominent location. ▪ Threat to private properties may increase post storm if public works are not reinstated. 	<p>This option is unlikely to have significant implications for the majority of development or future management options, as existing building setback controls generally ensure that private development will not be sited within the hazard zone.</p> <p>However, it will restrict any private development which is proposed to extend into the hazard zone.</p> <p>Restrictions upon public works may increase threats to private property and public assets post storm.</p> <p>Restriction on any maintenance and improvements to the existing hotel is not desirable given its visual prominence.</p>

Option No.	Option Controls	Positives	Negatives	General Implications
2.	<ul style="list-style-type: none"> ▪ No development, minor improvement or renovations are permitted on private land. ▪ No development on public land (other than outlined below). ▪ Minor community facility improvements and renovations permitted on public land, as long as they are able to be removed if threatened. ▪ Routine infrastructure maintenance and repair works post storm are permitted on public land. ▪ Maintenance is permitted on all land. 	<ul style="list-style-type: none"> ▪ Does not compromise future management options. ▪ Minimizes threats to private assets. ▪ Enables maintenance and repair of public works and existing private buildings. ▪ Retains access to private properties and the beach foreshore post storm. ▪ Enables the existing built environment to be maintained in a prominent location. 	<ul style="list-style-type: none"> ▪ Potential degradation of existing private built environment in prominent location (older housing stock can be maintained but not redeveloped). 	<p>This option is unlikely to have significant implications for the majority of development or future management options, as existing building setback controls generally ensure that private development will not be sited within the hazard zone.</p> <p>However, it will restrict any private development which is proposed to extend into the hazard zone.</p> <p>Maintenance and renovation of public roads and works should be allowed to enable the existing road and reserve buffer to be retained.</p>
3.	<ul style="list-style-type: none"> ▪ As for Option 2 except that minor improvements and renovation are permitted on all land. 	<ul style="list-style-type: none"> ▪ Enables the existing built environment to be maintained and improved in a prominent location. ▪ Enables maintenance and repair of public works. ▪ Retains access to private properties and the beach foreshore post storm. 	<ul style="list-style-type: none"> ▪ May compromise future management options (if planned retreat is preferred). ▪ May increase the value of private assets that may be threatened in the immediate term (although the potential extent for improvements and the risk of erosion threat are limited). 	<p>Although this option does not allow major development within the hazard zone it does allow minor improvements and renovations to existing buildings.</p> <p>As no specific mitigation measures are required for such works (given their limited extent), Council should consider seeking an indemnity in relation to damages from coastal hazards.</p> <p>It is unlikely to result in a substantial increase in the value of private assets however any increase may result in higher acquisition costs (with a planned retreat strategy) or an increased loss of assets if threatened in the immediate period.</p>
4.	<ul style="list-style-type: none"> ▪ Development is permitted on private land between Byron and Foster Streets, subject to design by an appropriately qualified engineer to 	<ul style="list-style-type: none"> ▪ Enables the built environment to be maintained and improved in a prominent location. 	<ul style="list-style-type: none"> ▪ May compromise future management options (if planned retreat is preferred, subject to who accepts liability for increased value). 	<p>This option does not restrict private development within the limited designated immediate hazard zone and is consistent with the recent DIPNR assessment of a</p>

