Coastal Zone Management Plan

for the Ballina Shire Coastline

quality solutions sustainable future

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for the Ballina Shire Coastline

Prepared for: Ballina Shire Council

Ballina Shire Council has prepared this document with financial assistance from the NSW Government through its Coastal Management Program. This document does not necessarily represent the opinions of the NSW Government or the Office of Environment and Heritage.

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Glossary

Beach	Has the same definition as the CP Act: *means the area of unconsolidated or other readily erodable material between the highest level reached by wave action and the place where tidal or lake waters reach a depth of 10 metres below Australian Height Datum.*
Beach erosion	The offshore movement of sand from the sub-aerial beach during storms or an extreme or irregular event.
Coastal erosion emergency event	A situation in which beach erosion is imminent, occurring or has occurred, and the beach erosion endangers, or threatens to endanger the safety or health of people or destroys or damages, or threatens to destroy or damage any property and which requires a significant and coordinated response.
Coastal hazard	Defined in the Coastal Protection Act 1979 (section 4) as: a) beach erosion b) shoreline recession c) coastal lake or watercourse entrance instability d) coastal inundation e) coastal cliff or slope instability f) tidal inundation g) erosion caused by tidal waters, including the interaction of those waters with catchment floodwaters.
Coastal inundation	Coastal inundation is the storm-related flooding of coastal lands by ocean waters due to elevated still water levels (storm surge) and wave run-up.
Coastal protection works	Activities or works to reduce the impact of coastal hazards on land adjacent to tidal waters and includes sea walls, revetment and beach nourishment.
CP Act	*Coastal Protection Act 1979*
CHDS	Ballina Shire Coastal Hazard Definition Study (WBM, 2003)
CZMP	Coastal Zone Management Plan
EASP	Emergency Action Sub Plan
MSL	Mean Sea Level (Australian Height Datum)
OEH	Office of Environment and Heritage (formerly DECCW – Department of Environment, Climate Change and Water)
Shoreline recession	A net long-term landward movement of the shoreline caused by a net loss in the sediment budget.
Sub-aerial beach	The beach above mean low water level
Tidal inundation	The inundation of land by tidal action under average meteorological conditions and under any combination of astronomical conditions.

Executive Summary

Section 1: Introduction

This report, the Coastal Zone Management Plan for the Ballina Shire coastline (CZMP), represents the culmination of various studies and consultative processes, including:

- *Ballina Coastline Hazard Definition Study* (WBM, 2003) and the *Updated Coastal Hazard Areas for Ballina Shire: Stage 1 – Preliminary Update* (BMT WBM, 2011);
- *Ballina Coastline Management Study – Stage 1 Values Assessment* (GeoLINK, 2007); and
- *Ballina Coastline Management Study – Stage 2 Management Options Assessment* (GeoLINK, 2008);

This CZMP focuses on maintaining or improving the ecological, cultural, recreational, and economic values that are exposed to the following coastal hazards:

- Beach erosion, due to offshore movement of sand from the sub-aerial beach during storms or an extreme or irregular event;
- Shoreline recession due to sediment budget deficits (i.e. more sand leaving a beach than entering it) and sea level rise; and
- Coastal inundation, resulting from extreme ocean storm events, overtopping dunes and inundating land behind the dunes.

Management of coastal ecosystems and community uses of the coastal zone has been thoroughly considered in various other plans. In cases where ecological, cultural, recreational, and economic values are *not* exposed to coastal hazards this CZMP complements or refers to, without duplication, these plans, in particular the Ballina Coastal Reserve Plan of Management (CRPOM) and the Precinct Plans that underpin it.

Section 2: Key findings of the Coastline Hazard Definition Study and the Coastline Management Study

WBM (2003) and BMT WBM (2011) estimated the potential threat from coastal hazards including:

- Beach erosion
- Shoreline recession; and
- Coastal inundation.

For planning purposes, coastal hazards were estimated for the immediate term (comprising beach erosion only), and for 50 year and 100 planning periods (comprising combinations of beach erosion and shoreline recession). Coastal inundation was not found to be a significant hazard.

There are inherent uncertainties in the estimation of future coastal erosion over timeframes spanning close to 100 years. These uncertainties are accommodated by a conservative approach to developing the recommended management actions and the recommendation for further and on-going monitoring of coastal processes.

Beach erosion estimates for landward movement of the shoreline range between 20 m and 45 m.

Sediment budget deficit erosion estimates for landward movement of the shoreline by 2050 range between 2.5 m and 25 m, and by 2100 the estimates range between 5 m and 50 m.

The sea level rise erosion estimate for landward movement of the shoreline is 20 m by 2050, and 45 m by 2100. These estimates are derived from the Bruun Rule and adoption of the sea level rise estimates presented in *NSW Sea Level Rise Policy Statement* (DECCW, 2009 now OEH). These sea level rise estimates are for 0.4 m by 2050 and 0.9 m by 2100 (relative to 1990 global mean sea levels). Note that this policy has been withdrawn by the NSW Government but is now Council policy for planning purposes

These erosion mechanisms typically occur together with total recession distance an additive combination of these estimates.

The erosion estimates assume no management intervention and, at Lennox Head north of Byron Street no mitigating influence of the existing buried rock wall or other existing structures.

Values and Threats

GeoLINK (2008) identified many ecological, cultural, social, recreational and economic values ascribed to the Ballina coastline by the community, and where these values might be threatened by coastal erosion hazard.

Ecological values considered to be under threat from coastal erosion include the following.

- Around 76 ha of coastal heath may be lost by 2050 (around 160 ha by 2100).
- Lake Ainsworth may be subject to oceanic breakthrough within 50 years.
- Sandy beaches may be lost 'against' hard structures such as seawalls and natural cobble fields, particularly in Lennox Head and at Boulder Beach.
- Intertidal rock platforms may be subject to significantly altered inundation regimes. This will result in major ecological shifts where there is limited 'space' for intertidal species to move to more suitable ecological niches.

Some local recreation values may be lost such as those ascribed to the beach at Lennox Head due to the beach being lost 'against' the existing seawall and constructed levee if nourishment does not occur.

It is not possible to quantify the potential reduction in economic value of the Ballina coast as a result of coastal erosion due to the diversity and complexity of components that make up this value. The estimated current annual economic value of the Ballina coast is $18M. The estimated current annual recreation value of the beach (not coast) is $5.1M. These values are likely to reduce overall as a result of coastal erosion.

It is estimated that around $83M and $122M (present value) of private and community assets are under coastal hazard threat by 2050 and 2100 respectively.

Section 3: Recommended Management Actions

Management actions are recommended to address priority coastal management issues along the Ballina Shire coastline and in particular to mitigate against

- Beach erosion; and
- Shoreline recession; and
- Coastal inundation.

Shoreline recession generally occurs over the long term, while beach erosion is generally the result of a severe storm event, or a closely-spaced series of such events, that can occur at any time. Beach erosion is often followed by a period of accretion.

Cost-effective management of coastal erosion requires a set of complementary short-term (emergency) and long-term management actions to coordinate preparedness, mitigation and recovery in order to maintain coastline amenity.

The overall philosophy of the plan is to balance a limited level of coastal hazard threat along the Ballina coastline with provision of practical and adaptive responses to the identified threats over time. The major civil work promoted by the plan is a seawall at Lennox Head coupled with longer term investigation of sand nourishment. The establishment of management actions have had regard for a changing coastal policy landscape in NSW over the timeframe of the plan's development.

Coastal Erosion Emergency Events

Coastal erosion emergency events 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. Coastal erosion emergency events may also occur under relatively benign conditions where, due to the significant lowering of a beach profile as resulting from natural processes, waves are able to scour the back beach erosion escarpment resulting in landward recession of the escarpment. Coastal erosion and or inundation may exacerbate risk to development, infrastructure, and/or persons.

To manage these risks Council has prepared an Emergency Action Subplan for Coastal Erosion (EAS) that is separate but related to this CZMP. This is provided in Appendix F. The EAS details actions to be carried out by Ballina Shire Council (Council) in response to a coastal erosion emergency event.

North and Central Seven Mile Beach

The broad management objective adopted for this beach unit is to allow coastal processes to proceed under monitoring. Coastal erosion is expected to take the form of a gradual landward movement of the beach and dune system without a substantial change to the nature or extent of these environments, but resulting in a net loss of the coastal heath. No development is under coastal hazard threat in this beach unit.

Lennox Head – North of Byron Street

The broad management objective adopted for this beach unit is to protect development landward of the beach rather than remove development and allow erosion to proceed, i.e. protect rather than retreat. In response, GeoLINK (2008) identified that the most effective strategy for this beach unit is the *Beach Nourishment with Seawall* option.

Under this CZMP, the primary strategy to protect development and infrastructure along this beach compartment is via construction of an engineered seawall. On a receding coastline a seawall acts to halt the natural recession of the coastline. This may result in the narrowing of the beach and thus a reduction in the scale of the amenity provided by the natural beach system over time, unless augmented with additional (external) reserves of sand. While Seven Mile Beach has been receding at low rates in recent decades, the recession rate will be exacerbated by projected sea level rise into the future. It is therefore necessary to investigate and determine opportunities for sand nourishment in order to mitigate impacts associated with the proposed seawall upgrade and construction. This will ensure the beach environment and recreational amenities along Seven Mile Beach are maintained into the future until the combination of sea level rise and natural forcing processes take hold.

Dredging activities in and around the Richmond River estuary would provide an opportunistic source of beach nourishment sand to enhance recreational amenity of Lennox Head Beach over the short to medium term. It is considered that such a strategy may provide sufficient sand reserves to manage the beach amenity effectively for the next couple of decades (based on current trends). To manage the spectre of projected sea level rise beyond (say) 2050 will likely require large ongoing sand sources that might only be practically available from offshore marine reserves. The current level of uncertainty regarding the cost, funding and timing of such larger scale beach nourishment works mean that they cannot be considered fully within this CZMP. However beach nourishment is identified for futher investigation under section 3.4.

BMT WBM (2011) estimates that, in the absence of any management intervention and any mitigating effect from the buried rock wall or exiting structures:

- beach erosion may affect Pacific Parade between Byron Street and Lennox Street in the immediate term but only as a result of the effects of the zone of reduced bearing capacity; and
- coastal hazards are estimated to affect assets as far landward as Cliff Murray Lane at its southern end by 2050 (including a breach of Lake Ainsworth), and as far landward as Stewart Street (southern end) by 2100.

Full implementation of all works required to protect against potential future long term recession is not required immediately. Thus the management plan for this beach unit comprises investigations and monitoring followed by staged implementation of on-ground works.

Step 1 relates to investigations and monitoring and includes (Section 3.4.3):

- In the event that dredging of the Richmond River is undertaken in the short to medium term, then pursue opportunities to utilise spoil as a source of beach nourishment.
- Investigate feasibility for a medium to long-term sand supply for beach nourishment.
- Establish a comprehensive program of beach and dune monitoring integrating various monitoring methods to identify site specific beach processes, short and long-term trends, and trigger points for initiating detailed monitoring and protective works.
- Conduct coastal engineering assessment of the structural capacity of the existing buried rock wall between Byron Street and the Lennox Head Alstonville Surf Lifesaving Club (SLSC) and the Lake Ainsworth Sports and Recreation Centre (LASRC). This investigation will identify requirements for upgrading their construction to a standard that will provide protection from coastal hazards as a 'last line of defence'.

Step 2 relates to on-ground works of seawall upgrade/ construction as informed by Step 1.

Management Plan – Investigations and Monitoring

Therefore Immediate Management Actions recommend that these investigations are started immediately, followed by design and planning, and approvals to ensure that works can commence when the trigger point is reached having the investigation, design, planning and approvals in place is also necessary for any seawall works to commence under this CZMP.

A clear picture of the changing nature of the beach is critical for timely and cost-effective management, primarily by means of identification of the trigger point for implementation of protective works. There are various monitoring methods available for Council to determine both short and long-term trends of shoreline recession rates; current condition of the beach and dune including:

- Photogrammetric analysis (minimum basis of monitoring program);
- Analysis of LIDAR data

- Land-based surveys;
- Low cost beach monitoring;
- Bathymetric surveys; and
- Coastal conditions monitoring system.

The existing rock wall buried under the dune east of Pacific Parade was built between 1977 and 1980. As its structural design, construction and present condition are unknown Management Action I2 requires that it be assessed with respect to current best practice design standards by a suitably qualified and experienced coastal engineer.

Management Plan – Protective Works

In principle, the trigger for implementation of an engineered seawall is reached when the dune erodes to the 'line of protection'. Preparation for provision of the seawall becomes more immediate and detailed dune monitoring is required once the erosion scarp is less than 35m from the line of assets to be protected (line of protection) Identification of when this trigger point for preparing to implement a seawall solution is reached requires:

- determination of the 'line of protection', landward of which property or infrastructure is to be protected and along which a seawall would ultimately be constructed;
- quantification of the sand that is available seaward of that line and above the limiting design storm profile; and
- assessment of the trends in the volume of sand available above the limiting design storm profile.

Section 3.4.3.4 provides a basic outline of the concept design requirements of the seawall. The alignment of the seawall will follow the 'line of protection' landward of which property or infrastructure is to be protected. It is recommended that the seawall is aligned as far landward as possible to maximise the potential to retain a sandy beach seaward of the wall into the future.

It is recommended that seawall works commence where consistent with the protection strategy and the associated line of protection following a beach erosion event that exposes the existing rockwall, based on the following reasons:

- Significant excavation of the *existing* dune profile would be required to implement seawall works, whether these works comprise repair, reconstruction and/or relocation of the existing buried rock wall, installation of a new seawall, or some combination. The process of beach erosion will do much of the excavation that is necessary for the seawall works.
- North of Foster Street the immediate hazard line is approximately 20 m seaward of the Pacific Parade roadway indicating it is currently extremely unlikely that major assets will be damaged by beach erosion, even if more than 200 m^3/m of sand is lost in the beach erosion event. Thus, under the estimates put forward in BMT WBM (2011), there is currently very little risk to this area in waiting for the beach erosion event to occur. South of Foster Street to Byron Street the immediate hazard line is closer to Pacific Parade, however is still seaward of the road. Should an erosion event occur this may be the area requiring priority seawall upgrade in the first instance. Preparedness and readiness for this scenario is required under this CZMP and accompanying EAS.

The natural capacity of the dune will be severely reduced during the works period as a result of the excavation, whether it is done by beach erosion or mechanically. While a storm resulting in significant beach erosion can occur at any time, the historical record shows that such events tend to be isolated. Hence it is less likely that a large beach erosion event will occur shortly after one has just occurred.

Lennox Head, South of Byron Street

The broad management objective adopted for this beach unit is to protect development landward of the beach rather than remove development and allow erosion to proceed, i.e. protect rather than retreat.

The existing seawall and levee, if appropriately monitored and maintained, are considered adequate to withstand a large coastal erosion event (or series of smaller events). Thus, theoretically there is currently no coastal hazard threat to assets in this beach unit. However, the levee appears to have slumped in places from a design height of 5.5 mAHD to around 4.8 mAHD, mainly near access points.

A number of management actions are recommended for this beach unit, some of which are effectively extensions of those recommended for Lennox Head – North of Byron Street. The management actions include:

- Various monitoring and dune management actions;
- Conduct coastal engineering investigation to determine condition and adequacy of constructed levee;
- Upgrade constructed levee on basis of management action investigation, including importation and stabilisation of additional sand to ensure that the crest elevation of the constructed levee is returned to the design level of RL 5.5 mAHD to mitigate against wave overtopping;
- Investigate, re-design and install new stormwater drains discharging at the constructed levee;
- Carry out beach nourishment in conjunction with any nourishment of the beach further north (if carried out) within ecological constraints associated with the adjacent reef areas to improve or maintain beach amenity and access;
- Monitor and maintain the structural integrity of the existing seawalls into the future; and
- Design and install a boardwalk on the existing seawall between Rayners Lane and Byron Street if public foreshore access is constrained too frequently.

Ballina Pocket Beaches and South Ballina Beaches

The broad management objective adopted for these beach units is to allow coastal processes to proceed under monitoring.

Coastal erosion is generally expected to take the form of a gradual landward movement of the beach and dune system without a substantial change to the nature or extent of these environments, but resulting in a net loss of natural areas. There is no significant development or infrastructure at risk from coastal hazards over the 2100 planning horizon in this management area. The landward extent of erosion is likely to limited at Boulder and Shelly beaches due to the cobble fields that underlie the sand in these locations.

Monitoring by means of photogrammetric analysis is recommended in addition to dune management works where necessary, especially in critical locations such as the Flat Rock tombolo.

1 Introduction

1.1 Background

The coastline of the Ballina Shire is a dynamic environment subject to the natural processes of coastal erosion and accretion. An additional element of change is introduced by local developments, such as the Richmond River training walls and seawalls, and global phenomena, such as climate change and sea level rise, which alter the extent and nature of these processes to varying degrees.

This report, the Coastal Zone Management Plan for the Ballina Shire coastline (CZMP), represents the culmination of various studies and consultative processes. These studies and processes are described in the following:

- *Ballina Coastline Hazard Definition Study (WBM, 2003) and the Updated Coastal Hazard Areas for Ballina Shire: Stage 1 – Preliminary Update (BMT WBM, 2011) concentrating on Lennox Head;*
- *Ballina Coastline Management Study – Stage 1 Values Assessment (GeoLINK, 2007);* and
- *Ballina Coastline Management Study – Stage 2 Management Options Assessment (GeoLINK, 2008).*

This CZMP provides the strategic framework for Ballina Shire Council (Council) to protect coastal values in a manner that has the support of its government partners and the community.

1.2 Scope

1.2.1 Geographical Scope

The geographical area covered by this CZMP includes the coastline of the Ballina Shire inland to the landward limit of coastal hazards over the 2100 planning period which are described in Section 2.1 and, in the case of Lennox Head, shown in Illustrations 2.1 and 2.2.

1.2.2 Thematic Scope

Subsection 55C(1) of the *Coastal Protection Act 1979* (CP Act) requires that a CZMP make provision for:

a) protecting and preserving beach environments and beach amenity, and

b) emergency actions carried out during periods of beach erosion, including the carrying out of related works, such as works for the protection of property affected or likely to be affected by beach erosion, where beach erosion occurs through storm activity or an extreme or irregular event, and

c) ensuring continuing and undiminished public access to beaches, headlands and waterways, particularly where public access is threatened or affected by accretion, and

d) where the plan relates to a part of the coastline, the management of risks arising from coastal hazards, and

e) where the plan relates to an estuary, the management of estuary health and any risks to the estuary arising from coastal hazards, and

f) the impacts from climate change on risks arising from coastal hazards and on estuary health, as appropriate, and

g) where the plan proposes the construction of coastal protection works (other than emergency coastal protection works) that are to be funded by the council or a private landowner or both, the proposed arrangements for the adequate maintenance of the works and for managing associated impacts of such works (such as changed or increased beach erosion elsewhere or a restriction of public access to beaches or headlands).

Subsection 55C(3) permits the Minister to give direction that a CZMP make provision for only one or more of the items listed in subsection 55C(1). This CZMP does *not* relate to an estuary and thus does not provide for item (e) above.

Furthermore, the *Guidelines for Preparing Coastal Zone Management Plans* (OEH, 2013) requires that a CZMP address three broad areas, namely:

- Managing risks to public safety and built assets;
- Pressures on coastal ecosystems; and
- Community uses of the coastal zone.

1.2.2.1 Managing risks to public safety and built assets

This CZMP focuses on maintaining or improving the ecological, cultural, recreational, and economic values that are exposed to the following coastal hazards:

- Beach erosion, due to offshore movement of sand from the sub-aerial beach during storms or an extreme or irregular event;
- Shoreline recession due to sediment budget deficits (i.e. more sand leaving a beach than entering it) and sea level rise; and
- Coastal inundation, resulting from extreme ocean storm events, overtopping dunes and inundating land behind the dunes.

The nature and extent of these coastal hazards are identified in WBM (2003) and BMT WBM (2011) and summarised in Section 2.1. The values and the respective threats posed by coastal hazards are outlined in GeoLINK (2007; 2008) and summarised Section 2.2.

1.2.2.2 Coastal Ecosystems and Community Uses of the Coastal Zone

Management of coastal ecosystems and community uses of the coastal zone has been thoroughly considered in various other plans including those listed in Section 1.4. Therefore, to avoid uncessary duplication where ecological, cultural, recreational, and economic values are not exposed to coastal hazards this CZMP refers to these plans, in particular the Ballina Coastal Reserve Plan of Management (CRPOM) and the Precinct Plans that underpin it.

In defining the purpose of the CRPOM it states:

> *The primary objective of the Ballina Coastal Reserve Plan of Management is the rationalisation of all vacant Crown lands and existing Crown reserves into a single coastal Crown reserve for the notified purpose of Public Recreation and Coastal Environmental Protection with the appointment of Ballina Shire Council as Reserve Trust Manager.*
>
> *The [CRPOM] has been prepared by DLWC [now OEH] in partnership with Ballina Shire Council through Council's Coastal Committee. The Committee was established in 1999 primarily to oversee development of the Plan, and adopted as its terms of reference "…….to assist Ballina Shire Council in achieving integrated, balanced, responsible and ecologically sustainable development of the Ballina Shire coast".*
>
> *...[The CRPOM] will consider social, economic, aesthetic, recreational and ecological values, wider aspects of land use in the coastal zone and an assessment of the impact of coastline hazards on future planning and land use.*

The CRPOM is described in more detail in Section 1.4.1.

1.3 Objectives

The *Guidelines for Preparing Coastal Zone Management Plans* (OEH, 2013) sets out ten 'Coastal Management Principles' to guide the preparation and content of CZMPs, with Principle 1 as an overarching principle supported by a further nine principles. The Coastal Management Principles are shown as Figure 1.

A more detailed list of legislative requirements for CZMPs is provided at Appendix 1, comprising relevant provisions of the Coastal Protection Act 1979 and the above Guidelines, with a description of how they are met by this CZMP.