Option No.	Option Controls	Positives	Negatives	General Implications
	<p>accommodate erosion and inundation potential. Foundations must address the effect of the zone of reduced bearing capacity and minimum floor levels may apply where there is the threat of inundation (refer Appendix B for criteria).</p> <ul style="list-style-type: none"> ▪ Minor improvements and renovation are permitted on private land between Byron and Foster Streets. ▪ No development on public land (other than outlined below). ▪ Minor community facility improvements and renovations permitted on public land, as long as they are able to be removed if threatened. ▪ Routine infrastructure maintenance and repair works post storm are permitted on public land. ▪ Maintenance is permitted on all land. 	<ul style="list-style-type: none"> ▪ Enables maintenance and repair of public works. ▪ Enables minor public infrastructure improvements and renovations, if required. ▪ Retains access to private properties and the beach foreshore post storm. 	<ul style="list-style-type: none"> ▪ Substantially increases the value and hence future acquisition cost of private assets that may be threatened in the immediate term (although the potential extent for new development and the risk of erosion threat are limited). ▪ Increases the cost of development (although proportion unlikely to be high for redevelopment). 	<p>motel development.</p> <p>Given the 6 metre building line that applies, the redevelopment of private residential land north of the hotel and motel sites is unlikely to extend into the immediate hazard zone.</p> <p>In addition to the effect of the 6 metre building line the option ensures that no development is undertaken within the majority of land (i.e. public land) that is within the immediate hazard zone.</p> <p>Development on public land is restricted but maintenance and renovation of public roads and works should be allowed to enable the existing road and reserve buffer to be retained.</p> <p>It may increase the value of assets within the immediate impact zone and this would result in higher immediate acquisition costs with a planned retreat strategy. Further, if a protection strategy was adopted but delayed it may increase the value of assets that would be under immediate threat.</p> <p>Council should consider seeking an indemnity in relation to damages from coastal hazards, particularly with respect to minor improvements and renovations which do not require specific mitigation measures.</p> <p>Council could consider measures to limit liability for increased acquisition costs and thereby not compromise planned retreat as a future coastline management option.</p>

Option No.	Option Controls	Positives	Negatives	General Implications
5.	<ul style="list-style-type: none"> ▪ Development is permitted on all land, subject to design by an appropriately qualified engineer to accommodate erosion and inundation potential. Foundations must address the effect of the zone of reduced bearing capacity and minimum floor levels may apply where there is the threat of inundation (refer Appendix B for criteria). ▪ Minor improvements and renovation are permitted on all land. ▪ Maintenance is permitted on all land. 	<ul style="list-style-type: none"> ▪ Enables the built environment to be maintained and improved in a prominent location. ▪ Enables maintenance and repair of public works. ▪ Enables new public infrastructure, if required. ▪ Retains access to private properties and the beach foreshore post storm. 	<ul style="list-style-type: none"> ▪ May compromise future management options (if planned retreat is preferred, subject to who accepts liability for increased value). ▪ Substantially increases the value and hence future acquisition costs of assets that may be threatened in the immediate term. ▪ Increases the cost of development (although proportion unlikely to be high for redevelopment). 	<p>It may substantially increase the value of assets within the immediate impact zone and this would result in higher immediate acquisition costs with a planned retreat strategy. Further, if a protection strategy was adopted but delayed it may increase the value of assets that would be under immediate threat.</p> <p>Council should consider seeking an indemnity in relation to damages from coastal hazards, particularly with respect to minor improvements and renovations which do not require specific mitigation measures.</p> <p>Council could consider measures to limit liability for increased acquisition costs and thereby not compromise planned retreat as a future coastline management option.</p>
6.	<ul style="list-style-type: none"> ▪ No development controls. 	<ul style="list-style-type: none"> ▪ Minimizes effect on property values prior to storm event. 	<ul style="list-style-type: none"> ▪ Would compromise future management options (if planned retreat is preferred). ▪ Not in the public interest. ▪ Ignores known threats. ▪ Potential adverse amenity and environmental impacts. ▪ Substantially increases the value of assets that may be threatened in the immediate term. 	<p>This option is inconsistent with the existing building setback applied to new development along Pacific Parade.</p> <p>It would allow unrestricted public and private investment within the immediate hazard zone and this would result in an increase in the value of assets that could be threatened in the immediate time period, increase the cost of acquiring private land and/or a premature loss of public buildings/facilities.</p>

Discussion and Recommendation

Options 1 to 3 do not allow any major development during the interim period and are inconsistent with the recent State Government development consent for a motel in this area. However, they do not significantly compromise future coastline management options and are viable options which Council could consider.

Option 6 does not include any development controls and is considered to be not appropriate.

Options 4 and 5 allow development subject to conditions which minimise the potential damage from coastal processes such as erosion and inundation. Option 4 limits development on public land to minor community improvements and renovations while Option 5 also allows new public infrastructure. They are also consistent with the most likely future management option (i.e. protection in some form) but may compromise planned retreat as a potential option.

On balance, Policy Option 4 is recommended as the preferred approach. It allows development on private land to occur subject to conditions as discussed above which is also consistent with the recent DIPNR motel consent.

However, it may compromise future coastline management options by increasing the value of assets and thereby acquisition costs for a future planned retreat option. Such costs and the associated implications for planned retreat could be minimised with measures which limit future liability and it is therefore recommended that Council give consideration to such measures.

While Option 4 includes conditions to minimise the potential damage to development from coastal processes, there is still a risk that such damage could occur. Furthermore, no such controls are required or are practical for minor improvements and renovations which would also be at risk from damage. It is therefore recommended that Council give consideration to seeking an indemnity in relation to any damage suffered as a result of coastal hazards.

This option will have limited practical implications on the development of private land as only the frontage of a restricted area of private allotments is within the immediate hazard zone. Further, the existing building line control in DCP No. 1 of 6 metres, should ensure that most new residential development/redevelopment of private lots is not sited within the immediate hazard zone.

5.5.2.2 Land Between the Immediate Hazard Line and the Maximum 50 year Hazard Line

The 50 year hazard zone extends into all beach front properties north of Byron Street (see Figures 2-2 and 2-3). However, within the planning period for this interim policy, the 50 year erosion limits are unlikely to be reached. Consideration needs to be given to any direct threat which may occur during this interim period as well as the implications for future longer term situations. On the basis of information from the Coastline Hazard Definition Study (WBM Oceanics Australia, 2003), the erosion threat for a (say) 10 year interim planning period relates to:

- The immediate short term erosion as designated by the immediate hazard line; plus
- An upper limit of long term recession of 7m (10 years at 0.7m/yr); plus

- An allowance of 2m for climate change (sea level rise effects over 10 years); and
- An allowance for a zone of reduced bearing capacity that will exist landward of the erosion scarp. Based on typical figures presented in Table 7-1 of the Coastline Hazard Definition Study, the width of this zone is unlikely to exceed 13m.

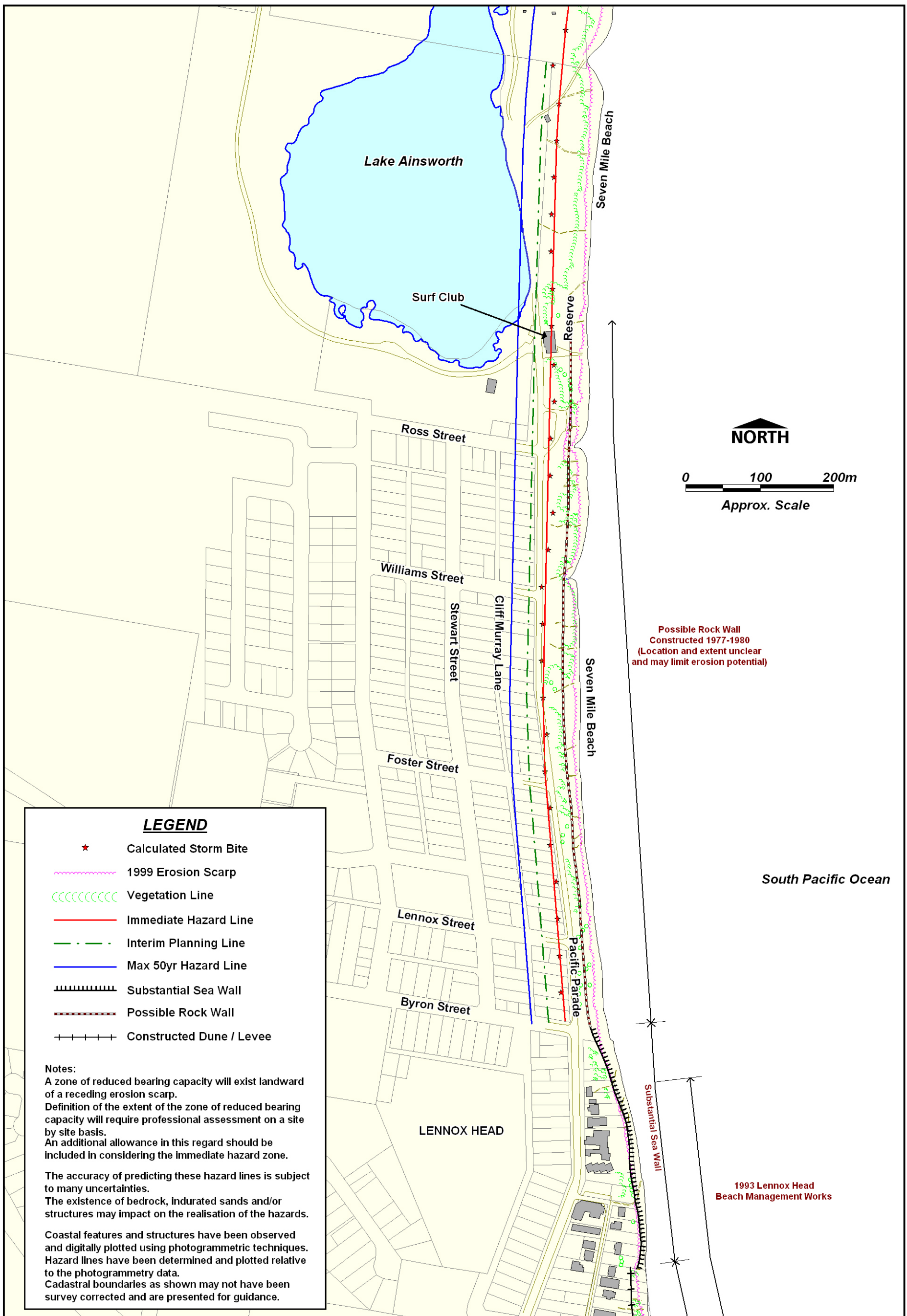
Accordingly, within a 10 year planning period, any development sited 22m or more landward of the immediate hazard line is unlikely to be threatened by the effects of coastal erosion. This distance will vary with the planning period and be larger for longer planning periods. An interim planning line landward of which development is unlikely to be threatened could therefore be established with the distance depending on the planning period.