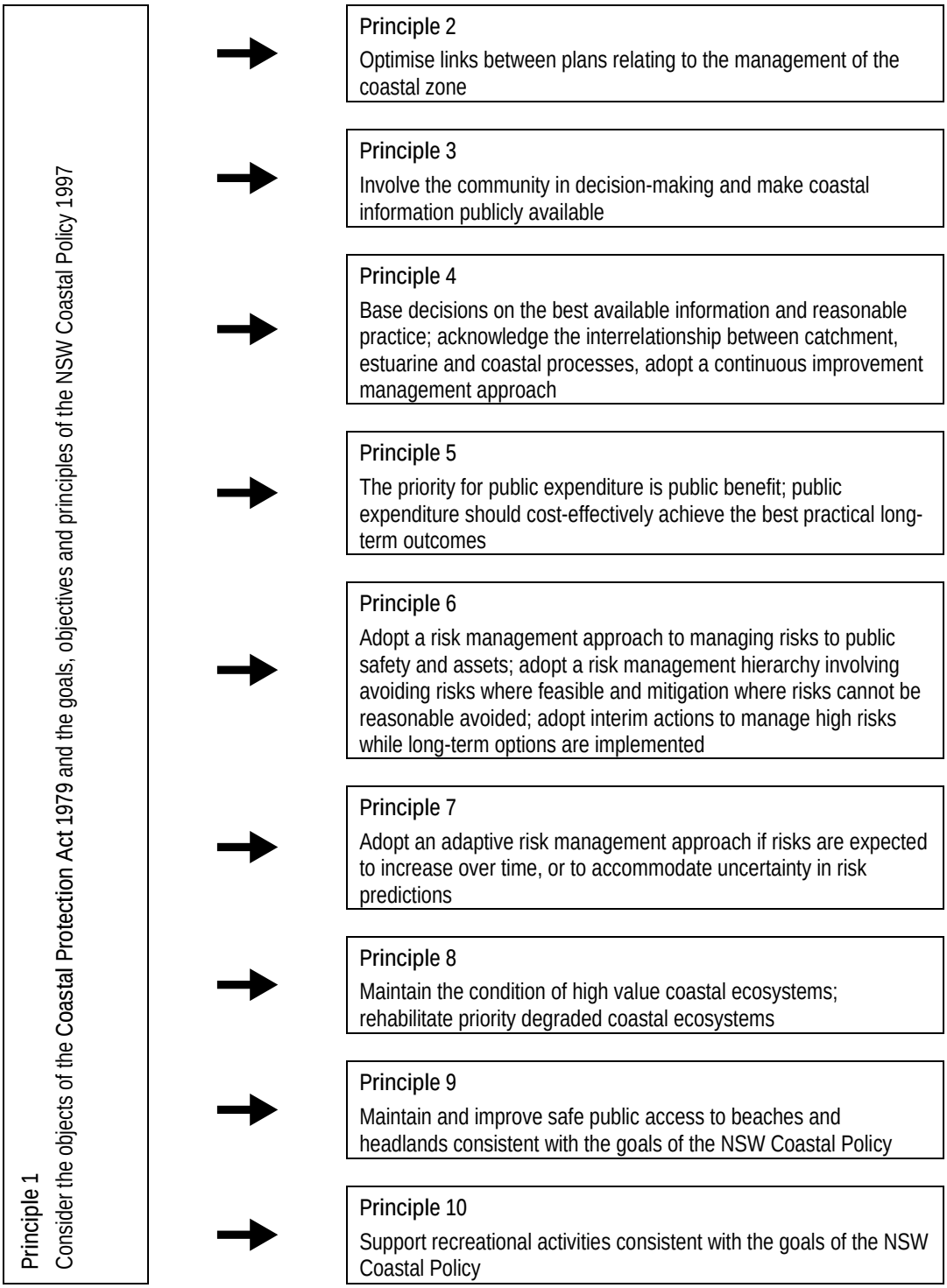


Figure 1 Coastal Management Principles, (OEH, 2013)

1.4 Existing Management Plans, Studies and Planning Instruments

There are a large number of existing studies, management plans and planning instruments that have varying degrees of interrelation and relevance to the scope and objectives of the CZMP. The preparation of this CZMP has taken into account the findings, recommendations and requirements set out in these various documents.

The existing studies and management plans and studies that relate to areas potentially under coastal hazard threat include:

- Ballina Flood Study Update (BMT WBM, 2008)
- Ballina Floodplain Risk Management Study (BMT WBM, 2012)
- Richmond River Estuary Processes Study (WBM, 2006) and Study Review (ABER, 2007);
- Coastal Zone Management Plan for the Richmond River Estuary (Hydrosphere, 2011) ;
- Richmond River Nature Reserve Plan of Management (DEC, 2005);
- Ballina Nature Reserve Plan of Management (DEC, 2003);
- Ballina Coastal Reserve Plan of Management (BSC and DLWC, 2003b);
- Ballina Shire Council Social Plan (BSC, 2004);
- Community Based Heritage Study (BSC, 2008);
- Threatened Species (Pied Oystercatcher) Management Strategy (DoL, 2006);
- The Coastal Reserve Precinct Plans (BSC, 2004 a to e);
- Lake Ainsworth Management Plan (GeoLINK, 2001);
- Lake Ainsworth Crown Reserve Master Plan (Connell Wagner and Hassell, 2005);
- Shaws Bay Estuary Management Plan (Patterson Britton & Partners, 2000);
- Coastal Zone Management Plan for Shaws Bay, Ballina (Hydrosphere Consulting, 2015);
- Ballina Coastline Interim Measures and Action Plan (BSC, 2005);
- Ballina Strategic Tourism Plan (Fletcher and Associates and the North Coast Ad Agency, 2002);
- Lennox Headland Master Plan (GeoLINK, 2007);
- Ballina Shire Coastal Vegetation Management Plans (EnviTE, var. dates); and
- Ballina Shire Growth Management Strategy (2012).

The planning instruments that relate to areas potentially under coastal hazard threat include:

- Ballina Local Environment Plan 1987;
- Ballina Local Environment Plan 2012;
- Lennox Head Community Aspirations Strategic Plan 2002;
- Lennox Head Structure Plan 2004;
- Lennox Head Beach Management Plan 1993; and
- Ballina Shire Development Control Plan 2012.

1.4.1 Ballina Coastal Reserve Plan of Management and Precinct Plans

Council's management approach and specific actions for coastal ecosystem health and community uses of the coastal zone are outlined in significant detail in Ballina Coastal Reserve Plan of Management (CRPOM) and the associated Precinct Plans that underpin it.

The CRPOM was developed in order to rationalise all vacant coastal Crown lands and existing Crown reserves into a single coastal Crown reserve. It was prepared internally by Council, supported and informed by extensive community consultation and consultation with relevant State Government agencies, and was adopted in 2003.

The single coastal Crown reserve is for the purpose of public recreation and coastal environmental protection with the appointment of Ballina Shire Council as Reserve Trust Manager.

Underpinning the CRPOM are five precinct plans that set out locally specific management actions to meet the broad objectives and strategies outlined in the CRPOM.

The five precincts are:

- Precinct area 1 – Northern end of Seven Mile Beach
- Precinct area 2 – Southern end of Seven Mile Beach (Lake Ainsworth to Lennox Point)
- Precinct area 3 – Boulder Beach to Sharps Beach
- Precinct area 4 – Flat Rock, Angels Beach and Black Head
- Precinct area 5 – Shelly Beach & Lighthouse Beach
-

The actions set out in the Precinct Plans include consideration of:

- Dogs
- Horses
- Beach access for vehicles
- Camping and social functions
- Commercial activities
- Dune stabilisation
- Vegetation management
- Other land managers
- Aboriginal heritage
- European heritage
- Surf Life Saving Clubs
- Traffic and parking
- Stormwater
- Pedestrian access
- Beach and headland erosion
- Public amenities
- Walkways and cycleways
- Development
- Water quality
- General regulations
- Education

The actions within the precinct plans are comprehensive, have been developed on the basis of extensive community consultation, and have been adopted by Council. This CZMP is required to fully integrate the objectives, recommendations and actions of CRPOM, both as a Council requirement and a requirement under Section 55C of the *NSW Coastal Protection Act 1979*. Under direction of Council, in order to avoid the duplication of previous processes or established outcomes, this CZMP wholly adopts the objectives, recommendations and actions of the CRPOM and the precinct plans, and makes reference to the precinct plan actions where necessary.

1.4.1.1 Consideration of Coastal Hazards in the Ballina Coastal Reserve Plan of Management and Precinct Plans

The CRPOM outlines a number of broad management objectives and the strategies by which those objectives will be met. With respect to coastal erosion, the CRPOM management objective is:

> "Give the impacts of natural hazards a high priority in the planning and management of the Coastal Reserve."

To address this objective, the CRPOM refers directly to WBM (2003), and by inference this CZMP, without further detail or direct reference to the coastal hazard mitigation influence of management strategies. Nevertheless, a number of the management strategies presented in the CRPOM and associated Precinct Plans will assist in the mitigation of coastal hazard, and cross references to these strategies are provided in the CZMP.

1.4.2 The Coastline South of the Richmond River

The coastline south of the Richmond River is primarily managed by

- The Crown Lands Division of the NSW Department of Trade and Investment, Regional Infrastructure and Services; and
- The National Parks Wildlife Service of the Office of Environment and Heritage within the NSW Department of Planning and Environment.

However Ballina Shire Council has responsibility for 1.4 Ha parcel of land adjacent to the settlement of Patches Beach. For this parcel, Council has prepared a vegetation management plan which addresses a variety of issues including damage to dunes, weed infestation, erosion and predation by feral animals.

The Threatened Species (Pied Oystercatcher) Management Strategy (Department of Lands, 2007) aims to facilitate cooperative land management to minimise the impact of human activities on the Pied Oystercatcher

within the area bounded by the southern breakwall of the Richmond River and the Black Rocks 4WD access track which is beyond the Ballina LGA boundary.

1.5 Stakeholder Consultation

The preparation of the study and plan has been underpinned by regular consultation with the project Community Reference Group (established specifically for this project), the Ballina Shire Council Civil Committee, the NSW Office of Environment and Heritage, and the general public. Key steps have also been reported to open meetings of the elected Council.

1.5.1 Community Reference Group

The primary consultative mechanism for this study is the Community Reference Group convened by Ballina Shire Council. The group's members were chosen by Council and assigned to the project as experienced and informed representatives of sections of the community and government agencies. The Community Reference Group operates under Terms of Reference which are included in Appendix D.

The Community Reference Group includes representatives of the following groups:

- Office of Environment and Heritage;
- Department of Lands;
- Lennox Head Residents Association;
- Ballina Environment Society;
- Lennox Head Landcare;
- Ballina Chamber of Commerce and Industry;
- Cape Byron Marine Park;
- Ballina Shire State Emergency Service;
- East Ballina Landcare; and
- Jali Local Aboriginal Land Council.

The Community Reference Group has met on four occasions to consider the study and plan:

- 26 August 2006 – introduction to project, review of Ballina Coastline Hazard Definition Study, responsibilities of group
- 14 November 2006 – identification of coastline values, study context
- 15 May 2007 – review and confirmation of values, consideration of management options and assessment criteria
- 14 August 2007 – assessment of management options for key locations, identification of preferred options

1.5.2 Ballina Shire Council Civil Committee

The Ballina Shire Council Civil Committee comprises all Ballina Shire Councillors. The primary function of the committee is policy formulation; however it often meets to consider items in detail prior to submission of the matter to the Council. It has no delegated authority and meeting minutes and recommendations are submitted to Council for approval.

The committee has met on three occasions to consider the study and plan:

- 29 October 2007 – review of management options and their consequences, preliminary recommendations on preferred options
- 14 March 2008 – review of Ballina Coastline Management Study
- 9 July 2008 – review of public comments on study, confirmation of recommendations

1.5.3 NSW Office of Environment and Heritage

The NSW Office of Environment and Heritage (OEH) is the division of the NSW Department of Planning and Environment that is the lead agency in developing government policies, guidelines and legislation in relation to coastal zone management. OEH also administers the NSW Government's Coastal Management and Estuary Management programs which are the primary mechanism for assisting local councils in the preparation and implementation of Coastal Zone Management Studies and Plans. The Ballina Coastline Management Study and this CZMP are jointly funded by Ballina Shire Council and the OEH Coastal Management program.

Representatives of OEH have reviewed this CZMP and the preceding management studies (GeoLINK, 2007; GeoLINK, 2008) at critical stages, and have been closely consulted on key elements.

1.5.4 Natural Disaster Mitigation Program

The Natural Disaster Mitigation Program (NDMP) is a national program aimed at identifying and addressing natural disaster risk priorities across the nation. The Ballina Coastline Management Study and this CZMP are jointly funded by Ballina Shire Council and the NDMP. Progress reporting to NDMP managers has continued throughout the project.

1.5.5 Public Consultation prior to Final Draft CZMP

Throughout the preparation of the study and the plan, the project team has remained open to receiving comments from the public as highlighted in all promotional material. The public has been informed of opportunities to comment by the shire-wide circulation of flyers in the Ballina Shire Advocate newspaper at key stages of the project. Flyers were circulated on the following dates:

- 24 August 2006 – general introduction to project
- 9 November 2006 – identification of coastline values (advertised 18 November 2006 open day)
- 29 May 2008 – review of recommended management options (advertised public exhibition of study and 14 June 2008 public open day)

Copies of these flyers are included in Appendix E.

Key members of the project team made themselves available to discuss the project with the public by means of open days whereby project material was placed on display boards in a prominent location. The public open days were held on the following dates:

- 18 November 2006 (River Street, Ballina) – identification of coastline values
- 25 August 2007 (Lennox Head shops) – Ballina coastal hazards and the range of possible management options
- 14 June 2008 (Lennox Head shops) – review of the study and recommended management options (held during public exhibition period)

1.5.5.1 Public submissions prior to Final Draft CZMP

Throughout the course of the preparation of the study and plan, 25 formal submissions were received, two of them major submissions of more than 10 pages. Of these 25 submissions, only one referred directly to management of coastal hazards, in particular suggesting that the stormwater discharges across Seven Mile Beach weaken the natural protective capacity of the dunes. The remainder, excluding the two major submissions, focussed primarily on the provision of facilities, beach access and vegetation management – all of which are considered in detail in the Ballina Coastal Reserve Plan of Management and the associated precinct plans.

The two major submissions were primarily concerned with challenging the hazard estimates put forward in WBM (2003) which was reviewed by the NSW Government and adopted by Council in 2003. The nature and complexity of estimating coastal hazard is discussed in Section 2.1.2.

1.5.6 Public Consultation on Final Draft CZMP

The Final Draft CZMP was placed on public exhibition for six weeks between Saturday 6 April 2013 and Monday 20 May 2013. During this period a PDF format copy of the report was available on-line on Council's website via a link on Council's homepage, and hard copies were available at Alstonville, Ballina and Lennox Head libraries and the Customer Service Centre Ballina.
In addition to the usual notifications in the *Northern Star* and *Ballina Shire Advocate*, and on Council's website, various methods were used to notify the public of the public exhibition of the Final Draft CZMP, and the opportunity to review and comment, including:

- Presentation to the Lennox Head Chamber at Business Breakfast meeting of Wednesday 3 April – approximately 15 people;
- A letter sent to each member of the CZMP Community Reference Group (CRG) – refer Section 1.5.1
- Meeting with the executive committee of the Lennox Head Residents Association;
- A public open day between outside the Lennox Head IGA supermarket;
- Presentation to the Lennox Head Residents Association general meeting on Monday 6 May; and
- A letter box drop of an A4 information flyer to all dwellings within the 2100 coastal hazard zone in Lennox Head.

The promotion of the Final Draft CZMP included shire-wide efforts, but focussed on Lennox Head as coastal erosion threats are primarily located in Lennox Head, and are considered very low in other areas.

1.5.6.1 Public submissions on Final Draft CZMP

None of the submissions raised major concerns regarding the Final Draft CZMP. All submissions related to Lennox Head (Seven Mile Beach), although two included minor consideration of the threatened walking track at Boulder Beach supporting protection of the track as outlined in the Final Draft CZMP. A summary of the submissions follows.

- Council's management philosophy to protect public and private property rather than retreat in the face of coastal erosion was unanimously supported.
- Some individuals questioned the efficacy of beach nourishment feeling that it would be "lost in the next storm", although these concerns are thought to be misplaced based on the advice of experts and OEH.
- Concerns were raised regarding the availability of state and federal government funding for beach nourishment and to a lesser extent sea wall construction.
- It was suggested there is a stretch of beach approximately 20-30 metres long between the rock wall and the constructed levee at the southern beach that is largely unprotected by formal structures. This is contrary to the findings of the Ballina Coastline Hazard Definition Study (2003; 2011), on which the CZMP is based, which indicates there is continuous protection south of Byron Street. This should be investigated.
- It was suggested the protective capacity of the clay/rock core of the constructed levee at the southern end of Seven Mile Beach is inadequate. This is contrary to the findings of the Ballina Coastline Hazard Definition Study (2003; 2011), on which the CZMP is based, which indicates the levee provides protection. This should be investigated.
- It was suggested the wall seaward of the Lake Ainsworth Sport and Recreation Camp was not constructed to the Council specified standard or length leaving the camp facilities and Lake Ainsworth exposed to coastal erosion risk. This is supported by the Ballina Coastline Hazard Definition Study (2003; 2011), on which the CZMP is based, which indicates the coast north of Byron Street is exposed to coastal erosion threat.

2

Summary of Coastal Hazards and Coastal Values

2.1 Coastline Erosion Estimates

The Ballina Shire Coastline Hazard Definition Study (WBM, 2003) and the Updated Coastal Hazard Areas [for Lennox Head] (BMT WBM, 2011) provide a detailed understanding of the physical coastal and ocean processes and associated coastal erosion mechanisms. They are collectively referred to here as the CHDS.

Generally, the CHDS found that these coastal and ocean processes are highly dynamic, change in response to the prevailing conditions, and are influenced by human action (e.g. Richmond River training walls, climate change, seawalls).

The CHDS provided estimates of the potential extent of future erosion associated with the following coastal hazards:

- Beach erosion, due to offshore movement of sand from the sub-aerial beach during storms or an extreme or irregular event;
- Shoreline recession due to sediment budget deficits (i.e. more sand leaving a beach and its embayment than entering it), and sea level rise; and
- Coastal inundation, due to large waves, resulting from extreme ocean storm events, overtopping dunes or seawalls and inundating the land behind.

These erosion mechanisms typically occur together with total recession distance an additive combination of these estimates. Historical shoreline movements include the influences of these naturally varying processes as well as the impacts of human activities/works. For planning purposes, the CHDS identified potential erosion hazard bands for immediate (beach erosion), 2050, and 2100 planning periods. The erosion estimates presented in the CHDS assume no management intervention and, at Lennox Head north of Byron Street no mitigating influence of the existing buried rock wall or other existing structures (see Section 3.4.1).

In recognition of the natural variability and considerable uncertainties associated with natural and anthropogenic influences, and their combination, on coastal erosion mechanisms, a range of long term recession rates and resulting hazard bands were determined with the intent of providing sufficient information for consideration of the threats in future planning.

The CHDS also recognised that there are uncertainties associated with the structural capacity of the buried rock wall at Lennox Head and how effective this may be in limiting shoreline recession. Again to assist future planning and provide information on the potential upper limit of erosion in the absence of any protection measures, hazard zones were assessed excluding any mitigating effects of this wall.

Table 2.1 below summarises the coastal erosion estimates for the beach units of the Ballina coastline. Illustrations 2.1 and 2.2 show the erosion hazard bands for the Lennox Head beach units. Note that the table and illustrations must be considered within the context of the CHDS, particularly Sections 6.7.3, 7.1 and 7.2 of WBM (2003) and Section 2 of BMT WBM (2011) which outline the basis for their development and the uncertainty associated with estimates of coastal hazard.

As stated in the CHDS and discussed in Section 2.1.2, there is uncertainty around the recession distances shown in Table 2.1 and Illustrations 2.1 and 2.2. This is reflected in the ranges that are given for the recession associated with beach erosion and sediment budget deficit. No range is provided for the recession associated with sea level rise as this is based on a simple application of the Bruun Rule (see Section 4.10.3 of WBM (2003)) using the vertical sea level rises put forward in the *NSW Seal Level Rise Policy Statement*

(DECCW, 2009). Note that this policy has been withdrawn by the NSW Government but is now Council policy and used for planning purposes.

It should be noted that recently revised sea level rise estimates (refer to Section 2.1.1) increase the risk that some public assets at the southern end of Shelly Beach may be exposed to coastal hazard by 2100. However, in the absence of a formal study, the level of this risk cannot be confirmed.

2.1.1 Revision of Coastal Hazard Lines for Lennox Head

BMT WBM (2011) provided an update of hazard lines presented in WBM (2003) for the critical area of Seven Mile Beach adjacent to the township of Lennox Head. This revision comprised:

- Definition of existing beach conditions using the most recent available photogrammetry (January 2010);
- Reassessment of the current (immediate) hazard line based on the most recent photogrammetry and an assumed design beach erosion volume of 200 m^3/m; and
- Revision of long term shoreline recession estimates accounting for updated projected climate change related sea level rise allowances as presented in the *NSW Sea Level Rise Policy Statement* (DECCW, 2009).

BMT WBM (2011) found that the beach in this area had accreted since the assessments presented in WBM (2003). Both analyses adopted the same assumed design beach erosion volume of 200 m^3/m. The result was that the current (immediate) hazard line presented in BMT WBM (2011) is approximately 20 m seaward of that presented in WBM (2003).

The sea level rise allowances presented in the *NSW Sea Level Rise Policy Statement* (DECCW, 2009) were adopted in BMT WBM (2011). Note that this policy has been withdrawn by the NSW Government but is used by Council for planning purposes. These allowances were 40 cm by 2050 and 91 cm by 2100 above 1990 levels, and an interim rate of sea level rise of 3 mm/yr since 1990. (By comparison WBM (2003), based on the best available advice at the time, adopted sea level rise allowances of 20 cm by 2050 and 50 cm by 2100.)

Both analyses applied the Bruun Rule in the same fashion with the only difference being the sea level rise allowances. (See Section 4.10.3 of WBM (2003) for a general explanation of the Bruun Rule.) The result was that the 2050 hazard line presented in BMT WBM (2011) is approximately 10 m seaward of that presented in WBM (2003) and the 2100 hazard line is approximately in the same location as that presented in WBM (2003).

Table 2.1 Erosion Recession Estimates due to Coastal Hazards (based on WBM (2003) and BMT WBM (2011))

Beach Unit	*Time frame*	*Beach erosion* [7]	*Shoreline recession*			
			Sediment budget deficit			*Sea Level Rise* [8]
			Lower estimate	*Best estimate*	*Upper estimate*	
North Seven Mile[1]	2050	Not estimated (25-40 m)	10 m	15 m	22.5 m	20 m
	2100	Not estimated (25-40 m)	20 m	30 m	45 m	45 m
Central Seven Mile [1]	2050	Not estimated (25-40 m)	15 m	25 m	35 m	20 m
	2100	Not estimated (25-40 m)	30 m	50 m	70 m	45 m
Lennox Head (north of Byron St) [2]	2050	40-45m	15 m	25 m	35 m	20 m
	2100	40-45m	30 m	50 m	70 m	45 m
Lennox Head (south of Byron St)	Erosion is expected to be limited by two sections of rock revetment sea wall and a constructed levee as shown in 0. See Section 5.3.1 of GeoLINK (2008) for further discussion.					
Boulder Beach [3]	2050	Not estimated (25-40 m)	5 m	10 m	15 m	20 m
	2100	Not estimated (25-40 m)	10m	20 m	30 m	45 m
Ballina Pocket Beaches [4]	2050	Not estimated (25-40 m)	-	10m	-	20 m
	2100	Not estimated (25-40 m)	-	10m	-	45 m
South Ballina Beaches [5]	2050	30 m	0 m	2.5 m	5 m	20 m
	2100	30 m	0 m	5 m	10 m	45 m
Patches Beach [6]	2050	20-30 m	5 m	10 m	15 m	20 m
	2100	20-30 m	10 m	20 m	30 m	45 m

[1] WBM (2003) Sections 8.5.2 and 8.5.3. Note that shoreline recession estimates reduce by 33% at the northern limit of the North Seven Mile beach unit (the shire boundary)

[2] BMT WBM (2011) and WBM (2003) Section 8.4.2 and 8.4.3.

[3] WBM (2003) Section 8.4.2 and 8.4.3. Note WBM (2003) also suggests that the cobbles that dominate this beach unit are likely to limit the extent of erosion; however no estimate of this limiting effect is presented.

[4] The Ballina Pocket Beaches are Boulder Beach (considered separately here), Sharpes Beach, Angels Beach, Shelly Beach and Lighthouse Beach

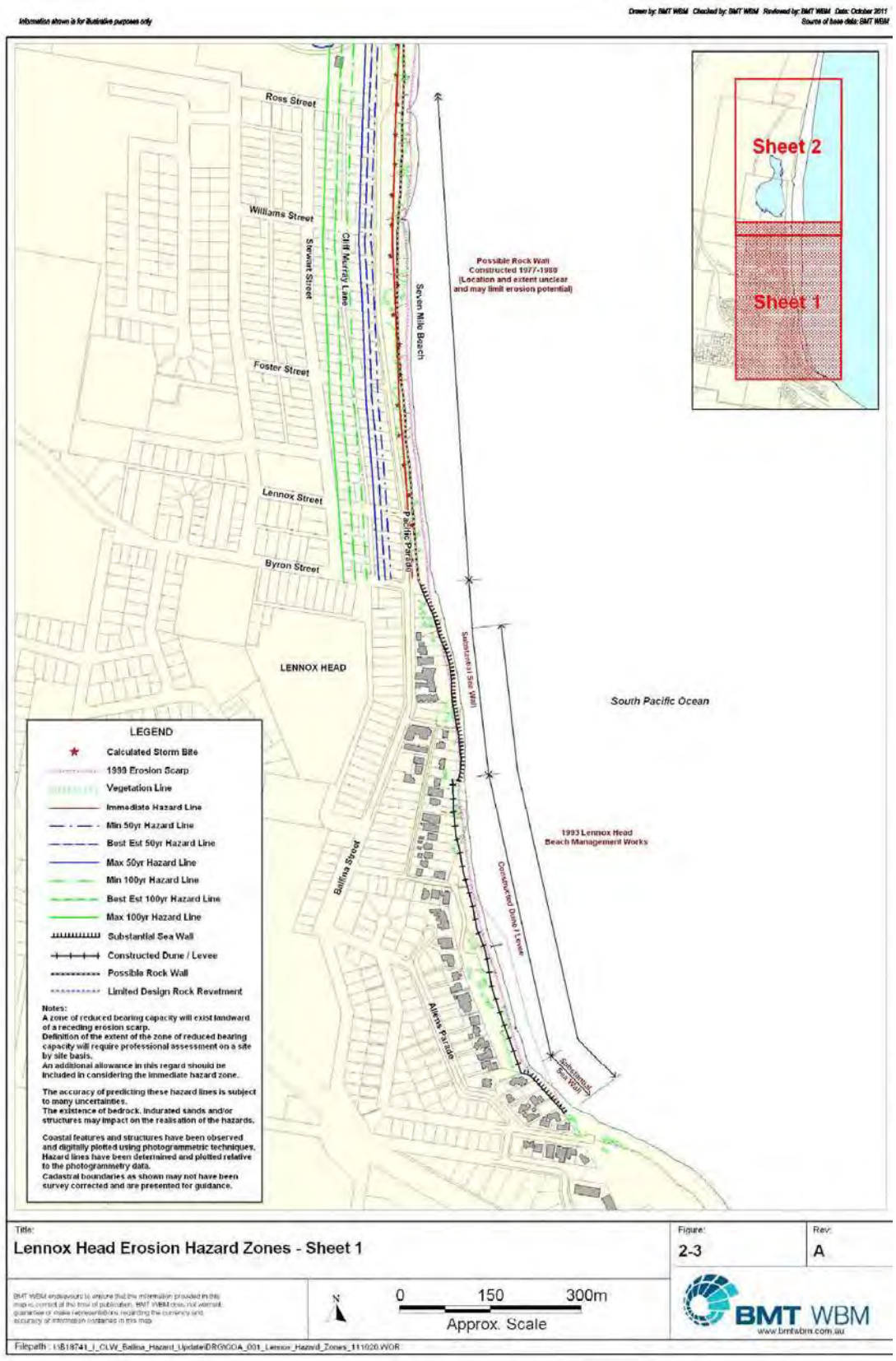
[5] WBM (2003) Section 8.3.2 and 8.3.3

[6] WBM (2003) Section 8.2.2 and 8.2.3

[7] WBM (2003) does not provide lateral distances for beach erosion for some beach units. Instead, it recommends the adoption of a loss of 200 m^3 of beach and foredune sand above MSL per lineal metre of coastline (in line with estimates for other Ballina beaches). This corresponds to around 25-40m of lateral recession and depends on dune height and, in the cases of Boulder and Sharpes beaches, the mitigating effect of cobbles. BMT WBM (2011) adopts the 200 m^3/m rate for Lennox Head north of Byron Street.

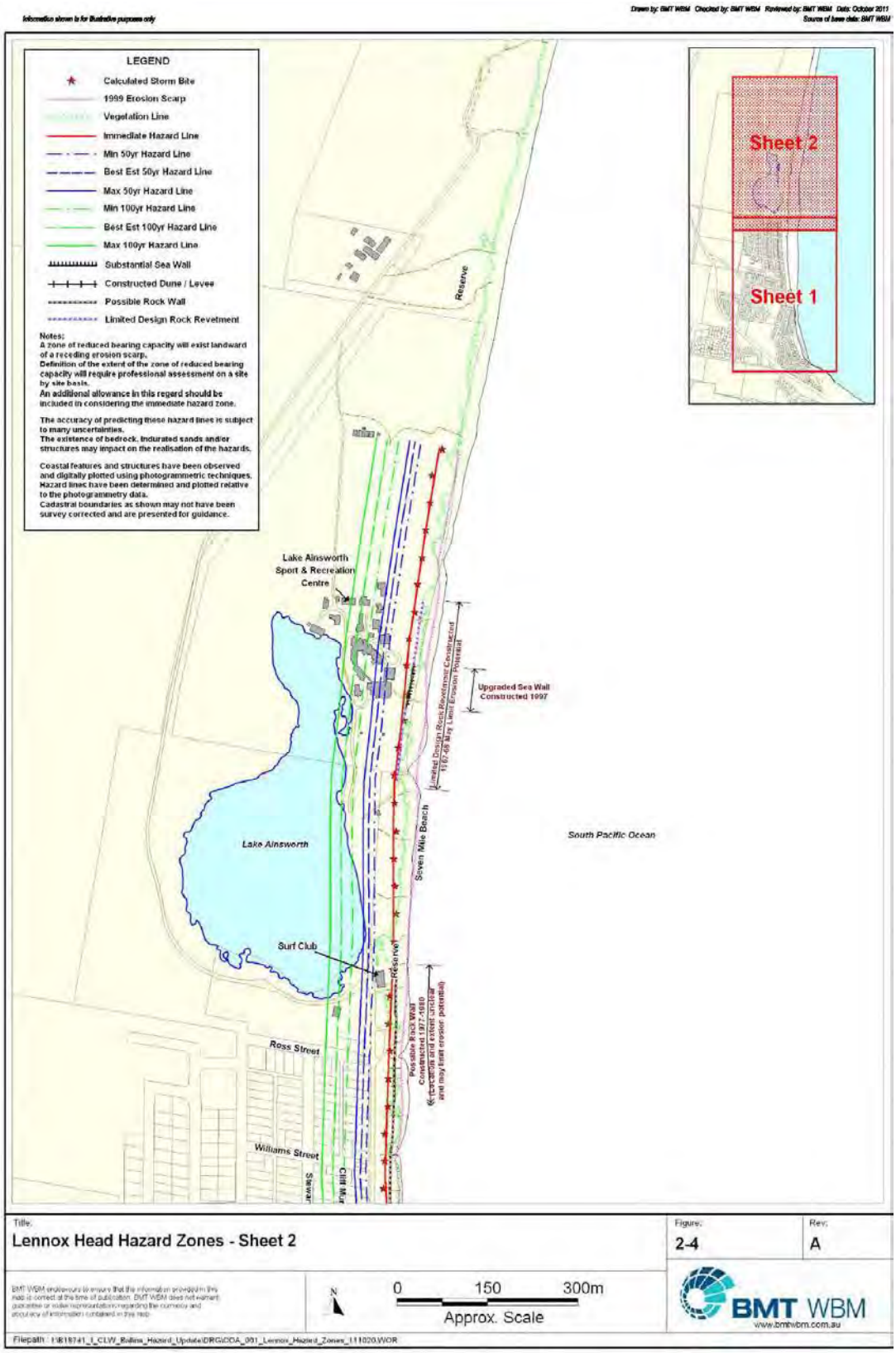
[8] Lateral recession distances associated with sea level rise estimates have been derived using the Bruun Rule, as discussed in Section 4.10.3 of the CHDS. Sea level rise estimates adopted are those recommended in DECCW (2009) (refer Section 2.1.1). Note that this policy has been withdrawn by the NSW Government but is currently still used by Council for planning purposes.

Illustration 2.1 - Lennox Head Erosion Hazard Zones – Sheet 1 (from BMT WBM, 2011)



Lennox Head Erosion Hazard Zones - Sheet 1 (from BMT WBM, 2011)

Illustration 2.2 - Lennox Head Erosion Hazard Zones – Sheet 2 (from BMT WBM, 2011)



Lennox Head Erosion Hazard Zones - Sheet 1 (from BMT WBM, 2011)

2.1.2 Uncertainty in Coastal Erosion Estimates

The determination of coastal erosion resulting from beach erosion (due to storms or an extreme or irregular event), and shoreline recession (due to sediment budget deficits and sea level rise) will always be subject to debate and review and estimates will change as new information comes to hand, particularly with an increasing base of historical data.

The complexities and deficiencies in the understanding of the coastal processes occurring in the Ballina LGA are highlighted in WBM (2003). The CHDS estimated each of the components of the erosion hazard on the basis of the data and information available at the time. With respect to Lennox Head and Seven Mile Beach, the range of factors that are likely to be influencing the past and future behaviour and the uncertainties involved are discussed in Section 6.7.3 of WBM (2003). The report goes on to acknowledge that there is not yet a comprehensive understanding of all of the factors influencing coastal erosion. However, in the absence of investigations beyond the scope of the CHDS, estimation of coastal erosion relied predominantly on the photogrammetric data covering the period 1947 to 1999 for WBM (2003), which was augmented with photogrammetric data from 2010 in BMT WBM (2011).

Section 7.1 of WBM (2003) notes that the influences of man-made structures, such as protective seawalls and river entrance training walls, disguise the underlying *natural* recession rate. This makes the interpretation of the erosion hazard components from the data difficult in some areas. However, the underlying effect of these structures in altering the coastal alignment is largely inherent in the photogrammetric analysis. Interpretation of these effects was bolstered by the knowledge gained from previous studies (for example impacts of the Tweed River training walls on Gold Coast beaches).

Furthermore, Section 7.5 of WBM (2003) notes progressive long term hazard typically does not occur at a consistent rate every year and it can be expected that there will be periods of higher and lower erosion and recovery within a longer term pattern of change. This is evident in the historical photogrammetry record which shows that the behaviour over the last 50 years incorporates both periods of extensive erosion and subsequent recovery due to both natural and anthropogenic influences.

The findings of the CHDS rely on interpretation by its authors of the available data. It clearly advises that, while the assessed hazard components represent the best estimate at the time within the limitations of available data, the hazard definition work should be viewed as an advisory tool only in the formulation of long term management strategies. The hazard zones remain open to review on the basis of ongoing investigation and monitoring. The implicit uncertainties and limitations of the predictive capabilities are reflected in recommended management actions, with a long-term management strategy that is both robust and flexible in order to accommodate future changes in coastal process regimes. While somewhat different interpretive approaches to identifying the persisting long term trends could be adopted in areas directly impacted by adjacent works, the coastline management provisions will accommodate such differences.

Section 8.5.3 of WBM (2003) clearly acknowledges that the shoreline recession along Lennox Head and Seven Mile Beach has been influenced by a reduced supply of sand from the south in the past, with such influences likely to be reducing over time, and that the seawall works at Lennox Head are likely to have exacerbated the erosion further north. Future projected sea level rise will further complicate the trends in these areas.

At the 2009 NSW Coastal Conference, Dean Patterson of BMT WBM presented the findings of recent modelling of the sand transport along the Ballina coastline, with a particular emphasis on investigating the influence of the Richmond River training walls that were built between 1890 and 1910. The findings presented in the paper include the following.

- *The training walls appear to be the dominant influence on the sustained shoreline erosion that has been experienced at Lennox Head and Seven Mile Beach.*
- *In the absence of sea level rise, the shoreline appears to be recovering slightly at south Lennox Head and has stabilized along Seven Mile Beach. Ongoing monitoring is needed to confirm this.*

- *Despite the above, there appears to have been a long term reduction in the longshore transport past the training walls and along Seven Mile Beach and some impact of the training walls may start to be felt at Suffolk Park [north of Ballina Shire] over the next 100 years.*
- *Sea level rise will exacerbate the erosion at all beaches in a manner that is more complex than that indicated by application of the 'Bruun Rule', with headland controls minimizing recession updrift and exacerbating recession (up to 2-3 times) downdrift of those controls. This is a significant issue for future management considerations. Note that the modelled behaviour at Lennox Head does not include the control on recession provided by the seawalls constructed there.*

(Patterson, 2009)

These findings suggest that there may be cause to see the shoreline recession rates developed in the CHDS as potential overestimates for a long term trend as they may have been artificially and temporarily accelerated by the training walls.

However, the final finding listed above suggests that the recessional effect per unit of sea level rise on the southern parts of Seven Mile Beach (which is downdrift of the Lennox Headland control), which is a considerable proportion of the total shoreline recession, may have been underestimated "up to 2-3 times" in the CHDS by use of the Bruun Rule. It should be noted that in the absence of complex modelling, application of the Bruun Rule is common practice.

Given the uncertainty as to the balance of all of these effects, a cautionary approach was adopted for long term planning purposes with recession rates based primarily on historical trends with due regard to these anthropogenic influences. It is acknowledged that the erosion hazard lines presented in BMT WBM (2011) for the section of beach between Byron Street and Lake Ainsworth are in the area of greatest uncertainty as to what may have occurred there without anthropogenic interference in natural processes.

In response to this uncertainty, the CZMP recommends ongoing monitoring of the progressive pattern of beach/dune behaviour and global sea level rise trends. In the absence of sufficient resources for a comprehensive regional investigation of the long term behaviour of this coastal system, the proposed ongoing site-based monitoring and continued utilisation of historical photogrammetry (or alternative data), represent the most responsible and cost-effective means of providing information to inform the need for and timing of management responses under this CZMP.

2.2 Coastline Values and Threats

Many ecological, cultural, social, recreational and economic values are ascribed to the Ballina coastline by the community. Some of these values are considered to be under coastal erosion threat. These values and threats are reviewed in detail in stages one and two of the *Ballina Coastline Management Study* (GeoLINK, 2007; GeoLINK, 2008), and are summarised here.

2.2.1 Ecological Values

Vegetation clearance, agricultural practices and flood mitigation works have altered the ecology of the coastal zone of Ballina; however it still holds rich and diverse ecological values.

Ecological values of marine environments include:

- sandy beaches that support simple invertebrate communities, shorebirds and sea birds;
- rocky shores that support more complex invertebrate communities, as well as more complex terrestrial communities including birds, reptiles, insects, invertebrates and small-medium mammals;
- off-shore reefs that support a range of threatened fish, as well as two turtle species; and
- sub-tidal sand that supports invertebrates and fish, and a number of species of commercial importance
- habitats that support over 65 species of conservation significance, and include the southern extent of the Cape Byron Marine Park.

Ecological values of terrestrial and estuarine environments include:

- seagrass that support highly productive nursery and feeding grounds for a diversity of aquatic species;
- mangroves and saltmarsh that support highly productive nursery and feeding grounds for a diversity of aquatic species, and provide important habitat for many bird and terrestrial species;
- freshwater wetlands that support numerous Endangered Ecological Communities under the NSW Threatened Species Conservation Act and provide habitat for numerous threatened fauna species;
- communities on coastal sands that support a high diversity of threatened fauna species restricted to these habitat types; and
- a freshwater coastal lake, Lake Ainsworth, which supports an unusual diversity of habitats, and a unique suite of species.

Terrestrial and estuarine environments in Ballina Shire support eight flora species of conservation significance, and include the southern extent of the Cape Byron Marine Park which was declared in 2002.

2.2.1.1 Coastal erosion threats to ecological values

The complexity of ecosystems and uncertainty inherent in estimating coastal erosion means it is impossible to determine with great detail the nature and extent of coastal erosion threats to many ecological values.

Estimated recession distances summarised in Table 2.1 can be translated simplistically into spatial extents of natural environments that may be lost as a result of recession due to coastal erosion, as shown in Table 2.2. Under this simplified approach, recession processes on open stretches of coast are expected to shift dunal systems landward without significant alteration to their structure, shifting the losses of natural area to the environments found landward of the dunes. These natural areas, generally coastal heath, are often extensive in relation to the area that is estimated to be lost as a result of recession.

The hazard estimates presented in the CHDS suggest that oceanic breakthrough of Lake Ainsworth is quite possible (although the protective effect of the buried rock wall seaward of the lake has not been included due to uncertainty). Even a temporary breakthrough would result in a significant ecological shift in the existing freshwater lake system, and a subsequent loss of much of its current unique and high ecological value. Sustained breakthrough of the dunal system seaward of the lake is likely to result in permanent loss of the lake and a major localised realignment of Seven Mile Beach.

It is recognised that sandy beaches support large and diverse communities of infauna and interact physically with inshore marine areas. Coastal erosion estimates suggest that the sandy beach at Lennox Head, and possibly Boulder Beach, may be lost 'against' hard structures (or in the case of Boulder Beach, the natural cobbles) as recession proceeds landward. Loss of the beach's infaunal community may have effects on inshore food webs, and prolonged absences of sand will likely alter local inshore rocky reef ecosystems.

The sea level rises above 1990 levels put forward in DECCW (2009) (40 cm by 2050 and 90 cm by 2100) constitute significant proportions of the local tidal range. Note that this policy has been withdrawn by the NSW Government but is now Council policy and used for planning purposes. Intertidal rock platforms without a substantial vertical range, such as Flat Rock, are likely to undergo significant ecological shifts as a result of alterations to the periods of inundation and exposure due to such changes in mean sea level.

2.2.2 Cultural Heritage Values

There are many registered Aboriginal sites in the Coastal Zone of Ballina. The vast majority of these, as at 2013, are shell middens (37) and stone artefact scatters / open campsites (32). Five burial sites, one bora / ceremonial site and one stone quarry have also been registered. Only one of these sites, a midden (OEH reference number 4-5-184) is located close to the landward extent of the 2100 hazard line.

The East Ballina Aboriginal Place, at Sharpes Beach, Angels Beach and East Ballina was declared a place of special significance to Aboriginal culture and people in 2012, under the National Parks and Wildlife Act 1974.

The study area contains 23 significant European historic cultural heritage items listed on heritage registers. In addition to these registered heritage items, two tea tree fences on Seven Mile Beach should be noted as unique coastal items of European heritage in the shire. These may be lost as a result of coastal erosion.

The Australian Historic Shipwreck Database lists 29 entries for the Coastal Zone of Ballina.

2.2.2.1 Coastal erosion threats to cultural heritage values

Two registered Aboriginal sites (an artefact scatter and a midden) are seaward of the 2100 hazard line presented in the CHDS and three sites (a burial, an artefact scatter and a midden) are seaward of the 50-year coastal erosion hazard line. All sites are therefore expected to be lost within the relevant timeframe. The burial site is reported to be below the existing seawall seaward of Rayner Lane in Lennox Head.

The tea tree fences on Seven Mile Beach, unregistered European heritage items, are seaward of the immediate hazard line and therefore may be lost in the next extreme storm event. No registered items of European heritage are seaward of the erosion estimates.