For this interim policy, the abovementioned 10 year period and associated interim planning line distance of 22m landward of the immediate hazard line are considered to be appropriate (see Figure 5-1). Should Council consider that a longer time frame is required for the determination and implementation of final Coastline Management Plan strategies, a larger distance will be required. The assessment of the erosion hazard, interim planning line distance and consequences for the interim policy as set out below should be reviewed following any severe storm or in the event of new information coming to hand.

Table 5-3 provides a development analysis for the 50 year hazard zone, while Table 5-4 sets out and assesses various development control options.

Table 5-3 Development Analysis (50 Year Hazard Zone)

Hazards (Present)	Existing development / assets / ownership	Potential future development trend (given current planning regime)	Threats (Present)
<ul style="list-style-type: none"> ▪ Storm erosion and failure of old seawall. ▪ Wave runup/overtopping of dune/wall. 	<ul style="list-style-type: none"> ▪ Public foreshore reserves (to north) and road reserves. ▪ All private lots fronting Pacific Parade and the majority of those with western frontage to Cliff Murray Lane (about 46 lots). ▪ Eastern edge of Lake Ainsworth Caravan Park. ▪ Lake Ainsworth. 	<ul style="list-style-type: none"> ▪ Redevelopment of older housing stock and vacant land into large dwelling, duplex or triplex development with dual access from roads and laneways. ▪ Renovation of existing buildings. 	<ul style="list-style-type: none"> ▪ Post storm slumping of foreshore land, Pacific Parade and private properties within the zone of reduced bearing capacity ▪ Limited overwash and inundation of low floors



Lennox Head Central - Interim Planning Line

Figure 5-1

Table 5-4 Potential Development Control Options and Implications (50 Year Hazard Zone)