Table 2.2 Estimates of Public Land Lost due to Coastal Recession for Each Beach Unit

Beach Unit	*Land type lost*	*Length (m)*	*Estimated shoreline recession 2050[a] (m)*	*Area lost 2050 (m^2)*	*Estimated shoreline recession 2100[a] (m)*	*Area lost 2100 (m^2)*
North Seven Mile Beach	Coastal heath	1,250	35	43,750	75	93,750
Central Seven Mile Beach	Coastal heath	2,350	45	105,750	95	223,250
Lennox Head – North of Byron Street	Coastal heath (limit of 50 m width assumed seaward of LASRC [b])	950	45	42,750	50 (limit)	47,500
	Urban Parkland (limit of 25m width assumed seaward of Pacific Pde [b])	850	25 (limit)	21,250	25 (limit)	21,250
Lennox Head – South of Byron Street	Beach loss against seawall/levee (limit of 25m beach width assumed)	950	25 (limit)	23,750	25 (limit)	23,750
Boulder Beach [b]	Coastal heath	400	30	12,000	65	26,000
Sharpes Beach [c]	Coastal heath	1,000	30	30,000	55	55,000
Angles Beach [c]	Coastal heath	1,400	30	42,000	55	77,000
Shelly Beach	Coastal heath	600	30	18,000	55	33,000
Lighthouse Beach	Coastal heath	620	30	18,600	55	34,100
South Ballina, Beswicks, Robins and Patchs beaches	Coastal heath	17,200	26	447,200	58	997,600
	Coastal heath (m^2)			760,050		1,587,200
	Urban parkland (m^2)			21,250		21,250
	Beach (m^2)			23,750		23,750
	TOTAL (m^2)			547,350		1,632,200

[a] Landward shoreline movement comprises long term shoreline recession based on WBM (2003) and BMT WBM (2011) and lateral recession due to sea level rise based on DECCW (2009) and BMT WBM (2011). Note that DECCW (2009) has been withdrawn by the NSW Government but is currently still used by Council for planning purposes. Figures adopted from Table 2.1 using "best estimate" for long term shoreline recession distance. See Section 2.1 for further discussion.

[b] Refer Section 2.2.4.1 for consideration of built assets such as LASRC and Pacific Parade.

[c] The cobbles that dominate this beach unit are expected to limit coastal erosion, however this has not been quantified and the erosion rates presented in the CHDS are adopted

[d] These estimates do not consider the losses that may occur as a result of detachment of the Flat Rock tombolo

2.2.3 Social and Recreational Values

Census data shows that in 2001 the shire population was 37,218, increasing by approximately 503 people annually, or 1.4%, between 1996 and 2001. Around 63% of the shire population lives on the 'coastal fringe' (BSC, 2006), primarily comprising the coastal settlements of Ballina, Skennars Head and Lennox Head.

During the December-January peak holiday period it is estimated that over 29,000 overnight visitors spend time in Ballina Shire. On average, over 11,000 overnight visitors spend time in Ballina Shire every month.

The coastline is undoubtedly one of the key recreational attractions of Ballina Shire. The report *Facts and Figures Ballina Shire* (BSC, 2003) states:

> 'Water based recreation activities such as fishing, surfing, and boating are…major tourist attractions and feature among the favoured pastimes of Ballina Shire residents.'

Among tourists 'visiting the beach' was the most popular single activity, with 44% of international visitors and 24% of domestic visitors reporting this as their primary reason for visiting the shire (BSC, 2003).

In February 2009 the Lennox Head National Surfing Reserve was declared to formally recognise the environmental, cultural and historical significance of the reserve area to Australian surfing culture. The reserve area stretches from the south side of Flat Rock to the Lennox Head SLSC at the northern end of Lennox Head village, and extends 500 m seaward of the high water mark. The reserve does not alter any existing laws or licences.

2.2.3.1 Coastal erosion threats to social and recreational values

Coastal erosion, and the alterations it is expected to bring to the coastal environment, are not likely to *threaten* social values, but are certain to bring general concern and political tension. Similarly, general recreational values will not be eliminated but are likely to be stressed as a result of a reduction in the area of coastal environments available for passive and active recreation. Some specific local recreation values may be lost such as those ascribed to the beach at Lennox Head (proximity to the village, ambiance) which due to projected coastal recession is expected to be lost 'against' the existing seawall and constructed levee if sand nourishment is not implemented to offset such loss.

2.2.4 Economic Values

Elements that contribute to the local economic value of the Ballina Shire coastline include:

- tourism;
- agriculture;
- commercial and recreational fishing;
- recreation;
- private and community assets; and
- public lands.

Around 57% of overnight visitors and 28% of day visitors report that visiting the beach and fishing are their primary reason for visiting Ballina Shire. Overnight visitors and day visitors are estimated to spend respectively $107M and $33M annually within Ballina Shire. Assuming a producer surplus of 20%, ascribing the proportions of visitors whose primary reason for visiting is an activity in the coastal zone, and considering the flow-on spending on other non-coastal activities suggests that the Ballina coast is worth around $18M annually to the local economy. (These calculations, and their basis, are outlined in more detail in GeoLINK, 2007).

This activity-based estimate accords with estimates based on population centres. A large proportion (32%) of Ballina visitors report staying with friends or relatives, suggesting visitor numbers (and therefore expenditure) could be distributed in line with population. Approximately 63% of the Ballina population lives near the coast. Assuming a producer surplus of 20%, this suggests that of the $140M spent by visitors annually, around $18M could be ascribed to the coastal zone based on the proportion of people that live near the coast.

Recreational fishing by residents and visitors is thought to contribute around $5.3M annually to the local economy, while commercial fishing is thought to contribute around $1M annually.

The recreational value of the beach, i.e. an economic value ascribed to the amenity that the beach provides, is estimated at around $5.1M annually.

2.2.4.1 Value of built and natural assets exposed to coastal hazard

It is not possible to quantify the potential reduction in value of the Ballina coastal zone resulting from coastal erosion because of the diversity of elements that make up this value and the complexity in determining their total value. In the most general terms, the activity-based and demographic-based economic values of the Ballina coast (both estimated at approximately $18M annually), and the recreation value of the beach only (estimated at $5.1M annually), are likely to reduce overall as a result of coastal erosion.

The economic impact of unmitigated coastal erosion as predicted in BMT WBM (2011) on private, community and natural assets is very difficult to quantify. Although there is low formal analytical value in considering the *present* value of assets that are under coastal hazard threat by *future* estimated coastal erosion, such a summary does provide some context as to the nature and extent of the hazards in relation to assets.

Table 2.3 provides a simple summary of informal estimates of the present value of private and community assets that are within hazard zones. Note that the response category for all private property subject to coastal hazards is Category A, which is defined by OEH in the Guidelines for Preparing CZMP's (OEH 2013) as "coastal protection works are considered technically feasible and cost-effective – funding is being sought for implementation"

Table 2.3 Estimated Value of Private and Community Assets at Risk from Coastal Hazards

Private and community assets	*Number of Assets*	*Estimated average current value (2013 $)*	*Estimated total current value (2013 $)*
Risk Category 1 – Current Hazard Area, i.e. seaward of the immediate hazard line			
All types	0	0	0
Risk Category 2 – 2050 Hazard Area, i.e. seaward of Best Estimate Hazard Line for 2050			
Hotel	1	17,000,000	17,000,000
Apartments (luxury) – 1 block	14	600,000	8,400,000
Apartments (standard) – 1 block	12	350,000	4,200,000
Dwellings (fronting Pacific Parade)	30	1,500,000	45,000,000
Lennox Surf Life Saving Club	1	2,000,000	2,000,000
Approximately 25% of Lake Ainsworth Sport & Recreation Facility	-	-	4,000,000
Pacific Parade roadway, footpath, guttering, signage and associated infrastructure	-	-	940,000
Sewer Services	-	-	400,000
Water supply services	-	-	260,000
Electrical services	-	-	1,000,000
Telecommunications services	-	-	TBC
		Risk Category 2 total	*83,200,00*
Risk Category 3 – 2100 Hazard Area, i.e. seaward of Best Estimate Hazard Line for 2100			
Dwellings (fronting Pacific Parade)	7	1,500,000	10,500,000
Dwellings	27	800,000	21,600,000
Additional 25% of Lake Ainsworth Sport & Rec Facility (comprising more buildings)	-	-	6,000,000
Cliff Murray Lane roadway, guttering, signage and associated infrastructure	-	-	800,000
		Risk Category 3 total	*38,900,000*
		OVERALL TOTAL	$122,100,000

Notes:

- Values adopted from GeoLINK (2008)
- Average property values provided by Lois Buckett Real Estate, Lennox Head.
- Caravan Park business value of $6.5 million (not including land value) provided by Ballina Shire Council
- It has been assumed that even though the hazard line may only cut across a portion of a property, for the purposes of this study it has been assumed that the buildings would be affected and they are thus included
- Pacific Parade, sewer and water supply values provided by Ballina Shire Council (pers. comm., 12/06/07)
- Electrical Services value provided by Country Energy (pers. comm., 14/06/07)
- Telstra was unable to provide a value estimate of telecommunications infrastructure on Pacific Parade
- The current depreciated value of the land and infrastructure of the Lake Ainsworth Sport and Recreation Centre is estimated to be approximately $16 million

Table 2.4 provides a simple summary of estimates of the present value of natural assets and public open space that are within hazard zones. In addition to the overly simplified approach of assessing the effects of *future* impacts on *present* values, the valuation of the 'services' to the community provided by natural assets (generally measured in $/ha/year) is also subject intense debate. Nevertheless, the values are presented to provide some context as to the nature and extent of the 'value' of natural assets that are exposed to coastal hazard. The derivation of the valuation rates used in Table 2.4 is discussed briefly in Section 4.5.6.2 of GeoLINK (2007).

Table 2.4 Estimated Values of Catural and Public Open Space Assets Under Threat

	Valuation rate (2013 $/ha/yr)	*Area lost 2050 (ha)*	*Value (2012 $/yr)*	*Area lost 2100 (ha)*	*Value (2013 $/yr)*
Coastal heath	19,920	76	1,514,000	159	3,170,000
Urban parkland	19,920	2	40,000	2	40,000
Beach	7,500	2	15,000	2	15,000
Lake Ainsworth	39,100	0	0	31.9 [a]	1,250,000
	TOTAL VALUE		1,570,000	82,848	4,475,000

[a] It is assumed that whole freshwater system and its associated 'value' would be lost should the lake be significantly and permanently breached

2.3 Future Coastline Uses and Conflicts

The quality of the 'coastal' experience in most instances is dependent on the quality of the environment. Quality of the environment in this context refers to both adequate ecological functioning and sufficient social capacity, i.e. a healthy ecosystem that meets the needs of all users.

The Ballina LGA's population is expected to increase from its current level of around 43,000 to 60,000 by 2026 (a growth rate of approximately 2% per annum). Much of this growth will reflect the current broad demographic pattern of two-thirds of the LGA's population living in the coastal zone.

In addition to local population growth, the LGA is becoming increasingly accessible to the large population centres of the Gold Coast and Brisbane as a result of highway upgrades. And increased levels of air travel mean that more visitors are arriving from more distant centres. While no estimates of expected tourism growth are presented in key documents, the growth is expected to be significant and will undoubtedly increase pressure on recreational resources.

The expected coastal hazards outlined in this section and in Section 3 indicate that coastal recession, and associated processes such as increased storminess, will lead to changes in the coastal environment that are likely to be adverse for recreation resources, however, the scale and precise nature of those changes is not clear.

Careful management through this CZMP and the Coastal Reserve Plan of Management will be necessary to offset and/or manage increasing pressure on the shire's coastal recreational resources resulting from these combined social and environmental changes.

3

Recommended Management Actions

3.1 Introduction

As discussed in Section 2.1, this CZMP focuses on addressing priority coastal management issues along the Ballina Shire coastline and in particular to mitigate against the three main coastal hazards identified in WBM (2003) and BMT WBM (2011):

- Beach erosion, due to offshore movement of sand from the sub-aerial beach during storms or an extreme or irregular event;
- Shoreline recession due to sediment budget deficits (i.e. more sand leaving a beach and its embayment than entering it), and sea level rise; and
- Coastal inundation, due to large waves, resulting from extreme ocean storm events, overtopping dunes or seawalls and inundating the land behind.

Shoreline recession generally occurs over the long term and has been observed on many beaches of the Far North Coast as a dominant process in recent decades. Beach erosion is generally the result of a severe storm event, or series of closely spaced events, that can occur at any time and is generally followed by a period of accretion.

As a result of the variation in the nature and timeframe of the erosion components, the management actions to mitigate the threats associated with beach erosion will not necessarily mitigate the threats associated with longshore sediment transport differentials and sea level rise. However, some possible management actions to mitigate against long term erosion threats (e.g. seawalls and beach nourishment) are likely to be effective to a large degree against beach erosion. Conversely, some possible management actions to mitigate against beach erosion (e.g. temporary rock walls) may in fact *exacerbate* long term erosion threats if not implemented appropriately, and this may necessitate their removal following the abatement of the storm threat.

Cost-effective management of coastal erosion requires a set of complementary short-term (emergency) and long-term management actions to coordinate preparedness, mitigation and recovery in order to maintain coastline amenity.

- Section 3.2 outlines the Emergency Action Subplan for Coastal Erosion (EAS) which guides Council's response to immediate coastal erosion emergency events in which beach erosion threatens the safety of people or destroys or damages any property (refer glossary). The EAS is provided in Appendix F.
- Sections 3.3 to 3.7 present long term management actions to mitigate against coastal erosion due to longshore sediment transport differentials and sea level rise, which can also have beach erosion imposed on top of them.

3.2 Coastal Erosion Emergency Events

Coastal erosion emergency events 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. Coastal erosion emergency events may also occur under relatively benign conditions where, due to the significant lowering of a beach profile as resulting from natural processes, waves are able to scour the back beach erosion escarpment resulting in landward recession of the escarpment. Coastal erosion and or inundation may exacerbate risk to development, infrastructure, and/or persons.

To manage these risks Council has prepared an Emergency Action Subplan for Coastal Erosion (EAS) that is provided in Appendix F. The EAS details actions to be carried out by Ballina Shire Council (Council), in response to a coastal erosion emergency event.

A coastal erosion emergency event is defined as a situation in which:

- beach erosion is imminent, is occurring, or has occurred; and
- this beach erosion endangers, or threatens to endanger, the safety or health of people or destroys or damages, or threatens to destroy or damage, any property and which requires a significant and coordinated response.

In addition to erosion, inundation of land and property due to wave overtopping dunes due to large swell conditions and/or diminished dune profiles may also be secondary effect of a coastal erosion emergency.

The purpose of the EAS is to outline Council's intended actions before, during and after a coastal erosion emergency. The emergency may or may not trigger Ballina Shire Council's Disaster Management Plan (DISPLAN) or the NSW State Storm Plan.

Note that the term "coastal erosion emergency event" in the context of the EAS is limited to hazards associated with beach erosion, and does not include events such as Tsunamis or maritime emergencies.

Once implemented, the long-term coastal hazards management actions outlined in this CZMP will reduce the threat of beach erosion and coastal inundation hazards in the Lennox Head village area. However, even once all these works are in place, emergency management of public risk, coastal infrastructure, and beach access points will be an ongoing responsibility of council.

3.3 North and Central Seven Mile Beach

3.3.1 Background and Objectives

This beach unit extends north from the northern extent of the Lake Ainsworth Sport and Recreation Centre to the shire boundary with Byron Shire. Within the assessed 2100 planning period, there is no development under coastal hazard threat throughout this beach unit.

The broad management objective adopted for this beach unit is to allow coastal processes to proceed under monitoring. Coastal erosion is expected to take the form of a gradual landward movement of the beach and dune system without a substantial change to the nature or extent of these environments, but resulting in a net loss of the coastal heath. Long term recession distances are shown in Table 2.1, and estimated losses of coastal heath are shown in Table 2.2.

3.3.2 Management Plan

Due to the current absence of any development under coastal hazard threat, no physical management actions are recommended in this CZMP. However, under Management Action M2 in Table 4.2, it is recommended that analysis of long term recession trends is undertaken every six years or so to quantify the short and longer term beach changes taking place. This would provide an extension of the database of photogrammetry presently available providing accurate data and re-assessment of existing hazard estimates for consideration of any future action. Photogrammetric analysis of aerial photography, or analyses using alternative means should be undertaken on selected profile locations based on the profiles analysed previously for the hazard definition study (refer Illustration 3.3).

Dedicated horse and 4WD access points were recently installed within this beach unit. Although the hazard zones presented in BMT WBM (2011) do not extend as far north as these access points, it is likely that they would be exposed to beach erosion (due to storms or an extreme or irregular event) and shoreline recession (due to sediment budget deficits and sea level rise). Management of these beach access points is included under Management Action DM2 in Table 4.3.

Management plan actions are summarised on Illustration 3.1.

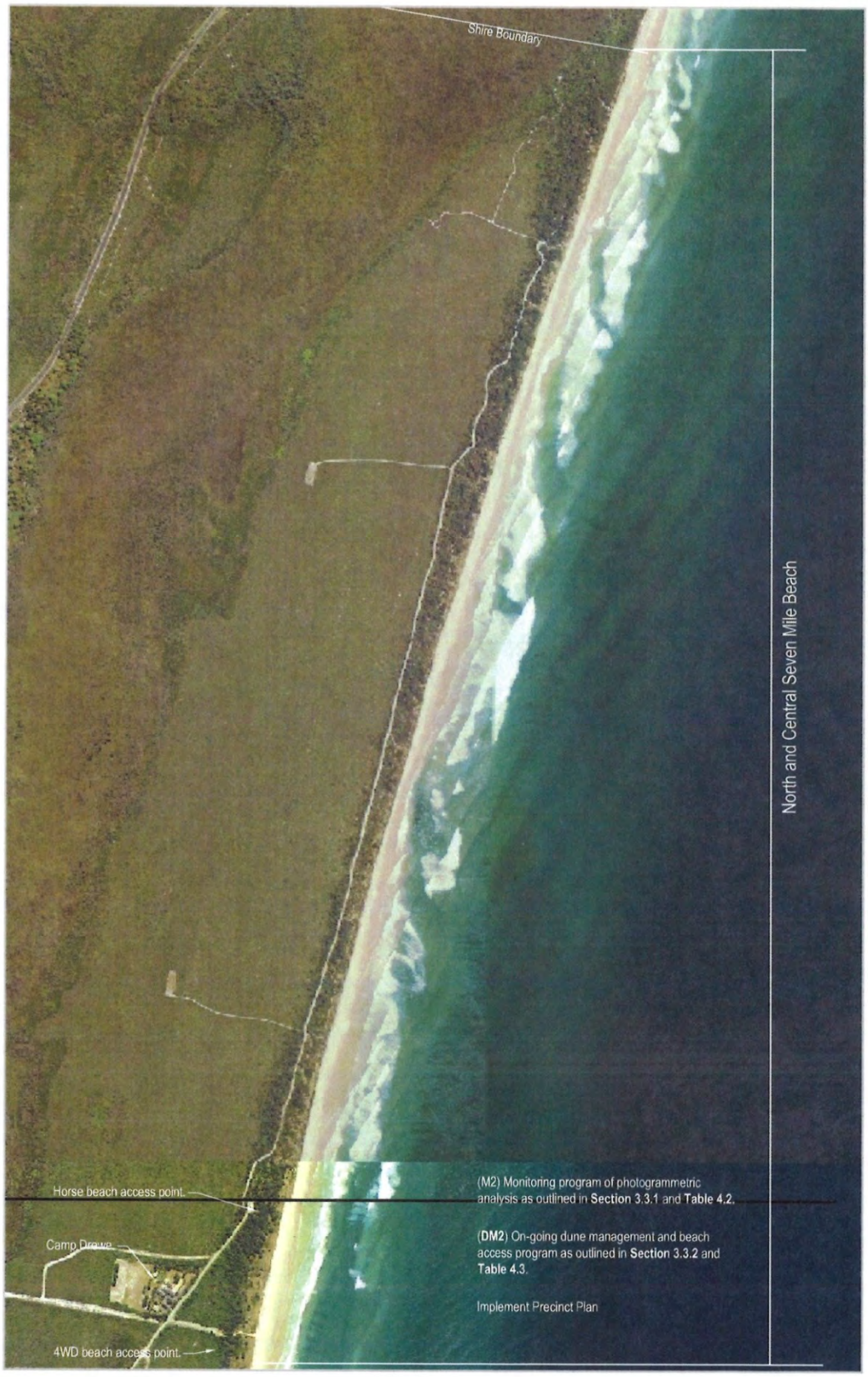
3.3.3 Precinct Plan (Precinct 1) Management Actions

A number of the actions presented in *Precinct Plan – Precinct 1* will aid in stabilising the fore-dunes north and Central Seven Mile Beach which will mitigate against coastal hazards and support public access, including:

- Management Objective 1.2 – Management of horses
  - (Now complete) Relocate horse beach access to end of Camp Drewe Road in conjunction with establishment of new vehicle access track. Rehabilitate eroded track through dune and stabilise for horse access.
  - Prohibit horses from dune and hind-dune by means of Code of Conduct and public promotion of restrictions.
- Management Objective 1.3 – Vehicle beach access
  - (Now complete) Re-locate vehicle beach access point to north of Lake Ainsworth Sports and Recreation Centre.
  - (Now complete) Close and repair existing vehicle access track at Lake Ainsworth
  - (Now complete) Close illegal tracks between the beach and the hind-dune track. Leave northern most track open for emergency access.
- Management Objective 1.6 – Dune stabilisation
  - Encourage the community to provide input into the development of future management strategies for coastal hazard reduction.
  - Ballina Shire Council continues and increases the level of support to Landcare groups and individuals engaged in native vegetation and habitat management.
- Management Objective 1.7 – Vegetation management
  - Prepare a Vegetation Management Plan for Seven Mile Beach
  - Prioritise actions in Vegetation Management Plans for Precinct 1
  - Support Community involvement in native vegetation management
  - Employ bush regenerator to assist community and work in areas not being managed by the community
  - Continue Bitou Bush aerial spray program and associated management

Illustration 3.1 - North and Central Seven Mile Beach – Management Actions

Source: Ballina Shire Council Date: May 2015



North and Central Seven Mile Beach - Management Actions

3.4 Lennox Head – North of Byron Street

3.4.1 Background and Objectives

This beach unit extends north from the northern end of the rock revetment seawall near the corner of Byron Street and Pacific Parade to the northern extent of the Lake Ainsworth Sport and Recreation Centre.