Option No.	Option Controls	Positives	Negatives	General Implications
1.	<ul style="list-style-type: none"> ▪ No development, minor improvements, renovations or maintenance are permitted on any land. 	<ul style="list-style-type: none"> ▪ Does not compromise future management options. ▪ Does not increase the value of assets that may be threatened (except that threats may increase post storm event without public works repair). 	<ul style="list-style-type: none"> ▪ Does not enable routine maintenance of roads or services. ▪ Does not enable repair of public works. ▪ Potential limitations on access to private property and beach foreshore. ▪ Potential degradation of built environment in a prominent location. ▪ Threat to private properties may increase if public works are not reinstated. ▪ Potential downward pressure on property prices. ▪ Potential social and economic hardship for private property owners <i>(Note: this impact is not felt significantly for land within the immediate hazard zone due to limited extent of private land affected).</i> 	<p>This option would have significant socio-economic impacts upon private landowners.</p> <p>Given that the most likely long term management strategy is to involve protection, this option may be unduly conservative.</p>
2.	<ul style="list-style-type: none"> ▪ No development, minor improvement or renovations are permitted on private land. ▪ No development on public land (other than outlined below). ▪ Minor community facility improvements and renovations permitted on public land, as long as they are able to be 	<ul style="list-style-type: none"> ▪ Does not compromise future management options. ▪ Does not increase the value of assets that may be threatened. ▪ Enables maintenance and repair of public works. ▪ Retains access to private properties and the beach foreshore. ▪ Enables the existing built environment to be maintained in a prominent location. 	<ul style="list-style-type: none"> ▪ Potential degradation of existing private built environment in prominent location. ▪ Potential downward pressure on property prices. ▪ Potential social and economic hardship for private property owners. 	<p>This option would have significant socio-economic impacts upon private landowners as redevelopment of land is likely to form a major share of property improvements within the affected area.</p> <p>Further, there is likely to be a significant demand for renovation and maintenance of much of the housing stock within the interim period.</p> <p>Given that the most likely long term management strategy is to involve protection, this option may be unduly conservative.</p>

Option No.	Option Controls	Positives	Negatives	General Implications
	<p>removed if threatened.</p> <ul style="list-style-type: none"> ▪ Routine infrastructure maintenance and repair works post storm are permitted on public land. ▪ Maintenance is permitted on all land. 			
3.	<ul style="list-style-type: none"> ▪ As for Option 2 except that minor improvements and renovation are permitted on all land. 	<ul style="list-style-type: none"> ▪ Enables the existing built environment to be maintained and improved in a prominent location without a substantial increase in the value of existing private assets. ▪ Enables maintenance and repair of public works. ▪ Retains access to private properties and the beach. 	<ul style="list-style-type: none"> ▪ May compromise future management options (if planned retreat is adopted) by increasing the value of assets. ▪ Potential downward pressure on property prices. ▪ Potential social and economic hardship for private property owners (as redevelopment is not permitted). 	<p>This option would have significant socio-economic impacts upon private landowners redevelopment as of land is likely to form a major share of property improvements within the affected area.</p> <p>Given that the most likely long term management strategy is to involve protection, this option may be unduly conservative.</p> <p>Council should consider seeking an indemnity in relation to damages from coastal hazards with respect to minor improvements and renovations which do not require specific mitigation measures.</p>
4.	<ul style="list-style-type: none"> ▪ Development is permitted on land which is landward of an adopted interim planning line (22m landward of the designated immediate hazard line based on a 10 year planning period – see Figure 5-1). ▪ Development is permitted on all other land, subject to design by an appropriately qualified engineer to accommodate erosion and inundation potential. 	<ul style="list-style-type: none"> ▪ Allows for an informed risk-based assessment for development based on an adopted planning period. ▪ Enables the built environment to be maintained and renewed in a prominent location. ▪ Enables the pressure for redevelopment of sites to be met. ▪ Enables maintenance and repair of public works. ▪ Retains access to private properties and the foreshore. 	<ul style="list-style-type: none"> ▪ May compromise future management options by increasing the scale, extent and value of assets (i.e. place more pressure on adopting a protection strategy and make planned retreat more difficult subject to who accepts liability for the increased value). ▪ May substantially increase the value of assets that may be threatened within the 50 year period if protection strategies are not implemented. ▪ Increases the cost of development (although the proportion unlikely to be high for redevelopment) 	<p>This option allows for likely future development trends to continue and thus does not result in the socio-economic impacts that the more conservative approaches would result in.</p> <p>The option is consistent with the most likely future management option (i.e. protection). However, increasing the value of assets seaward of the 50 year erosion line does increase the pressure to ensure that protection measures are undertaken in a timely manner and may compromise planned retreat as a future coastline management option.</p> <p>It enables implementation of an assessment of risk based on the likely storm erosion scarp, zone of reduced bearing capacity and long term</p>