The broad management objective adopted for this beach unit is to protect development landward of the beach rather than remove development and allow erosion to proceed, i.e. protect rather than retreat.

A buried rock wall currently extends along much of this beach unit, however because details of its installation and condition are unknown, any possible mitigating effect has not been included in the coastal hazard estimated discussed here, in WBM (2003) or in BMT WBM (2011).

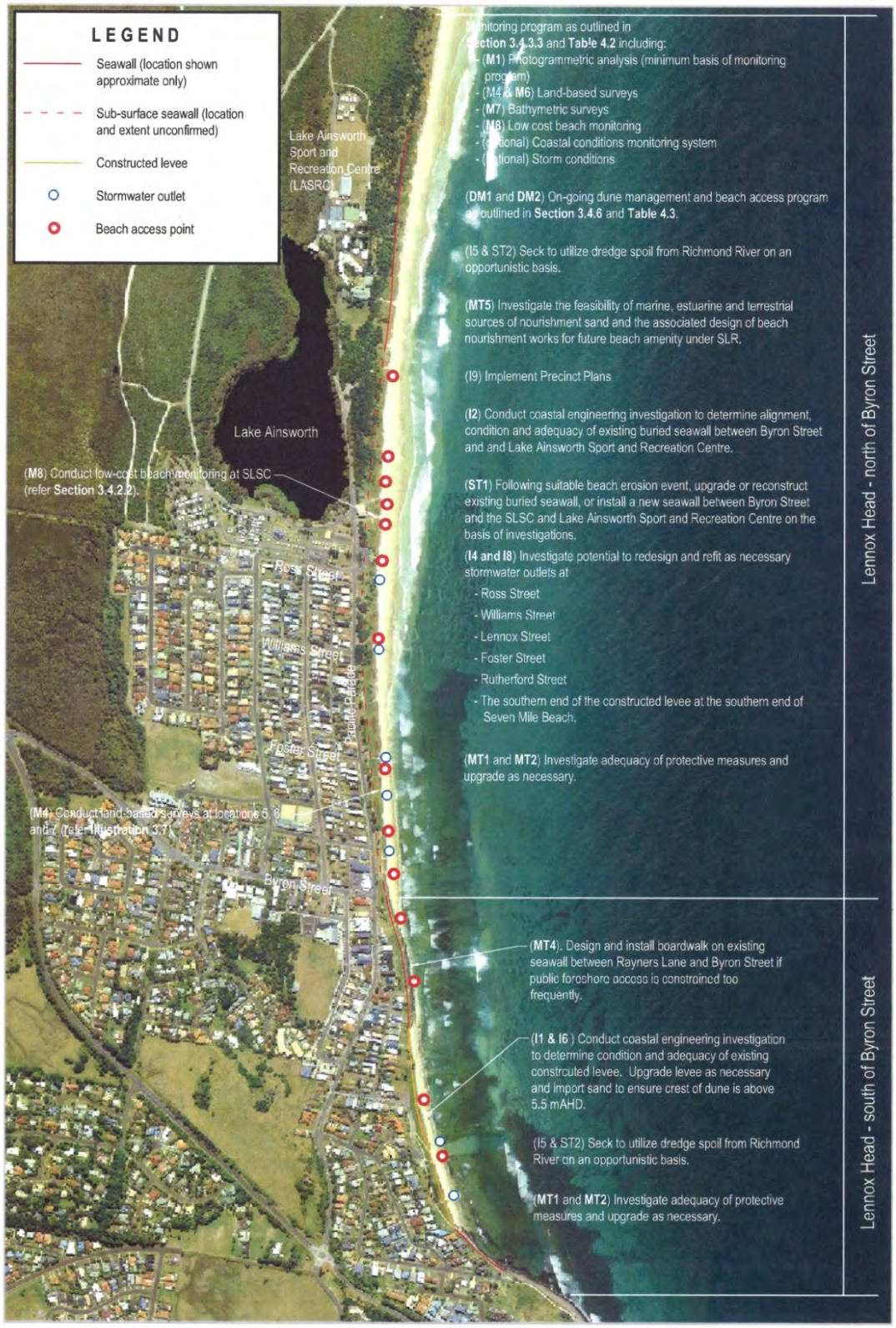
As shown in Illustration 2.1 and 2.2, BMT WBM (2011) estimates are that there is currently no development under immediate coastal hazard threat in this beach unit. However, in the absence of any management intervention, assets on and fronting Pacific Parade are likely to be subject to coastal hazard by 2050. Similarly, assets as far landward as Stewart Street are expected to be subject to coastal hazards by 2100. It is important to note that the foundations of assets landward of these lines would be affected by a zone of reduced bearing capacity which would extend some metres landward of the top of the erosion escarpment. The actual extent of this zone is dependent on local conditions and the foundations affected and would require a professional assessment on a site by site basis.

BMT WBM (2011) notes that recent data show the general trend of shoreline recession in this beach unit to have reversed, at least temporarily, between 2003 and 2010. However, the present understanding of the long-term processes and behaviour of this beach system requires that the projected shoreline recession erosion hazard must be considered a probability for coastal management planning purposes. This is particularly so under projected sea level rise and the exacerbation of shoreline recession this may yield. The uncertainty inherent in the present projections of future shoreline behaviour requires that seawall construction works, and beach nourishment for beach amenity, be undertaken only as and where required, as determined by ongoing beach and dune system monitoring.

With regard to coastal inundation (due to large waves overtopping dunes or seawalls), WBM (2003) estimates that Pacific Parade may be exposed to this hazard in the immediate term but this is unlikely to be significant. Although it does not consider coastal inundation directly, BMT WBM (2011) estimates the immediate hazard line to be seaward of that presented in WBM (2003) thus the threat of coastal inundation is assumed to be further reduced and is not considered further.

Illustration 3.2 - Lennox Head – Management Actions

Source: Ballina Shire Council Date: May 2015



3.4.2 Management Plan – Introduction

In response to Council's decision to protect rather than relocate assets, GeoLINK (2008) identified that the most effective strategy for this beach unit is the *Beach Nourishment with Seawall* option.

As discussed in Section 3.4.1, beach erosion and shoreline recession are expected to occur in this beach unit into the long term. Under these processes the beach and dune are expected to continue to move landward unless the processes are stopped by a seawall or reversed by beach nourishment. Under this CZMP, the primary strategy to protect assets along this beach unit against projected coastal recession is via upgrade of the existing rock wall to an engineered standard, or construction of a new engineered seawall. If a seawall is used *without* beach nourishment the projected landward movement of the beach and dune will manifest in a lowering and narrowing of the beach 'against' the seawall. This will result in temporary loss of the beach from time to time in response to cyclic near-shore movement of sand and beach erosion events. However, in the medium to long term the beach may be expected to be lost permanently if shoreline recession continues and indeed increases under sea level rise projections, and beach nourishment is not undertaken.

This temporary and possibly permanent loss of beach will impact on environmental and recreational amenity, and therefore seawalls *without* beach nourishment may be contrary to the objectives of the Coastal Protection Act (see Section 1.2.2). Accordingly, the plan considers opportunities for beach nourishment to maintain the beach environment and recreational amenity which is an important value to the community.

To offset the impacts of the seawall, it is necessary to take-up opportunities for sand nourishment when and if available in the short to medium term. Should dredging activities in and around the Richmond River estuary recommence, then this may provide an opportunistic source of beach nourishment sand to enhance recreational amenity of Lennox Head Beach over the short to medium term (Section 3.4.3.1). It is considered that such a strategy may provide sufficient sand reserves to manage the beach amenity effectively for the next couple of decades (based on current trends). It is noted that the State Government ceased estuary maintenance dredging during the 1970's, however investigations of the Richmond River bar recommenced in 2013.

To manage the spectre of projected sea level rise beyond (say) 2050 will likely require large ongoing sand sources that might only be practically available from offshore marine reserves. The current level of uncertainty regarding the cost, funding and timing of such larger scale beach nourishment works mean that they cannot be considered fully within this CZMP, however are required for investigation under section 3.4.3.2.

The alignment of the proposed seawall should be as landward as possible to maximise the space available for the beach and dune system. The alignment of the existing buried rock wall may be suitable, however substantial repair and/or reconstruction along some parts will almost certainly be necessary for it to withstand severe wave attack. In order to determine its alignment, and the extent and detail of repair and reconstruction measures, an investigation by a qualified and experienced coastal engineer of the existing buried rock wall is recommended.

Full implementation of all works required to protect against potential future long term recession of the whole beach unit is not required immediately. Thus the management plan for this beach unit comprises two main steps, investigations and monitoring followed by staged implementation of on-ground works.

Management plan actions are summarised on Illustration 3.2.

Step 1 relates to investigations and monitoring and includes:

- In the event that dredging of the Richmond River in undertaken in the short to medium term then pursue opportunities to utilise spoil as a source of beach nourishment..
- Investigate feasibility for a medium to long term larger scale sand supply for beach nourishment to offset the expected loss of the beach 'against' the existing and proposed seawalls due to projected long term coastal recession including sea level rise impacts (see Section 3.4.4).

- Establish a comprehensive program of beach and dune monitoring integrating various monitoring methods to identify beach processes, short and long-term trends, and trigger points for initiating detailed monitoring and protective works.
- Conduct coastal engineering assessment of the protective capacity of the existing buried rock wall between Byron Street and the Lennox Head Alstonville Surf Lifesaving Club (SLSC) and the Lake Ainsworth Sports and Recreation Centre (LASRC). This investigation will identify requirements for upgrading their construction to the necessary standard.

Step 2 relates to on-ground works of seawall upgrade/construction, and possibly beach nourishment, as informed by results of Step 1 and is described in Section 3.4.4.

Section 3.4.5 outlines the statutory planning framework that underpins the management plan for this beach unit and Sections 3.4.6 to 3.4.8 outline recommended regulations and actions for beach and dune management in order to support the management plan.

Figure 3.1 provides a diagrammatic summary of the management strategy for the area north of Byron Street under this plan.

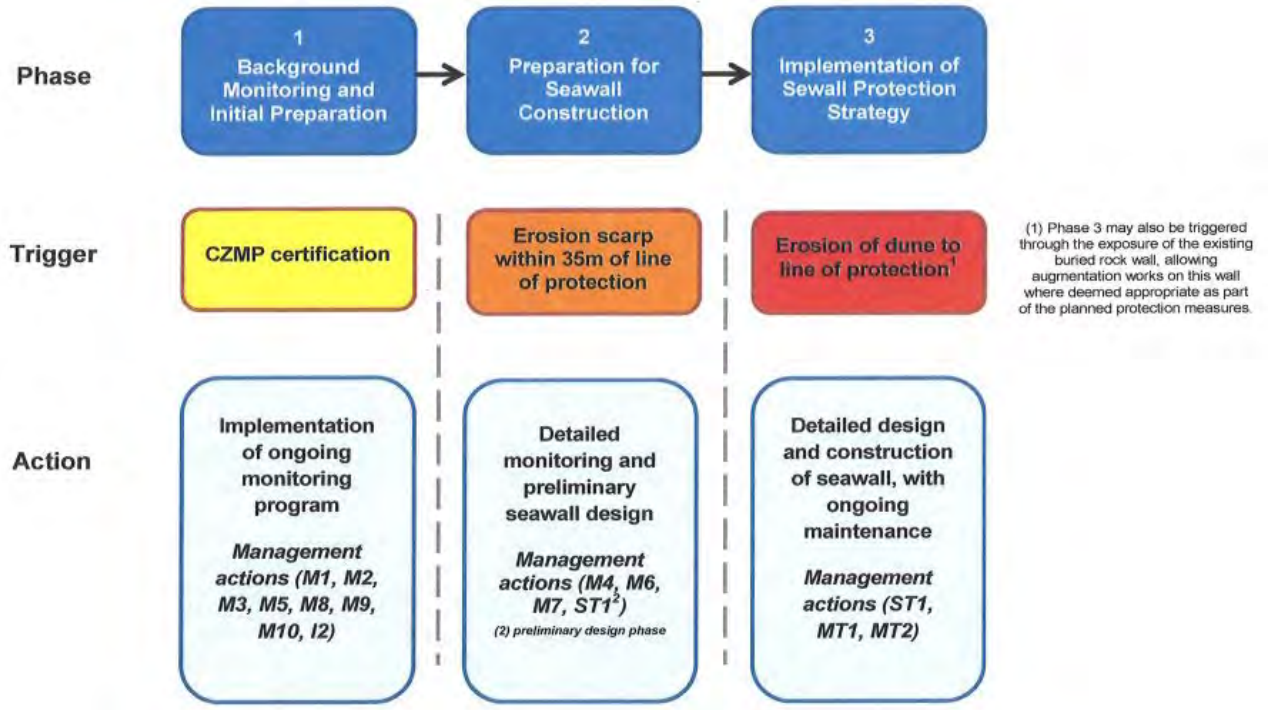


Figure 3.1 Key Management Steps and Trigger Points – Seawall Priovision

3.4.3 Management Plan – Investigations and Monitoring

3.4.3.1 Step 1.1 – Sand Source Investigation

As described above, under the projected trend of shoreline recession there will be a lowering and narrowing, and eventual loss, of the beach 'against' existing and proposed seawalls throughout this beach unit. Therefore, it is highly desirable that opportunities for sand nourishment be investigated for the future in order to maintain and improve recreational beach amenity.

Larger scale beach nourishment utilising offshore sand reserves is currently a complex and uncertain concept for the reasons described below in section 3.4.4.3.

Therefore, a short to medium term position may present which seeks to utilise dredge spoil from the Richmond River on an opportunistic basis to nourish and improve the amenity of Seven Mile Beach. Dredge spoil is considered to represent a feasible local source of sand for small scale nourishment purposes, and it is

considered that such an opportunity may maintain and improve beach amenity for the next couple of decades (based on current trends) until the combination of sea level rise and natural forcing processes take hold. This action, should it occur, will need to prepare the associated design and approval of a program for placement of that sand.

Note: No dredging program for the Richmond River is currently funded by the State Government being the manager of the Richmond River and Ballina bar. Opportunistic sand nourishment would be subject to funding for such a program.

3.4.3.2 Step 1.2 Offshore Sand Source Investigation

As described above, under the predicted trend of shoreline recession there will be a lowering and narrowing, and eventual loss, of the beach 'against' existing and proposed seawalls into the future. As projected sea level rise takes hold a reduction in beach width and amenity will become more and more pronounced. Smaller scale beach nourishment such as required under section 3.4.3.1 above may become ineffective, owing to the landward encroachment of mean sea level. Therefore, it is highly desirable that larger scale sand nourishment be investigated and undertaken, and the first step towards doing so is to confirm suitable sources of offshore sand, and prepare the associated design and approval of a program for extraction and placement of that sand. This is likely to be a complex and lengthy exercise.

Discussion of the most likely option for sourcing offshore sand for beach nourishment is included in Section A4.8 of GeoLINK (2008).

3.4.3.3 Step 1.3 – Monitoring Program

A clear picture of the changing nature of the beach is critical for timely and cost-effective management, primarily by means of identification of the trigger point for implementation of protective works. There are various monitoring methods available for Council to determine both short and long-term trends of shoreline recession rates; current condition of the beach and dune; and whether trigger points have been reached to initiate detailed monitoring or protective works. These include:

- Photogrammetric analysis (minimum basis of monitoring program);
- Land-based surveys;
- Analysis of LIDAR data
- Low cost beach monitoring;
- Bathymetric surveys; and
- Coastal conditions monitoring system.

<u>Photogrammetric analysis</u>

The recommended monitoring program is based on a minimum of on-going photogrammetric analysis of the aerial orthophotos provided by the NSW Government, which may be complemented by the other monitoring methods, as described below. This assumes that the NSW Government will continue to acquire aerial photography suitable for photogrammetric analysis. The analysis should be continued on the profile locations based on the profiles analysed previously (refer Illustration 3.3) which underpin the findings of WBM (2003) and BMT WBM (2011). These profiles also cover the beach unit Lennox Head, south of Byron Street, which is discussed in more detail in Section 3.5.

The NSW Office of Environment and Heritage has historically provided suitable aerial photography approximately every three to five years. Assuming this continues into the future, analysis of these images is recommended to be undertaken at the same frequency for this beach. BMT WBM (2011) shows that a recent short-term trend of accretion overlays the long-term trend of recession; however this reversal is expected to be temporary.

Ideally the photogrammetric analyses should be complemented with land-based surveys as described below.

For cost-effectiveness, flexibility may be allowed on the timing of the aerial photography to suit opportunistic photography that may be available from time to time and/or to fit with other activities of the aerial photograph contractor. Otherwise, special-order photography may be needed. The NSW Government photogrammetry

facilities would be capable of undertaking the analysis, assuming these are maintained into the future. Otherwise independent analysts may need to be engaged at a cost. Should analysis costs be a substantial limiting factor, the photography should be obtained and archived for analysis at a later time when funding is available, or alternative contemporary data capture and analysis methods pursued.

Results of the photogrammetric analyses should be compiled and reviewed every six years, or following a major storm, or as determined necessary from visual inspections (refer Management Action M10), in conjunction with results of land-based surveys discussed below if available. The review should:

- Describe the current condition of the beach and dune in relation to assets and projected coastal hazards;
- Quantify recent changes and provide revised short-term and long-term trends;
- Consider recommendations with respect to trigger points for protective works as outlined in Section 3.4.4.1 and
- Monitor the performance of beach nourishment works that may be implemented in future.

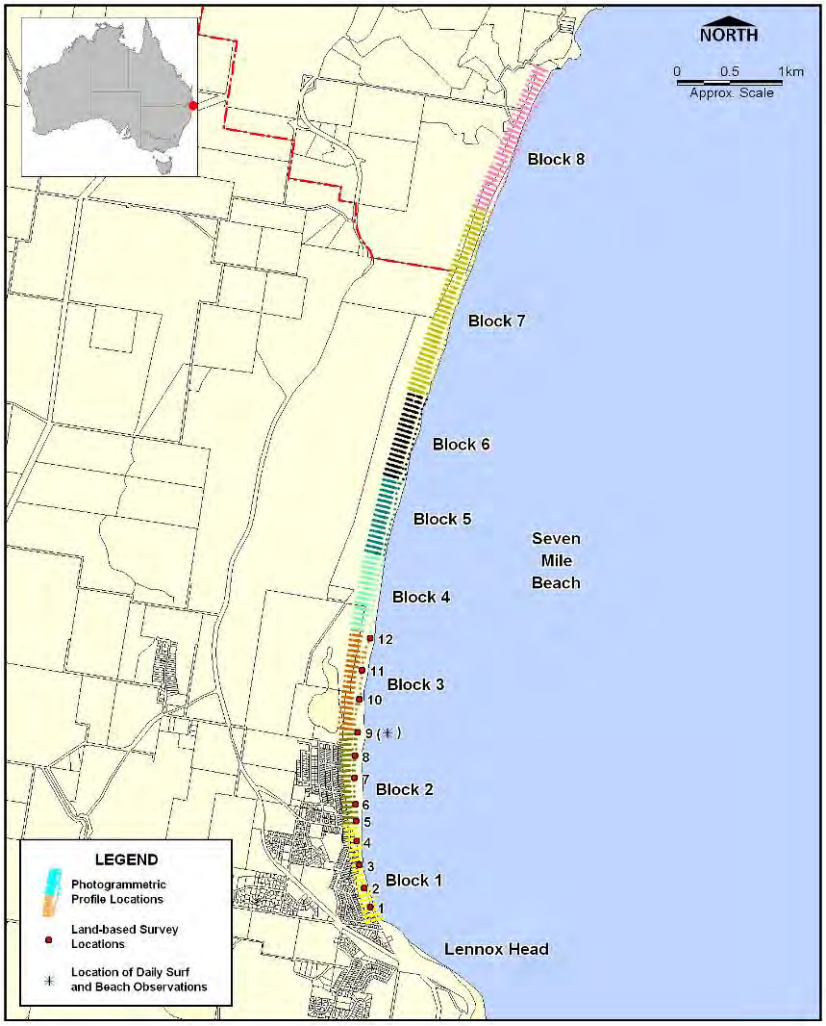


Illustration 3.3 - Proposed Land-based Surveys and Photogrammetry Sections – Lennox Head

Land-based surveys

It is recommended that photogrammetric analyses are complemented with land-based surveys to provide greater spatial definition, especially at locations where assets may be under immediate coastal hazard threat as discussed below.

The surveys should extend across the beach and dune from the low water line to at least as far landward as the 50 year hazard line in undeveloped areas. This will, at the selected locations, enable quantification of:

- Changes in the quantity of sand in the upper beach/dune system;
- The volume of sediment loss associated with storms or an extreme or irregular event;
- Progressive longer term changes in the shoreline position and any long term trend of erosion or accretion.

The recommended locations of surveys are shown in Illustration 3.3. It is possible that historical survey information, collected in conjunction with bathymetric surveys discussed below, is available. If this is the case the location of land based surveys should include consideration of historical surveys to simply the establishment of trends based on consistent survey profiles across the dune and beach.

Extensive land-based surveys may not be possible or cost-effective depending on the resources available for monitoring. Thus it is recommended that surveys are conducted in locations where the top of the erosion scarp is less than 35 m from the line of assets to be protected.

Ideally, the recommended frequency of surveys would be:

- Immediately following major erosion events;
- Six monthly over the following five years; and
- Annually after the first five years.

BMT WBM (2011) shows that the 1999 erosion scarp is within 30 m of the Pacific Parade roadway which suggests that survey locations 5, 6 and 7 shown in Illustration 3.3 should be surveyed as soon as possible (Management Action M4).

Land-based survey information, if collected, should be included in the summary and compilation of monitoring results discussed under photogrammetric analysis above (Management Action M10).