Option No.	Option Controls	Positives	Negatives	General Implications
	<p>Foundations must address the effect of the zone of reduced bearing capacity and minimum floor levels may apply where there is the threat of inundation (refer Appendix B for criteria).</p> <ul style="list-style-type: none"> ▪ Minor improvements and renovation are permitted on all land. ▪ Maintenance is permitted on all land. 		<p>high for redevelopment).</p>	<p>zone of reduced bearing capacity and long term erosion potential for an adopted planning period.</p> <p>The major risk of this option is that if protection works are delayed beyond the adopted planning period, assets constructed without measures to minimise damage from coastal erosion may be threatened.</p> <p>Council should consider seeking an indemnity in relation to damages from coastal hazards, particularly with respect to minor improvements and renovations which do not require specific mitigation measures as well as development which may be threatened/damaged if implementation of long term protection is delayed beyond the adopted interim planning period.</p> <p>Council could consider measures to limit liability for increased acquisition costs and thereby not compromise planned retreat as a future coastline management option.</p>
5.	<ul style="list-style-type: none"> ▪ No development controls. 	<ul style="list-style-type: none"> ▪ Enables the pressure for redevelopment of sites to be met. 	<ul style="list-style-type: none"> ▪ Would compromise future management options (if planned retreat is preferred). ▪ Not in the public interest. ▪ Ignores known threats. ▪ Potential adverse amenity and environmental impacts. ▪ Substantially increases the value of assets that may be threatened in the 50 year period. 	<p>The major risk of this option is that new development or major investment is permitted without measures to ensure protection of the asset in the interim period. Likewise, if protection works are delayed, new investment may be damaged.</p> <p>This option ignores known threats and may have significant legal and financial implications for Council.</p>

Discussion and Recommendation

Options 1 to 3 do not allow any major development during the interim period and are inconsistent with the recent State Government development consent for a motel in this area. They also introduce potential social and economic hardship for landowners by not permitting development. However, they do not significantly compromise future coastline management options and are viable options which Council could consider.

Option 5 does not include any development controls and is considered to be not appropriate.

Option 4 allows development subject to conditions which minimise the potential damage from coastal processes such as erosion and inundation seaward of an interim planning line based on an adopted (say 10 year) planning period. Development is permitted landward of this interim planning line. This option is consistent with the most likely future management option (i.e. protection in some form) but may compromise planned retreat as a potential option. It also minimises potential social and economic hardship by permitting development.

On balance, Policy Option 4 is recommended as the preferred approach. It allows development on private land to occur subject to conditions as discussed above which is also consistent with the recent DIPNR motel consent.

However, Option 4 may compromise future coastline management strategies by increasing the value of assets and thereby acquisition costs for a future planned retreat option. Such costs and the associated implications for planned retreat could be minimised with measures which limit future liability and it is therefore recommended that Council give consideration to such measures.

While Option 4 includes conditions to minimise the potential damage to development from coastal processes, there is still a risk that such damage could occur. Furthermore, no such controls are required or are practical for minor improvements and renovations which could be at risk from damage. Development landward of the adopted interim planning line may also be at risk if protection strategies are delayed beyond the adopted planning period. It is therefore recommended that Council give consideration to seeking an indemnity in relation to any damage suffered as a result of coastal hazards.

The coastal hazards and associated risks to development including the adopted setback line in Option 4 should be reviewed following any major storm and/or as any new information comes to hand.

5.5.2.3 Land between the Maximum 50 year Hazard Line and the Maximum 100 year Hazard Line

No new development controls are recommended for this land as assets are unlikely to be threatened in the interim period and new development will not significantly compromise the coastline management planning process.

5.5.3 Lennox Head – Northern Section

This area covers the Lake Ainsworth Sport and Recreation Centre.

The Hazard Definition Study has identified that the Lake Ainsworth Sport and Recreation Centre is under threat from coastal hazards in the absence of protective seawalls. Existing protection measures provided for the site include a 370 metre length of buried seawall, of which a 75 metre section was upgraded in 1998 as a condition of consent for development on the site. The development consent also requires the upgrading of the remainder of the seawall to provide protection to the site. However, the remainder of the upgrade has yet to take place.

5.5.3.1 Existing seawall upgraded

If during the interim period the existing seawall is upgraded to comply with outstanding conditions of consent, then the site will benefit from protection against coastal hazards. Under this scenario, it would be appropriate for development to be permitted landward of the upgraded protection works subject to a site specific risk-based assessment by a coastal engineer and the incorporation of recommended design measures into the development to mitigate against any coastal hazards that may still threaten the site.