Contemporary Data Capture and Analysis

The future remote sensing of the NSW coastline is a rapidly developing area. Recent developments in the acquisition of 3D terrestrial and bathymetric data are yielding good results for interpretation of fine scale features on the coast. LIDAR data is now being used for analysis of beach platform, and beach and dune volume and recessionary trends. The NSW Government will continue to provide Council with any data such as LIDAR for the purpose of trend detection and analysis. This is currently an evolving area and may result in more cost effective monitoring of Seven Mile Beach into the future.

Low Cost Beach Monitoring

It is feasible to undertake simple but effective beach monitoring without significant expense. This may involve input from Council staff, surf club members or volunteer residents, with minimal technical knowledge or expertise. Typically, it could include:

- Volunteer daily observations of waves, currents and sand transport at (say) the SLSC. This would entail a trained observer using established observation techniques to record reasonably accurate results (Patterson, 1985; Patterson & Blair, 1983).
- Regular (say monthly) survey of selected beach cross-sections using simple techniques. This best involves the installation of a graduated reference pole levelled to Australian Height Datum (AHD) at the site. This would allow a trained observer to record level versus distance measurements based on line of sight to the horizon.
- Visual inspections of the rock seawall following each substantial storm erosion event to monitor the integrity/stability of the rock wall.
- Recording of storm intensity data including barometric pressure, sea level, wind speed and direction, and wave height and direction, and correlation of this data with the extent and nature of beach erosion. This would assist in consideration of trigger points and increasing the accuracy of forecasting erosion from storm events.

Such observation procedures have proven to be reasonably accurate and an invaluable data resource in other locations. They are described in more detail in Appendix C. The cost of such a program is likely to be less than $10,000 per year.

Bathymetric Surveys

While a northerly longitudinal movement of sand is the dominant long-term process affecting sediment budgets on Ballina beaches, there is also considerable cross-shore movement at times, which can have a much greater effect on beach conditions over the short-term.

Bathymetric surveys off the Ballina coastline have been conducted on a number of occasions over the last century or so and most recently in 2011, and OEH continues to conduct these surveys from time to time using Laser Airborne Depth Sounder technology. Bathymetric surveys have not been reviewed to inform this CZMP. A review of bathymetric survey records and an assessment of their usefulness is recommended under Management Action M5.

Integration of this historical bathymetric data and the results of photogrammetric analysis *may* improve understanding of cross-shore movement of sand and how it relates to beach and dune condition and improve the accuracy of coastline modelling and erosion prediction. If this is the case, then contemporary bathymetric surveys would contribute, with other data, to improving the level of certainty around the likelihood and extent of beach recovery, particularly following beach erosion. This may enable more strategic allocation of resources.

The location and frequency of bathymetric surveys will be dependent on a number of factors, including:

- The findings of the existing data review – if existing bathymetric data are suitable, collecting new data in a way that allows for integration with existing data may allow better analysis of historical trends and relationships;
- Funding – compared to photogrammetric analysis and land-based surveys, bathymetric surveys are likely to be expensive with lower cost-benefit in terms of trend analysis and hazard estimation;
- Opportunistic availability – establishment costs may be avoided if the survey vessel and/or equipment is available locally for some other purpose; and
- Integration with other monitoring – to obtain a good 'snapshot' of beach condition bathymetric surveys ideally should occur at a similar time to the land-based surveys and/or photogrammetric analyses.

Bathymetric survey information, if collected, should be included in the summary and compilation of monitoring results discussed under photogrammetric analysis above (refer Management Action M10).

Coastal Conditions Monitoring System

Coastal Conditions Monitoring System ('CoastalCOMS') is an automated real-time observation and data management service for coastal monitoring. Developed by Coastalwatch Pty Ltd, the system uses video recordings, raw data from climatic and other physical processes, and processed information derived from raw data to monitor and/or predict a range of beach conditions.

In relation to coastal hazard management, the system can measure shoreline position by geo-referencing the position of the water with respect to a fixed video camera. Calibrated using existing beach survey information this system can provide real-time monitoring of the volume of sand on a particular beach, informing decisions on the level of coastal hazard threats and management responses.

A camera managed by Coastalwatch Pty Ltd is currently in place on the Lennox Alstonville Surf Life Saving Club. The video feed from this camera may be suitable for determining the level of coastal erosion hazard at Seven Mile Beach using image interpretation software provided and managed by Coastalwatch Pty Ltd.

3.4.3.4 Step 1.4 – Assessment of Existing Buried Rock Wall

The existing buried rock wall under the dune east of Pacific Parade was built between 1977 and 1980. As its structural design, construction and present condition are unknown Management Action I2 requires that it be assessed with respect to current best practice design standards by a suitably qualified and experienced coastal engineer.

This assessment would need to provide recommendations to either upgrade or reconstruct the existing structure to an adequate standard, including as a minimum:

- An adequate height of structure to prevent excessive wave overtopping when exposed but allow for adequate coverage for vegetation establishment and recreational amenity when buried by the dune;
- A flexible rubble mound structure that may adapt its shape without structural failure and allowing practical repair and/or maintenance in the event of damage during extreme wave attack;
- A toe foundation embedded soundly in the upper beach such that it will not be significantly undermined during severe wave attack;
- A backing filter layer (or layers) of either fine rock (gravel) and/or geotextile fabric over the sand, grading up to the larger armour rock in such way that neither the sand nor the finer rock may be lost through the structure during wave attack;
- Two layers of armour rock of adequate size placed randomly with void spaces to minimise wave uprush and act to absorb the wave energy;
- A suitable design for the northern end to protect against adverse 'end effects' and/or out-flanking by erosion behind the last section of rocks, most effectively involving a landward return of the alignment; and
- Rehabilitation of the land behind the seawall as required for stability, access and control.

A conceptual design section is shown in Illustration 3.4. Use should be made of any rock in the existing seawall as much as feasible, particularly where it is well bedded into the beach to act as a toe foundation, thus minimising the cost of rock supply.

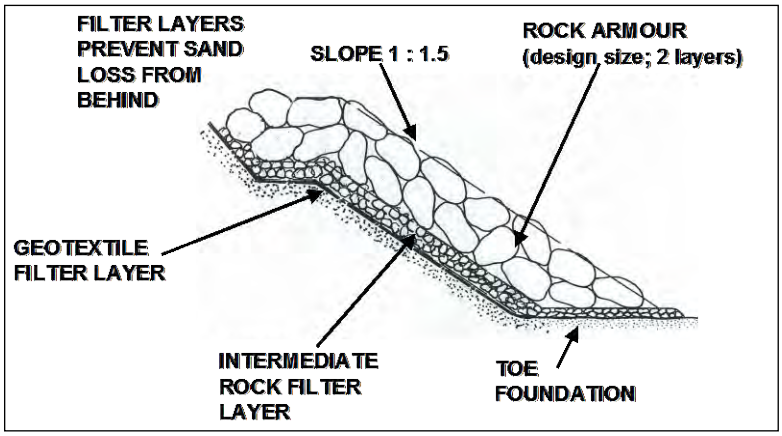


Illustration 3.4 - Typical Seawall Design Section

At the northern end of the seawall, a landward 'return' to the seawall is required to tie it into the dune, as shown conceptually in Illustration 3.5. It should be noted that the final detail of the end design will need to be adapted to the dune topography at the time and the return extended sufficiently far landward to avoid outflanking by wave erosion.

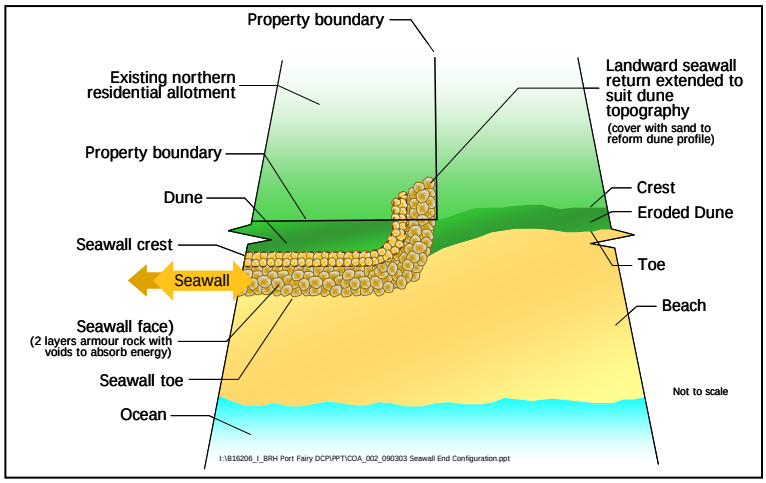


Illustration 3.5 - Conceptual Seawall End Configuration

This seawall investigation is recommended for the first year of the CZMP implementation under Management Action I2. It will most probably include excavation and assessment of the seawall at a number of randomly selected locations spread along its length to obtain a reliable representation of its present alignment and status. The outcome should be a detailed status report, together with design drawings and cost estimates for the required upgrade works.

3.4.4 Management Plan – Protective Works

3.4.4.1 Seawall Design and Alignment

The basic design standard for a new seawall would be the same as that recommended for the upgrade of the existing buried rock wall in Section 3.4.3.4. The alignment of the seawall will follow the 'line of protection' landward of which property or infrastructure is to be protected. It is recommended that the seawall is aligned as far landward as possible to maximise the potential to retain a sandy beach seaward of the wall. However, the alignment of the seawall may be influenced by the location of the buried rock wall if investigations (Section 3.4.3.4) indicate significant efficiencies in upgrading this structure rather than building an entirely new seawall.

Notwithstanding the influence of the existing buried rock wall, seawall alignment considerations include:

- For the area between Byron Street and the Surf Lifesaving Club, it is recommended that the seawall be as close to Pacific Parade as possible while balancing the future amenity provided by the beach with that provided by the grassed public open space between the beach and the roadway. The key considerations relating to the alignment include the following:
  - Investigations may show that the existing buried rock wall already offers substantial protection, in which case there would be significant economic savings associated with following its alignment.
  - The further seaward the alignment of the seawall, the sooner beach amenity can be expected to be reduced due to the estimated shoreline recession occurring "against" the seawall. These reductions in beach amenity will be in the form of a gradual increasing frequency with which public access along and general use of the beach will be restricted due to combinations of low sand supply and tide levels. Such effects already occur on occasions as a result of the seawall south of Byron Street.
  - The further landward the alignment of the seawall, the less grassed public open space will ultimately remain once shoreline recession has occurred up to the seawall.
  - It is likely that the unique amenity provided by the beach will be valued more highly by the community than the amenity provided by the grassed public open space, thus indicating an alignment as close to Pacific Parade as possible is preferred.
- Given that relocating the Surf Lifesaving Club building is not likely to be viable and that it does not protrude substantially further seaward of the general alignment of Pacific Parade, the wall alignment could extend seaward of this structure.

- Between the Surf Lifesaving Club and the Lake Ainsworth Sport and Recreation Centre, the primary protection requirements are preventing a breakthrough to Lake Ainsworth and maintaining access between those centres. Accordingly, the seawall could be located further landward here; however consideration of increased interaction of seawater with the freshwater ecosystem of the lake will need to be considered.
- At the Lake Ainsworth Sport and Recreation Centre, the seawall works will need to be integrated with the existing upgraded seawall in front of the centre constructed in 1997.

It can be seen from Illustrations 2.1 and 2.2 that the immediate hazard line is landward of the assumed alignment of the existing buried rock wall, but is seaward of Pacific Parade along the length of the roadway. Thus, BMT WBM (2011) estimates that the existing buried rock wall will be exposed in the next major beach erosion event, but no major assets are under immediate coastal hazard threat. (The Lennox Head Alstonville SLSC and the southern end of Pacific Parade are possible exceptions to this and are discussed briefly below.)

Therefore, it is recommended that seawall works commence following a beach erosion event that exposes the existing seawall, based on the following reasons.

- Significant excavation of the *existing* dune profile would be required to implement seawall works, whether these works comprise repair, reconstruction and/or relocation of the existing buried rock wall, installation of a new seawall, or some combination. The process of beach erosion will do much of the excavation that is necessary for the seawall works.
- North of Foster Street the immediate hazard line is approximately 20 m seaward of the Pacific Parade roadway indicating it is currently extremely unlikely that major assets will be damaged by beach erosion, even if more than 200 m^3/m of sand is lost in the beach erosion event. Thus, under the estimates put forward in BMT WBM (2011), there is *currently* very little risk in waiting for the beach erosion event to occur.
- The natural protective capacity of the dune will be severely reduced during the works period as a result of the excavation, whether it is done by beach erosion or mechanically. While a storm resulting in significant beach erosion can occur at any time, the historical record shows that such events tend to be isolated. Hence it is less likely that a large beach erosion event will occur shortly after one has just occurred.

Wave climate data shows that mean peak wave period and mean significant wave height are lowest in spring and summer for the Byron Bay region (Shand et al, 2010). Therefore seawall works ideally would be carried out during this time of year, although a suitable beach erosion event should be the primary determining factor for the timing of seawall works.

3.4.4.2 Staged Construction of Seawall

The approach of waiting for beach erosion to occur before commencing seawall works described above may expose the southern end of Pacific Parade roadway and the Lennox Head Alstonville SLSC to coastal hazard threat. Illustration 2.1 shows that the immediate hazard line is seaward but close to the Pacific Parade roadway between Byron Street and Foster Street, and particularly close south of Lennox Street. Considering the effect of the zone of reduced bearing capacity Pacific Parade may currently be under immediate coastal hazard threat between Byron Street and Lennox Street. If more than 200 m^3/m of sand is lost due to beach erosion this threat may extend north of Lennox Street, and the SLSC may be under coastal hazard threat also.

This variation in coastal hazard threat along Pacific Parade may warrant the upgrading / building of seawalls in short stretches to prevent unnecessarily early expenditure on protective works seaward of areas not under threat. Conversely, economies of scale may be lost if such an approach is taken. Therefore, a more specific economic analysis, including consideration of seawall and effects plus shoreline recession trends at the time will be necessary to determine the extent of works, once they become necessary at a particular location.

3.4.4.3 Beach Nourishment to Offset Seawall Effects

Preceding sections describe the influence of building a seawall on a coastline exhibiting a trend of shoreline recession and how beach nourishment can offset the consequent loss of beach and associated amenity. It is therefore important to take-up opportunities for sand nourishment when and if available in the short to medium term. This may present as dredge spoil from the Richmond River bar at Ballina. Currently there is no State Government program in place, however it may be an opportunity, if delivered into the future.

This approach will require the associated design and approval of a program for placement of sand. Once the design and approvals are in place nourishment should be undertaken as the opportunity arises and be accompanied by a monitoring program to assess the retention and disbursement of the placed sand. A sound monitoring program will inform future nourishment campaigns and will complement the adaptive management strategy enshrined in this CZMP.

The cost and timing of larger scale sand nourishment being undertaken (and perhaps even the likelihood of it happening at all), and the process of coordinating various government agencies and funding arrangements, all remain unclear (refer section 3.4.3.2). The technical requirements, at least to a concept design level, are clearer and are described briefly here.

The beach profile at the time of nourishment will guide nourishment volumes and locations. However, for planning purposes and assuming a fully depleted beach, an initial quantity of about 600,000 m^3 will be necessary. The required nourishment volume per lineal metre of beach is expected to vary from 500 m^3/m seaward of Byron Street to 250 m^3/m seaward of the Lake Ainsworth Sport and Recreation Centre (LASRC). This would provide sufficient sand to accommodate the short term storm volume per lineal metre demand of 200 m^3/m above the storm profile. It is difficult to determine the possible required frequency for subsequent re-nourishment, however it may be required every decade to decades following the initial nourishment (depending on storm frequency and intensity, erosion trends and sea level rise) with a volume of approximately 400,000 m^3.

The sand would be placed predominantly on the upper beach and near shore zone out to about the normal position of the offshore bar. Ideally the quantity of sand should be sufficient to allow a dune of about RL 6.0 mAHD to be formed and the general beach to widen by about 20 m to 35 m. Both alongshore and across-shore dispersal under the prevailing waves and currents will integrate nourished sand into the normal active system. The beach will be expected to adopt its natural dynamic shape, subject to normal erosion and accretion cycles associated with storm erosion and subsequent beach recovery.

3.4.5 Statutory Planning Requirements for Protective Works

Clause 128 of *State Environmental Planning Policy (Infrastructure) 2007* defines 'waterway or foreshore management activities' to include:

> *coastal management and beach nourishment, including erosion control, dune or foreshore stabilisation works, headland management, weed management, revegetation activities and foreshore access ways.*

Beach nourishment is clearly included in this definition, and the seawall works are *foreshore stabilisation works* and so also constitute waterway or foreshore management activities.

Clause 129 of the Infrastructure SEPP provides that:

> *Development for the purpose of waterway or foreshore management activities may be carried out by or on behalf of a public authority without consent on any land.*

Protective works, therefore, will not require development consent. They are, however, considered to be an *activity*, pursuant to the provisions of Part 5 of the *Environmental Planning and Assessment Act, 1979*. Section 111 of the Act requires that an authority proposing to undertake an activity must *examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity*. This is normally undertaken by the preparation of a Review of Environmental Factors (REF).

However, if the activity is likely to significantly affect the environment (including critical habitat) or threatened species, populations or ecological communities, or their habitats, an Environmental Impact Statement (EIS) would need to be prepared and considered (note: the Act specifies public exhibition requirements for an EIS).

Pursuant to Section 38 of the *Coastal Protection Act 1979*, a public authority shall not, without the concurrence of the Minister:

(a) carry out any development in the coastal zone, or

(b) grant any right or consent to a person:

i. to use or occupy any part of the coastal zone, or

ii. to carry out any development in the coastal zone,

if, in the opinion of the Minister, as advised from time to time by the Minister to the public authority, the development or the use or occupation may, in any way:

- *be inconsistent with the principles of ecologically sustainable development, or*
- *adversely affect the behaviour or be adversely affected by the behaviour of the sea or an arm of the sea or any bay, inlet, lagoon, lake, body of water, river, stream or watercourse, or*
- *adversely affect any beach or dune or the bed, bank, shoreline, foreshore, margin or flood plain of the sea or an arm of the sea or any bay, inlet, lagoon, lake, body of water, river, stream or watercourse.*

Under the Coastal Protection Regulation (2004), a person (including a public authority) must not, without the concurrence of the Minister, carry out development on any part of the coastal zone that is below the high tide mark, excluding estuaries, lakes or artificial harbours. Beach nourishment works are very likely to be considered development below the high tide mark.

Council will need to liaise with the State Government to determine whether the Minister's concurrence will be required in this case.

3.4.6 Beach and Dune Regulation and Management

3.4.6.1 Regulation of Beach Management

Apart from the need for restoration of the beach and upgrade of the seawall as provided for in this CZMP, coastline management practices undertaken and/or regulated by Council along the developed parts of the beach should include the following:

- No sand is to be removed and the dune vegetation protected to prevent wind erosion along the beach and dune system;
- For any new buildings constructed on the dune beyond the set-back, consideration should be given to excavating sand from those developments and returning it to the beach system, with building fill being imported as needed from outside the beach/dune system;
- In the event of future erosion back to the seawall, regular visual inspection and maintenance of the rock seawall should be undertaken as needed to ensure safety and structural stability;
- Public access to the beach should be limited to controlled public paths and/or stairs at suitably spaced locations to ensure convenient and safe access to and from the beach;

3.4.6.2 Regulation of Activities in Undeveloped Dune Areas

It is recommended that Council develops guidelines to regulate works and activities within the potential erosion hazard zones. This may involve integration with relevant regional and state planning provisions. The dune system should be managed in accordance with the methods and procedures recommended by OEH. Such management may include planting and protection of native dune vegetation, clearing of weed species and provision of controlled access across the dunes.

General regulations to protect the natural dune system where alternative provisions do not apply could include:

- No structures may be erected or interference caused within the immediate erosion hazard zone, beach or nearshore areas. Such structures and interference includes buildings, roads, car parking areas, facilities, services, seawalls or other equivalent works;
- No sand is to be removed from the beach system (onshore and offshore) – this does not relate to sand for beach nourishment which by definition is sourced from *outside* the beach system;
- No sand is to be removed and the dune vegetation is to be protected to prevent wind erosion along the dune system; and
- No future subdivision of land that would provide additional building lots wholly or partially seaward of the 2100 hazard line will be permitted unless it can be shown that buildings provided for in the subdivision will be located wholly landward the 2100 hazard line.

3.4.6.3 Dune Rehabilitation and Management

Rehabilitation and management of dunes to maximise their natural protective functions as a physical barrier and a source of sand during periods of erosion, is generally a cost-effective and ecologically sensitive means of mitigating against coastal hazards. Best-practice rehabilitation and management methods are set out in the *NSW Coastal Dune Management Manual* (DLWC, 2001).

Native foredune vegetation, generally comprising grasses and vines, is fundamental to dune health by binding sand that is in already place or trapping aeolian sand following an erosion event. This effect can also be mimicked by the installation of dune fencing. Therefore dunes can be managed in various ways including:

- Conduct active regeneration (planting) in accordance with guidelines and vegetation management plans;
- Install dune fencing in accordance with *NSW Coastal Dune Management Manual* (DLWC, 2001);
- Remove invasive species and weeds;
- Manage pedestrian access in high traffic areas by installing signage, fencing and designated pathways; and
- Work with stakeholders to restrict 4WD access to key locations and conduct compliance and enforcement activity to limit inappropriate access and damage due to irresponsible 4WD behaviour.

Council and numerous dedicated volunteer groups are already active in Ballina implementing such initiatives, and in many cases have been instrumental in maintaining the health of dunes. It is recommended that Council maintains this program as outlined in Table 4.3.

BMT WBM (2011) notes that the dune system of this beach unit is currently in an acceptable condition, particularly as the foredune has developed recently in the absence of severe erosion. However, there has been some localised beach erosion in recent times and degradation of native dune plants and reduced dune level have occurred as a result of inadequate control of pedestrian access. Consequently, the existing foredune needs to be managed in certain locations and those degraded and poorly vegetated areas rehabilitated and managed to facilitate natural dune processes. Management Action DM1 in Table 4.3 outlines the broad elements of dune management actions, noting a focus on this beach unit.

Conceptual guidelines for management of the dune system are illustrated in Illustration 3.6. This Illustration also indicates the desired nature and location of control fencing, vegetation development and surface mulching needed both as part of any nourishment works and following major erosion events.

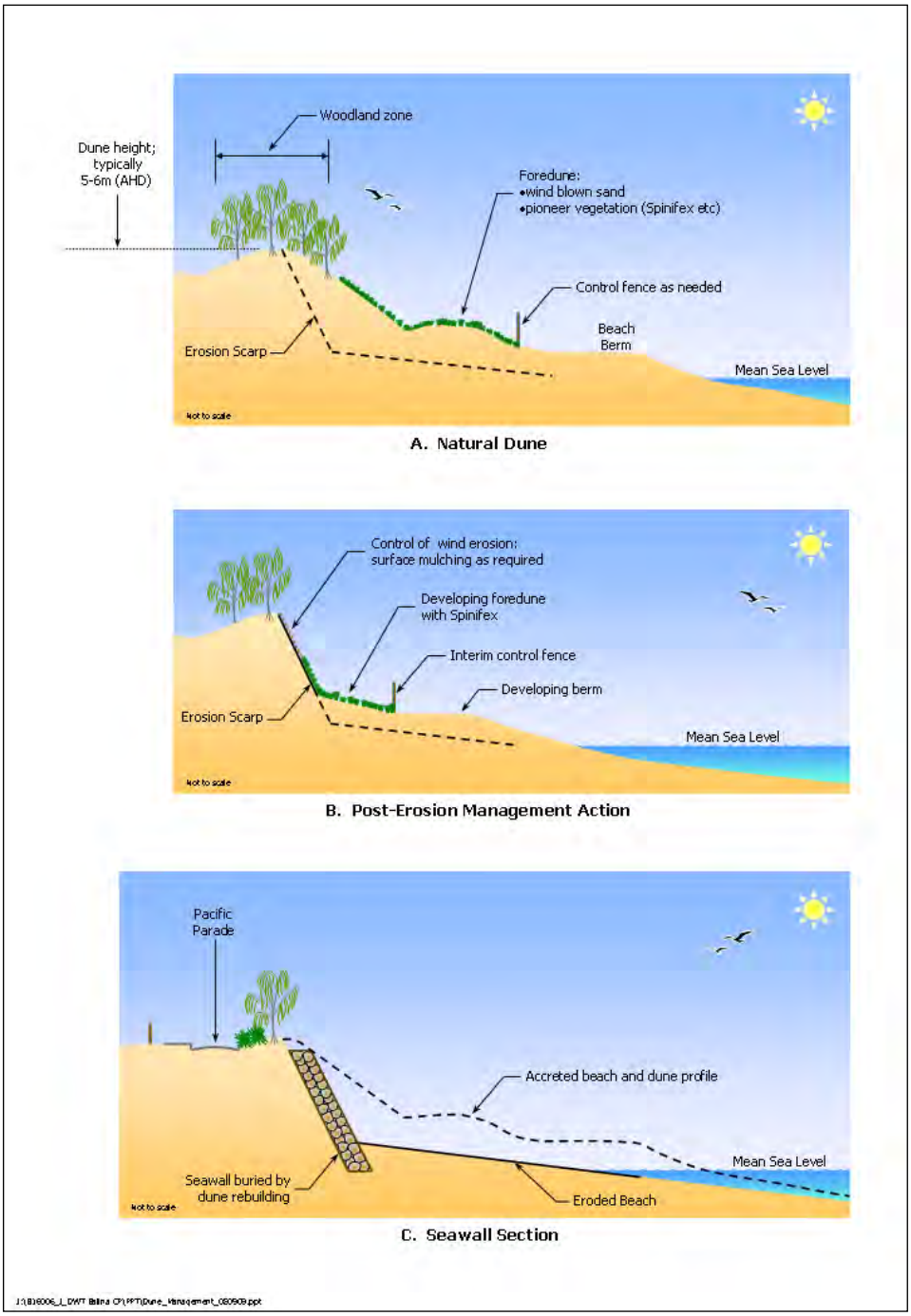


Illustration 3.6 - Conceptual Dune Management Guidelines

3.4.7 Stormwater Drains

In addition to the broad scale protection of property and beach/dune maintenance considered above, concern over stormwater drains discharging across Seven Mile Beach has been raised by members of the Community Reference Group. The drains discharge from points landward of the toe of the frontal dune and in the vicinity of the discharge point they tend to draw the toe of the dune landward of its natural alignment. This reduces the width of the frontal dune, and therefore its protective capacity in extreme storm events. In this regard the two northern-most drains in this beach unit are of particular concern.

Management Objective 2.1 of Precinct Plan 2 (refer Section 3.4.9) proposed the following actions:

- To prevent dune erosion, extend the storm water pipes to the natural dune line and install two stage gates at the following discharge points along Seven Mile Beach as shown on the locality plans.

- Lennox Street
- Williams Street
- Ross Street
- Foster Street

Investigation of the potential to extend the discharge point of these drains approximately 8-10m seaward of the current alignment of the toe of the dune is recommended. With the observed erosion trend, the toe of the dune is expected to move landward over time, therefore the pipe extension should, if possible, be modular to enable the location of the discharge point to be adjusted. This will also allow the outlet to be moved in response to any altered beach profiles resulting from beach nourishment should this be implemented in the future.

3.4.8 Development Control Plan

Chapter 2 of the Ballina Development Control Plan 2012, Section 3.14 Costal Hazards, is the key planning document that relates specifically to mitigating risk from coastal erosion hazard.

The revision of coastal hazard lines for Lennox Head BMT WBM (2011) found that the beach in this area had accreted since the assessment presented in WBM (2003) (Refer Section 2.1.1).

It is therefore appropriate for the provisions of the existing Development Control Plan, to be reviewed as monitoring and investigation under this plan identifies the nature of coastal processes occurring in relation to this area.

3.4.9 Precinct Plan – Precinct 2

A number of the actions presented in *Precinct Plan – Precinct 2* will serve to mitigate coastal hazard threats and support public access in this beach unit. Many of these relate closely to the points outlined in Section 3.4.6.3. They include:

- Management Objective 1.10 – Surf Life Saving Requirements [in *Precinct Plan – Precinct 1*]
  - Consider future options for the Lennox Head – Alstonville SLSC site re expansion or relocation [note that the SLSC is under coastal hazard threat and relocation may be necessary in future]
- Management Objective 2.1 – Stormwater management
  - Extend storm water pipes to the natural dune line and install two stage gates at discharge points along Seven Mile Beach as per locality plans to prevent dune erosion.
    - Lennox Street
    - Williams Street
    - Ross Street
    - Foster Street
- Management Objective 2.3 – Pedestrian beach access (erosion control of dunes)
  - Re grass dune system in front of Lennox Head Hotel in stages, upgrading fencing.
  - Educate Pacific Parade residents to the value of short-term erosion control through native vegetation. Seminars, signage, printed material.
- Management Objective 2.7 – Vegetation management and environmental rehabilitation
  - Prepare and implement Vegetation Management / Landscape Plans for:
    - The dune system along Pacific Parade
  - Prioritise actions in vegetation management plans and encourage community to focus their activities on priorities
- Management Objective 2.8 – Vegetation management and environmental rehabilitation
  - BSC provides additional support to Care groups to protect and enhance native vegetation e.g.:
    - Develop Best Management Practices
    - Pro-active in helping groups increase membership through media releases & assisting with organising field days and events.

- Promote sensitivity of dunes and impact caused by misuse via the local media, educational material and explanatory signage.

- Management Objective 2.10 – Erosion coastal hazard education
  - Encourage the community to provide input into future Coastal Hazard Plans for Precinct 2.
- Management Objective 2.11 – Beach erosion
  - Erect and maintain barriers to protect the fore-dune at the Boat Channel.
  - Stabilise pedestrian beach access points at the Boat Channel.

3.5 Lennox Head – South of Byron Street

3.5.1 Background and Objectives

This beach unit extends from the northern end of the rock revetment seawall near the intersection of Byron Street and Ballina Street to the southern end of Seven Mile Beach. It receives considerable protection from wave action by the extensive natural nearshore reef structure of cobbles overlying indurated sand.

In response to historical erosion at Lennox Head south of Byron Street, the Lennox Head Beach Management Plan was implemented in 1993. It included the construction of rock revetment seawalls at the northern and southern ends of the beach unit with a constructed levee linking the seawalls, as well as various recreational amenity improvements and planning controls.

The seawall and levee works were implemented prior to recent amendments to the *Coastal Protection Act 1979* which require such works to be accompanied by actions that attempt to retain a beach seaward of the works where possible, i.e. beach nourishment. As a result, the current situation is such that when the beach profile is depleted of sand, public access along the beach in front of the northern seawall is not maintained at certain times depending on the tide and the actual level of sand depletion. In the absence of beach nourishment such access restrictions are likely to become more frequent and last for longer periods as discussed in Section 3.4.2.

This beach unit is subject to potentially severe wave attack during major storm events with large waves accompanying abnormally high storm tide levels. It is likely that, in the absence of beach nourishment, erosion will occur up to the seawalls and levee resulting in loss of the beach in front of these structures.

The broad management objective adopted for this beach unit is to protect development landward of the beach rather than remove development and allow erosion to proceed, i.e. protect rather than retreat. Ideally, the method of protection should provide for a natural beach and dune system that will act as a buffer to accommodate erosion seaward of the development during storm events and will be available for recreational and environmental purposes.

3.5.2 Management Plan

The existing seawall and levee, if appropriately monitored and maintained, are considered adequate to withstand a large coastal erosion event (or series of smaller events). Their structural adequacy will need to be monitored during and following coastal erosion events. Thus, theoretically, there is currently no coastal hazard threat to assets in this beach unit. However, the levee appears to have slumped in places from a design height of 5.5 mAHD to around 4.8 mAHD, mainly near access points, prompting Management Actions I1 and I6.

While no assets are expected to be under threat following implementation of management actions, the shoreline recession that is estimated for this beach unit will occur 'against' the existing seawalls and levee, resulting in an on-going loss of beach amenity, as discussed in Section 3.4.2.

In response to Council's decision to protect rather than relocate assets, GeoLINK (2008) identified that the most effective strategy for this beach unit is the *Beach Nourishment with Seawall* option. Any beach

nourishment carried out north of Byron Street should extended into this beach unit to improve beach amenity and access in front of the seawalls and the constructed levee.

There is particular concern among members of the Community Reference Group regarding a stormwater drain discharging across the beach from a point that is landward of the toe of the frontal dune. The effect of this discharge is to draw the toe of the dune landward of its natural alignment in the vicinity of the discharge point reducing the width of the frontal dune, and therefore the local protective capacity of the dune in the face of a large storm event.

Some discussion of the following management actions recommended for this beach unit is provided in Section 3.4:

- Various monitoring actions discussed in Section 3.4.3.3 and outlined in Table 4.2;
- Various dune management actions discussed in Section 3.4.6.3 and outlined in Table 4.3;
- Management Action I1. Conduct coastal engineering investigation to determine condition and adequacy of constructed levee to mitigate against hazards from design storm events and shoreline recession.
- Management Action I6. Upgrade constructed levee on basis of investigation under Management Action I1. Upgrade to include importation and stabilisation of additional sand to ensure that the crest elevation of the constructed levee is returned to the design level of RL 5.5 mAHD along its full length and maintained at that level.
- Management Actions I4 and I8. Investigate, re-design and install new stormwater drains discharging at the constructed levee. There may be an option to redirect the discharge at the base of the nearby seawall (note that this is considered in *Precinct Plan – Precinct 2*, see Section 3.4.9);
- Management Action I5, ST2, MT3 – Take up opportunities which seek to utilise dredge spoil from the Richmond River on an opportunistic basis to improve the recreational amenity of Seven Mile Beach
- Management Actions MT4 and MT2. Monitor and maintain the structural integrity of the existing protective measures into the future;
- Management Actions MT3. Design and install boardwalk on existing seawall between Rayners Lane and Byron Street if public foreshore access is constrained too frequently.

3.5.3 Statutory Planning and Regulation

Chapter 2 of the Ballina Shire Development Control Plan 2012, relates specifically to mitigating risk from coastal erosion hazard in this beach unit, Lennox Head – south of Byron Street. The material in this chapter is considered appropriate.

The regulations outlined in Sections 3.4.6.1 and 3.4.6.2 should be applied to this beach unit.

3.5.4 Precinct Plan – Precinct 2

A number of the actions presented in *Precinct Plan – Precinct 2* will serve to mitigate coastal hazard threats and support public access in this beach unit. Precinct 2 includes two beach units considered under this CZMP, Lennox Head – North of Byron Street and this one, Lennox Head – South of Byron Street. The Precinct Plan actions relevant to this beach unit are outlined in Section 3.4.9.

3.6 Boulder Beach

3.6.1 Background and Objectives

This beach unit extends between the cliffs at each end of Boulder Beach as shown in Illustration 3.7. Note that the aerial used for this illustration shows a large amount of sand accumulated on the beach – sand coverage of the underlying cobble field varies considerably over time.

WBM (2003) indicates a recession trend for this beach unit as shown in Table 2.1. However, it is estimated that the landward extent of beach erosion and shoreline recession will be limited by the cobbles that dominate the embayment (WBM, 2003). Consequently beach erosion and shoreline recession are likely to manifest in

reduced coverage of the boulders both in terms of quantity of sand and frequency of coverage. If a rise in sea level of around 0.9 m is realised as previously advocated for use as a planning benchmark (DECCW, 2009) then it is possible some low lying areas behind the beach, which include a wetland area, will be inundated on high tides.

Despite the protection offered by the cobbles, there has been recent erosion in the southern corner of the beach from wave attack during high tides and storm events. There is speculation that removal of boulders some years previously may have contributed to exposure of the dune and subsequent erosion. The erosion is threatening a section of a popular walking track as well as adjoining remnant vegetation. It is expected that the erosion will worsen in the short-term due to continued wave attack, and will be exacerbated in the medium-to-long term by shoreline recession.

Loss of any part of the track is expected to encourage pedestrians to create informal walking tracks leading to damage to surrounding remnant vegetation and leading to further erosion. During 2010, Council recommenced investigating the upgrade of the walking track under another program related to community recreational assets and recommendations from that investigation include rock revetment protection similar to that recommended here.

Illustration 3.7 - Boulder Beach – Management Actions

3.6.2 Management Plan

There is no major development under coastal erosion threat in this beach unit (WBM, 2003). Consequently, the broad management objective for this beach unit is to allow coastal processes to proceed under monitoring, comprising photogrammetric monitoring of beach and foredune location and height as well as visual inspections on a regular basis. Recommended works are limited to those necessary to protect a short section of walking track as described below, and dune management works as required (Illustration 3.7).

In relation to the threatened section of track, the *Precinct Plan – Precinct 3* makes a number of recommendations:

- Upgrade safety and stabilise the Boulder Beach to Iron Peg section of the foreshore track.
- Provide an alternative track from Iron Peg to Boulder Beach if the foreshore track becomes unsafe or impassable.
- Undertake a study to investigate long term options for protecting the existing track and maintaining the foreshore.

Due to the topography and vegetation around the threatened section of track, the only viable option for an alternative alignment (as part of the second action listed above) is around 20 m landward of the threatened section. This alignment is in close proximity to an area of littoral rainforest and Endangered Ecological Community. Members of the Community Reference Group have expressed a desire to minimise exposure of and access to this area, and do not support an alternative track landward of the current alignment. Additionally, given that the users of the track generally have a desire to be close to the shore, it is likely that uncontrolled access to and along the shoreline would still occur even with the provision of an alternative track landward of the current alignment. This will result in damage to vegetation, safety risks, and greater potential for erosion.

Therefore, it is strongly recommended that in front of the directly threatened section of track and the threatened Casuarina tree, the track on its existing alignment is stabilised by means of a placed boulder wall blending in with the natural surroundings. Behind the placed boulders a backing filter layer of smaller rock and gravel grading up to the larger armour rock should be installed to reduce the loss of sand through the structure during wave attack. Finally, a heavy duty geotextile fabric should be installed behind the smaller rock/gravel layer.

The large boulders should be basalt with a nominal diameter of 0.75-1.0m. Angular basalt boulders can be sourced from a number of nearby quarries, or opportunistically from major road works such as Pacific Highway upgrades. However it may be preferable to source rounded basalt boulders from farm clearing works to better match the shape of the existing boulders. The boulders should be placed against the erosion scarp as shown in Illustration 3.8.

The concept design for the recommended protection works is shown in Illustrations 3.7 and 3.8.

Plant necessary for the placement of rock, such as 4WD loaders and excavators, may be able to access the works site from the seaward side if the boulder field seaward of it is covered sufficiently with sand. If the boulder field is exposed, or partially exposed, a temporary track may be required to provide access as the exposed boulder field will be damaging to and damaged by heavy plant.

Any temporary track should follow the existing pedestrian path south from the clearing until the stairs. Where the stairs deviate inland, the temporary track should continue over the slight rise seaward of the stairs and down a temporary ramp constructed from 200-300 mm cobbles at a slope of 1:3 (V:H). This ramp will lead directly to the area where the boulders are to be placed.

Illustration 3.8 - Boulder Beach – Management Action Details

The works will need to be monitored monthly over six months following installation to ensure that settlement has not destabilised the rocks and the 1:2 slope has been maintained. Following this initial period of settlement, the works should be inspected on a quarterly basis, and following large storm events, to assess general maintenance needs such as ensuring no boulders have become unstable and that sediment is not being entrained from behind the boulders and leading to erosion of the path. This monitoring is included under Management Action M9.

Construction activities associated with these works will prevent pedestrian access along the foreshore, with no apparent means of providing alternative access other than a temporary pedestrian path landward of the dunes. For reasons mentioned above, such a path is not favoured by members of the Community Reference Group, and therefore is not recommended. It is expected that pedestrian access will only be restricted for a maximum of six hours each day across low tide for approximately one to two weeks. Adequate forewarning of the inconvenience can be provided by means of temporary signage and public notices in the weeks leading up to the works.

In addition to protection works described above, it is recommended that Boulder Beach is included in the monitoring program that applies to the Ballina Pocket Beaches and South Ballina beaches, as described in Section 3.7.

3.6.3 Statutory Planning and Regulation

By virtue of clause 128 of *State Environmental Planning Policy (Infrastructure) 2007* the recommended works, being 'erosion control' and / or 'foreshore stabilisation works', are defined as 'waterway or foreshore management activities'. By virtue of clause 129 of the SEPP, these activities can be carried out by, or on behalf of a public authority on any land without the need for development consent.

However, environmental implications of the works must be considered in accordance with the requirements of Part 5 of the *Environmental Planning and Assessment Act, 1979*, through the preparation of a Review of Environmental Factors (REF). If the REF concludes that the works are likely to have a significant impact on the environment, an Environmental Impact Statement (EIS) would need to be prepared and publicly exhibited. Such a finding is, however, very unlikely.

While approvals under the *Coastal Protection Act* 1979, the *Crown Lands Act* 1989, the *Threatened Species and Conservation Act* 1995 and the *Fisheries Management Act* 1994 are not required for the recommended works, it will be the responsibility of the proponent, Council, to notify the relevant departments of the works and request advice on any measures that they may require.

The regulations outlined in Sections 3.4.6.1 and 3.4.6.2 should be applied to this beach unit.

3.6.4 Precinct Plan – Precinct 3

Actions relating to coastal erosion presented in *Precinct Plan – Precinct 3* focus primarily on the track. They are outlined and discussed in Section 3.7.3.

3.7 Ballina Pocket Beaches and South Ballina beaches

3.7.1 Background and Objectives

The Ballina pocket beaches comprise, from north to south, Boulder Beach which is considered separately in Section 3.6), and then Sharpes, Angels, Shelly and Lighthouse beaches, as shown in Illustration 3.9. The South Ballina beaches comprise, from north to south, South Ballina Beach, Beswicks Beach, Robins Beach and Patches Beach, as shown in Illustration 3.10. The estimated recession distances for these beaches are shown in Table 2.1.

As there is no major development under coastal erosion threat throughout all these beach units, and they exhibit general stability and low recession distances (WBM, 2003), the primary coastline management objective is to allow coastal erosion to proceed under monitoring. In addition to the monitoring, localised dune management works are also recommended (Section 3.7.2.1).

Sharpes Beach, Flat Rock and Angels Beach

Sharpes Beach and Angels Beach are separated by a tombolo that joins the rocky platform, known as Flat Rock, to the mainland. The Coastline Hazard Definition Study highlighted that the alignments of Sharpes and Angels beaches are governed by the presence of the tombolo. Should the tombolo become detached from Flat Rock due to sea level rise or other influences, substantial erosion and realignment of both beaches is expected. However, there is no development under direct threat of such an erosion scenario although extensive areas of coastal heath will be lost. The nearest development, the Flat Rock Tent Park, is located well inland and is not under any immediate threat.

Analysis of aerial photographs taken in 1945 and 1971 suggests sandmining affected Sharpes and Angels beaches during that time (WBM, 2003). And recent shoreline evolution modelling and investigations presented at the 2009 NSW Coastal Conference indicate that the training walls of the Richmond River, built between 1890 and 1910, are likely to have reduced the supply of sand to the Sharpes and Angels beach units (D. Patterson, 2009). This effect is thought to now be reducing.

Despite these impacts, the beaches appear to have been relatively stable since 1974, and, provided the tombolo remains attached, this stability is expected to continue into the future (WBM, 2003). The tombolo does not appear to have been significantly affected by any sediment budget deficit which may have been operating on this beach unit. However sea level rise induced shoreline recession, which is expected to increase over the 2100 planning period, is likely to have some effect on the tombolo, but in the absence of detailed modelling the nature and extent of this effect cannot be determined.

The two beaches are likely to exhibit shifts in the balance of sand between one end of the beach to the other depending on prevailing wave direction as influenced by the Southern Oscillation Index. This is known as beach rotation and does not lead to a net loss of sand, but nor does it mitigate against coastal hazards in the long term.