5.5.3.2 Existing seawall not upgraded

If during the interim period the existing seawall is not upgraded, then no new development should be permitted seaward of the Maximum 50 year Hazard Line. Maintenance of existing buildings seaward of the 50 year Hazard Line would be permitted.

This approach ensures that future management options are not compromised by the placement of additional assets within the hazard zone. The approach is imperative on this site given that the site is less developed and is more likely to be scrutinised for the full range of management options, from protection works to planned retreat.

5.5.4 Ballina Pocket Beaches

These beaches have exhibited relative stability in recent decades. The coastal hazards affecting the beaches are unlikely to generate significant threats given predominant public ownership of the land, existing planning controls, and no existing or potential development (other than an isolated property north of Skennars Head).

Recommendation

That existing planning controls continue to apply.

5.5.5 South Ballina

There has been an observed rate of long term accretion at South Ballina likely to be due to groyne effects and dune rehabilitation. However it is uncertain that this process will continue. The coastal hazards affecting South Ballina are unlikely to generate any threats given the predominant public ownership of the land, existing planning controls, and no existing or potential development.

Recommendation

That existing planning controls continue to apply.

5.5.6 Patches Beach

Storm bite and shoreline retreat are the primary hazards, although there is no existing development seaward of the Maximum 50 Year Hazard Line and no significant private land, seaward of the Maximum 50 Year Hazard Line.

Recommendation

That existing planning controls continue to apply and that no development be permitted seaward of the Maximum 50 Year Hazard Line.

5.6 Recommended Policy

Apart from the Lennox Head Central Section (between Byron Street and the southern boundary of the Lake Ainsworth Sport and Recreation Centre), existing planning controls and development consents should be adequate for the interim period. It is recommended that Council prepare an interim Development Control Policy or Plan for the Lennox Head Central Section with key components as follows:

- 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.

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. Foundations must address the effect of the zone of reduced bearing capacity and minimum floor levels may apply where there is the threat of inundation. Plans are to be submitted illustrating reduced levels to AHD.

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

6 INTERIM PROTECTION MEASURES

6.1 Background Considerations

A number of coastline threats have been identified relating primarily to erosion and oceanic inundation associated with severe coastal storm events as outlined in Section 2.4. Where this threat and the associated consequences are high, consideration should be given to implementing interim measures to reduce the risk and/or consequences prior to the adoption of the final Coastline Management Plan. Such measures would also reduce the need for emergency actions in the event of storm conditions.

These measures may include specific works, monitoring or regulatory actions. Again, as they are interim measures, they should be consistent with the goals of the NSW Coastal Policy, take into consideration likely final coastline management options and have all requisite approvals.

6.2 Specific Requirements

6.2.1 Protective Seawalls

As outlined in Section 4.6.1, most areas under immediate threat from erosion have a seawall of some form seaward of them. These walls are likely to provide sufficient interim protection against moderate storm wave attack and hence no specific works have been identified at this stage.

There remains some uncertainty with respect to the details and level of protection provided by older buried seawalls. Should these be exposed by storm conditions, a reassessment can be made at that time as to the need for and benefit of upgrading these walls (post storm). This should take into consideration available knowledge with respect to the timeframe and likely nature of future coastline management options.

Regular monitoring of all seawalls should be carried out, particularly following any storm wave exposure and any maintenance works carried out to ensure their structural stability is retained.

6.2.2 Dune Management

The potential for oceanic inundation is related primarily to the status of the dune system with respect to crest elevation and volume. As outlined in Section 4.6.1, it is noted that the crest elevation of the constructed dune at the southern end of Lennox Head may be lower than the original design level in places. This should be reviewed and works carried out as necessary to reinstate the intended design crest level.

Similarly, the crest elevation of the dunes at the southern end of Pacific Parade appears to be lower than RL 6.0m AHD. Surveys should be carried out to confirm dune levels in this area and works undertaken as necessary to maintain a crest elevation of at least RL 6.0m AHD and thereby minimise the risk of overtopping.

Implementation of appropriate dune management measures including pedestrian control to protect dune vegetation and prevent wind erosion should be included as part of ongoing works programmes.

Regular monitoring and maintenance works should be carried out as necessary to ensure weak points (lowering of crest) do not occur.

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: <ul style="list-style-type: none"> ▪ 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.