Similar to Boulder Beach, the northern half of Sharpes Beach is backed and underlain by cobbles. The Sharpes Beach car parking area is immediately behind the northern end of the beach, and some rock armouring has been placed seaward of the car parking area. The cobbles and rock armour are expected to limit any coastal hazard threat to the car parking area. However, there is uncontrolled stormwater runoff and pedestrian access from the car parking area, causing localised scour and instability of the rock armouring. These issues are considered in the landscape plan that is proposed in *Precinct Plan – Precinct 3* that covers Sharpes Beach. The measures presented in the precinct plan, refer Section 3.7.3 are considered sufficient to prevent coastal hazard threat.

In early 2012 Council put forward a development application for a major upgrade of the Sharpes Beach car parking area, including the provision of surf lifesaving and toilet facilities. In order to protect the proposed assets the application includes significant upgrade to the protective works, i.e. the rock armouring, currently in place.

Illustration 3.9 - Ballina Pocket Beaches – Management Actions

Source: Ballina Shire Council Date: May 2015

Ballina Pocket Beaches - Management Actions

Illustration 3.10 - South Ballina Beaches – Management Actions

Source: Ballina Shire Council Date: May 2015

0 NTS

South Ballina Beaches - Management Actions

The southern half of Sharpes Beach and all of Angels Beach have extensive dune systems and large areas of coastal heath landward of their beach alignments relative to other Ballina Pocket Beaches. Although there are no cobbles to limit erosion, these natural sand reserves and undeveloped areas constitute a substantial buffer to absorb coastal erosion and shoreline recession.

Shelly Beach

WBM (2003) indicates Shelly Beach is a relatively stable beach with some minor erosion of the main dune occurring between 1947 and 1974, and more recently in the lower sections of the beach. Similar to Sharpes and Angels beaches, Shelly Beach is thought to have been affected by the Richmond River training walls based on modelling by D. Paterson as described above.

In May 2009 Shelly Beach experienced significant beach erosion with some minor localised damage to a concrete path and erosion scarps reportedly up to 5 m in height. Accretion of the beach following the erosion was rapid and substantial.

Generally this beach is expected to remain stable into the future, with some beach rotation, and is likely to be subject to sea level rise induced shoreline recession. It may be more vulnerable to beach erosion than other pocket beaches.

Lighthouse Beach

Aerial photographs indicate Lighthouse Beach has steadily accreted since 1947, although the rate of accretion appears to have decreased recently. This accretion is thought to be due to the northern training wall of the Richmond River which defines the southern end of this beach. This beach is expected to remain stable into the future, with some beach rotation, and is likely to be subject to sea level rise induced shoreline recession.

South Ballina beaches

Accretion has been observed in the photogrammetric analysis of South Ballina Beach. This is thought to be due to realignment of the beach following the installation of the training walls and/or rebuilding of the dunes following previous wind drift losses, however WBM (2003) advocates a precautionary approach. This trend gradates to a low rate of observed recession at the southern end of Patches Beach (refer Table 2.1).

The coastline south of the Richmond River is primarily managed by:

- The Crown Lands Division of the NSW Department of Trade and Investment, Regional Infrastructure and Services; and
- The National Parks Wildlife Service of the Office of Environment and Heritage within the NSW Department of Planning and Environment.

Ballina Shire Council has responsibility for 1.4 Ha parcel of land adjacent to the settlement of Patches Beach. For this parcel, Council has prepared a vegetation management plan that addresses a variety of issues including damage to dunes, weed infestation, erosion and predation by feral animals.

The Threatened Species (Pied Oystercatcher) Management Strategy (Department of Lands, 2007) aims to facilitate cooperative land management to minimise the impact of human activities on the Pied Oystercatcher within the area bounded by the Southern training wall of the Richmond River and the Black Rocks 4WD access track, which is beyond the Ballina Shire boundary.

3.7.2 Management Plan

There is no major development under coastal erosion threat in this beach unit (WBM, 2003). Consequently the broad management objective for these beach units is to allow coastal processes to proceed under monitoring, comprising photogrammetric monitoring of beach and foredune location and height as well as visual inspections a regular basis. Recommended works are limited to dune management works as required, with a focus on the Flat Rock tombolo.

The photogrammetric monitoring program, Management Actions M2 and M3, would quantify the short and longer term beach changes taking place as an extension of the database of photogrammetry used in WBM (2003) providing accurate data for consideration of any future action. Photogrammetric analysis of aerial photography on selected profile locations based on the profiles analysed previously for WBM (2003) should be undertaken as shown in Illustrations 3.11 and 3.12.

Because of the critical role of the Flat Rock tombolo in maintaining the current alignment of Sharpes and Angels beaches, it is recommended that particular attention be paid to the status of the beach and dune in this area as part of regular inspections (Management Action M9).

As a result of the significant erosion experienced by Shelly Beach in May 2009, despite the beach's rapid recovery, it is recommended that particular attention be paid to the status of this beach and dune system also. This may require an intensification of the photogrammetry sections proposed for Shelly Beach.

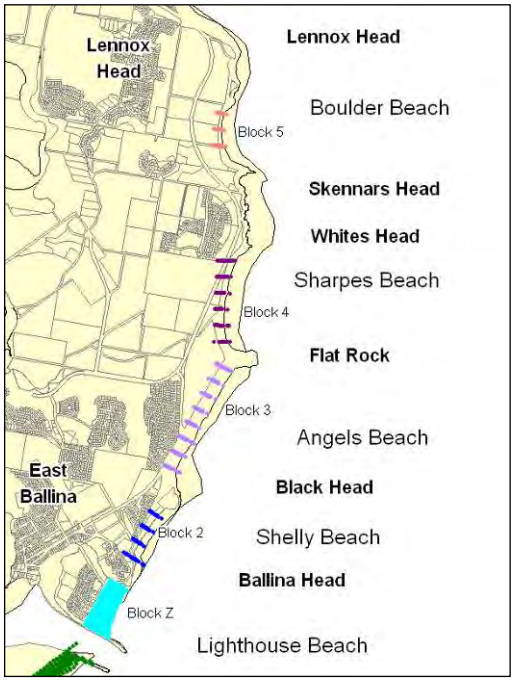


Illustration 3.11 - Proposed Photogrammetry Sections – Ballina Pocket Beaches

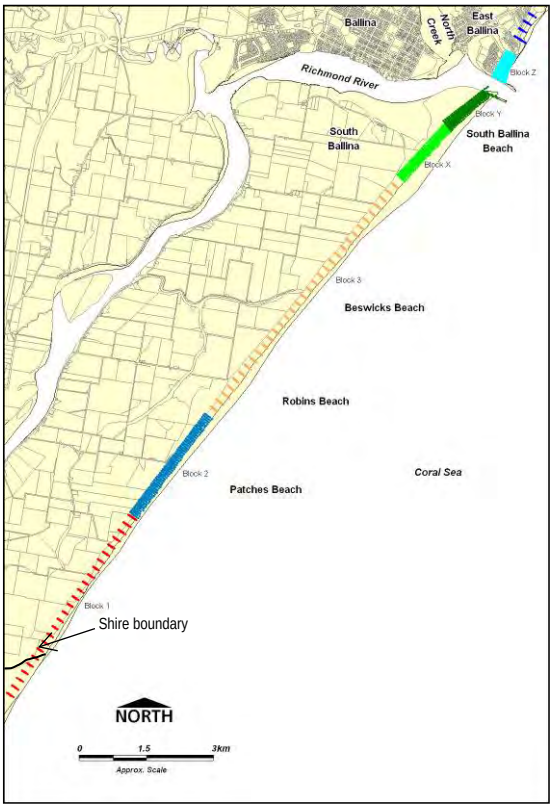


Illustration 3.12 - Proposed Photogrammetry Sections – South Ballina Beaches

The NSW Office of Environment and Heritage has historically undertaken aerial photography of the NSW coastline approximately every three to five years that is suitable for photogrammetric analysis. The professional services of the NSW state photogrammetry facilities would be suitable to undertake the analysis, however, the ongoing commitment to this program by the Government is uncertain. It is expected that the photogrammetric analysis every three years will cost approximately $20,000. Should analysis costs be a substantial limiting factor, the photography should be obtained and archived for analysis at a later time when funding is available. In addition, recent developments in remote sensing may derive more suitable data and analysis procedures for determining trends as discussed in section 3.4.3.3 above.

3.7.2.1 Dune Management Works

Maintenance or augmentation of dunes to maximise their natural protective role, both as a physical barrier and a source of sand during periods of erosion, is generally a cost-effective and ecologically sensitive means of managing small to moderate localised coastal erosion threats.

Native foredune vegetation, generally comprising grasses and vines, is fundamental to dune health by binding sand that is in already place or trapping aeolian sand following an erosion event. This effect can also be mimicked by the installation of dune fencing. Therefore dunes can be managed in various ways including:

- Conduct active regeneration (planting) in accordance with the *NSW Coastal Dune Management Manual* (DLWC, 2001);
- Install dune fencing in accordance with DLWC (2001);
- Remove invasive species and weeds;
- Manage pedestrian access in high traffic areas by installing signage, fencing and designated pathways; and
- Work with stakeholders to limit 4WD access to key locations and conduct compliance and enforcement activity to limit inappropriate access and damage due to irresponsible 4WD behaviour.

Council and numerous dedicated volunteer groups are already active in Ballina implementing such works, and in some cases have been instrumental in maintaining the health of dunes. It is recommended that

Council maintain this program by continuing to allocate modest funding and resources (around $10,000 per site) for works in strategic locations, including

- Confirm the broad community benefit of allowing public 4WD access to the Flat Rock area and conduct frequent 4WD compliance and enforcement schedules where required;
- Maintain existing and expand sand capture and revegetation works at Flat Rock tombolo;
- Conduct sand capture and revegetation works and manage pedestrian traffic around the northern car parking area at Shelly Beach; and
- Continue sand capture and revegetation works around Patches Beach

3.7.3 Precinct Plans for Precincts 2, 3, 4 and 5

A number of the actions presented in the Precinct Plans for Precincts 2, 3, 4 and 5 will serve to address coastal erosion issues in this beach unit, many of which relate closely to the points outlined in Section 3.7.2.1. They include:

- Management Objective 3.3 – Off road vehicle beach access
  - Restrict 4WD beach access at Sharpes Beach to emergency vehicles and professional fisherman.
  - Maintain signage advising of vehicle beach access regulations at each access point.
  - Promote regulations in local media and promotional material.
  - Upgrade policing of regulations by increased and coordinated ranger presence.
  - Install locked gate as part of Coastal Reserve Master Key system as required (if drivers disregard regulations).
- Management Objective 4.3 –Vehicle access
  - Discourage off road vehicle access onto Sharpe's Beach and Angels Beach.
  - Annual review off beach access regulations. Change regulations based on complaints and identified impact of vehicles on recreation and natural amenity of beach.
  - If usage impacts on beach Council revokes policy of permitting vehicles on Angels Beach between sunset and sunrise.
- Management Objective 4.9 – Vegetation management
  - Impose heavy fines on any illegal clearing of native vegetation.
  - BSC provides additional resources to support community participation in native vegetation management works (e.g. supply materials such as mulch, herbicide, and fencing). Be proactive in providing training and assisting networking.
- Management Objective 4.10 – Vegetation management
  - Prioritise actions in the Angels Beach Vegetation Management Plan. Encourage community to implement highest priority actions.
  - Implement Angels Beach Vegetation Management Plan focusing on highest priorities
- Management Objective 4.15 – Habitat protection through education
  - Promote the environmental values of Precinct 4 by using the local media, publication and distribution of brochures, placement of signage etc. Continue to use the area for public education.
- Management Objective 5.3 – Environmental Management (Shelly Beach)
  - Review, prioritise actions and implement the Shelly Beach Vegetation Management Plan
  - Support Care groups as per action 5.4.
- Management Objective 5.4 – Environmental Management (Lighthouse Beach)
  - Upgrade, prioritise actions and implement the Lighthouse Beach Vegetation Management Plan
  - Support Care groups as per action 5.4.

4

Recommended Management Actions Summary

This section comprises the following tables:

- Table 4.1 outlines the potential funding sources that may be available to fund the recommended actions. Each funding source is allocated a code that is used in Table 4.1, Table 4.3 and Table 4.4;
- Table 4.1 outlines recommended actions for monitoring that are generally ongoing with varying frequency. Each action is allocated a code for reference with Section 3;
- Table 4.3 outlines recommended on-going works associated with foredune and beach access management. These actions relate to all beach units with allocation determined on the basis of needs and resource availability;
- Table 4.4 outlines recommended longer-term works broken down into Immediate (0-5 years), Short Term (5-10 years), Medium Term (10-25 years) and Long Term (25+ years).

Beach unit abbreviations used in Table 4.1, Table 4.3 and Table 4.4.

- SMB Central and North Seven Mile Beach
- LHN Lennox Head, north of Byron Street
- LHS Lennox Head, south of Byron Street
- BB Boulder Beach
- BPB Ballina Pocket Beaches
- SBB South Ballina Beaches

Agency abbreviations used in Table 4.1, Table 4.3 and Table 4.4.

- BSC Ballina Shire Council
- OEH Office of Environment and Heritage
- DPI Department of Primary Industries
- DSTA NSW Department of Services, Technology and Administration (Public Works)
- DSR NSW Department of Sport and Recreation
- LGSA Local Government and Shires Association

Cost estimate brackets used in Table 4.1, Table 4.3 and Table 4.4.

- Op Included in Council's current operational budget
- 1 < $20,000
- 2 $20,000 to $50,000
- 3 $50,000 to $100,000
- 4 $100,000 to $300,000
- 5 More than $300,000

Table 4.1 Potential Funding Sources

Note: Actual funding under these potential programs will be subject to the continuation or availability of the program into the future, provision of funding and assessment of priorities and applications if required.

Code	*Source*	*Program*	*Activities*	*Type*
Federal Government				
F1	Environment Australia via Northern Rivers CMA	Natural Heritage Trust	Dune management works (revegetation, strengthening, access management etc.) Major works may be funded if integrated with CMA Catchment Action Plan	Grant
State Government				
S1	Office of Environment and Heritage	Coastal Management Program	Under the Coastal Management Program the NSW Government provides coastal management grants to support local government in managing the risks from coastal hazards, such as coastal erosion, and restoring degraded coastal habitats. The grants are offered on a 1:1 funding ratio	Grant
S2	Department of Lands	Crown Land Administration/ Management	Development and maintenance of the State's public reserves	Low interest loan
S3	Department of Planning	Coastal Lands Protection Scheme	Bring significant coastal lands (in terms of public access, scenic quality and/or ecological values) into public ownership and provide for their long term management and care.	Grant
S4	Department of Commerce	Natural Disaster Relief Program	Financial assistance for both emergency and restoration works of Council owned assets, other than those involving roads, bridges and Crown Lands.	Grant
Local Government				
L1	Ballina Shire Council	General rate revenue	Works	Rates
L2	Ballina Shire Council	Council loan funds	Works	Council
L3	Ballina Shire Council	Section 94 contributions	Land acquisition and improvement of amenities	Council
L4	Ballina Shire Council	Lease income from reserves	Works, land acquisition and improvement of amenities	Council
L5	Ballina Shire Council	Voluntary contributions	Works, land acquisition and improvement of amenities	Council
L6	Ballina Shire Council	Commercial venture involving coastal land	Works, land acquisition and improvement of amenities	Council/ commercial
L7	Ballina Shire Council	Special rate for area benefiting from works	Works	Rates
L8	Ballina Shire Council	Deferred payment scheme	Works	Loan funds
L9	Ballina Shire Council	Planning agreements	Works, land acquisition and improvement of amenities	Private, Council, commercial
Private				
P1	Private land owners	Private residents corporation	Works	Private

Table 4.2 Recommended Coastal Zone Management Actions – Monitoring

Note: BSC is lead agency responsible for action and OEH is support agency for example technical advice and guidance.

Code	*Beach units*	*Recommended Coastal Zone Management Actions – Monitoring*	*Responsibility (in bold) and supporting agency*	*Performance measure*	*Frequency / timeframe*	*Cost bracket*	*Funding (Table 4.1)*
M1	LHN LHS	Conduct aerial orthophoto pass and photogrammetric analysis. (Note: next aerial orthophoto passes currently expected in 2016 and 2019.)	BSC OEH (support)	Analysis complete	Following aerial orthophoto pass	1	S1, L1, L2, L4, L5, L6, L7, L8, L9
M2	SMB BB BPB	Conduct aerial orthophoto pass and photogrammetric analysis.	BSC OEH (support)	Analysis complete	Approximately every 6 years. First analysis expected in 2016	2	S1, L1, L2, L4, L5, L6, L7, L8, L9
M3	SBB	Conduct aerial orthophoto pass and photogrammetric analysis.	BSC OEH (support)	Analysis complete	Approximately every 9 years First analysis expected in 2019	2	S1, S2, L1, L2, L4, L5, L6, L7, L8, L9
M4	LHN	Conduct land-based surveys at locations 5, 6 and 7 (refer Illustration 3.3)	BSC	Surveys complete	Every six months for first 5 years, then annually		
M5	All	Review historical data set of land-based and bathymetric surveys and determine value of developing on-going survey program to build on existing data. Based on results of existing data review develop survey program and modify Management Actions M6 and M7 accordingly.	BSC	Survey monitoring program developed	2015	1	S1, L1, L2, L4, L5, L6, L7, L8, L9
M6	LHN LHS	Conduct land-based surveys	BSC OEH (support)	Surveys conducted and recorded	Refer Section 3.4.3.3, ideally after major storms, 6 monthly for first 5 years, then annually	1 (per survey)	S1, L1, L2, L4, L5, L6, L7, L8, L9
M7	LHN LHS	Conduct bathymetric surveys	BSC OEH (support)	Surveys conducted and recorded	Refer Section 3.4.3.3	TBC	S1, L1, L2, L4, L5, L6, L7, L8, L9
M8	LHN	Conduct low cost beach monitoring at SLSC (refer Appendix C)	BSC OEH (support)	Data provided	Weekly to monthly depending on volunteer commitment / funding	1 (per year)	L1, L2, L4, L5, L6, L7, L8, L9
M9	All	Conduct visual inspection and compile photographic record (from set locations) of beaches, seawalls (LHN and LHS), dunes, levees and boardwalk (LHS). Concentrate on critical areas such as Lennox Head, Boulder Beach and Flat Rock tombolo.	BSC OEH (support)	Data collated, documented and reviewed	Annual and after major storms	1 (per inspection and report)	L1, L2, L4, L5, L6, L7, L8, L9
M10	All	Analyse all monitoring data and prepare detailed report including a review of currency of existing hazard zones and the need, if any, to have hazards recalculated.	BSC OEH (support)	Report prepared	After major storms, or every 6 years (first in 2016)	2 (per report)	L1, L2, L4, L5, L6, L7, L8, L9

Table 4.3 Recommended Coastal Zone Management Actions – Dune Management Works

Code	*Beach units*	*Recommended Coastal Zone Management Action – On-going Works*	*Responsibility (in bold)*	*Performance measure*	*Cost bracket*	*Funding (Table 4.1)*
DM1	All	Continue program to manage foredunes in line with Precinct Plans including the following broad actions: ▪ Conduct regular inspections (coordinated with Emergency Action Subplan) to confirm condition of dunes. ▪ Install and maintain sand capture fencing to complement the natural capacity of foredune vegetation in holding sand that is blown onto dunes, thereby increasing the sediment store and erosion mitigation capacity of dunes. ▪ Locate sand capture fencing based on regular inspection of condition of foredune and shift seaward if sufficiently 'full' or relocate entirely if toe of fore-dune is considered to be adequately seaward; and ▪ Revegetate foredune where practicable to increase rates of natural sand capture and the consolidating influence of root systems. ▪ Inspections and works should be focused on critical areas such as; o Between Byron and Foster streets; o Adjacent to stormwater outlets at Lennox Head village; o Adjacent to beach access points; and o Around the base of the Flat Rock tombolo.	BSC	Program continued	Op	L1, L2, L4, L5, L6, L7, L8, L9
DM2	All	Continue program to manage beach access points in line with all Precinct Plans including the following broad actions: ▪ Close informal beach access paths over dunes by fencing off, conducting revegetation and installing signage noting the revegetation site and directing people to the nearest formal beach access point. ▪ Monitor beach access points to ensure that any lowering of the foredune or damage to foredune vegetation associated with their installation and use does not occur to such an extent so as to exacerbate coastal hazard threat. ▪ Develop and implement a prioritised program of installing board-and-chain walkways and signage to identify and formalise appropriate beach access points throughout all beaches under Council management (i.e. north of the Richmond River). ▪ Following erosion events, remove sections of board-and-chain walkways that overhang scarps and/or conduct localised beach scraping to maintain suitable grades onto the main body of the beach. Reinstall necessary sections of walkways as the beach and foredune naturally accrete following the erosion event.	BSC	Program continued	Op	L1, L2, L4, L5, L6, L7, L8, L9

Table 4.4 Recommended Coastal Zone Management Actions – Protective Works and Associated Investigations

Action	*Beach units*	*Recommended Coastal Zone Management Action – Longer-Term Works*	*Responsibility (in bold)*	*Performance measure*	*Cost bracket*	*Funding (Table 4.1)*
Immediate (0-5 years)						
I1	LHS	Conduct coastal engineering investigation to determine condition and adequacy of the constructed levee to mitigate against hazards from design storm events and shoreline recession. Investigation to include survey of the levee to inform Management Action I6, for returning the levee to a minimum design crest elevation of RL 5.5 mAHD.	**BSC**	Investigation complete and determination made	3	S1, S2, L1, L2, L4, L5, L6, L7, L8, L9, P1
I2	LHN	Conduct coastal engineering investigation to determine alignment, condition and adequacy of existing buried rock wall between Byron Street and the SLSC and Lake Ainsworth Sport and Recreation Centre. Investigation is to include survey of the dune to inform Management Action ST1 to ensure the dune has a minimum crest elevation of RL 6.0 mAHD.	**BSC** OEH (support),	Investigation complete and determination made	3	S1, S2, L1, L2, L4, L5, L6, L7, L8, L9, P1
I3	BB	Conduct survey and investigations, prepare designs and obtain approval for protective works to prevent loss of walking track at the southern end of Boulder Beach.	**BSC**	Design complete Approval obtained	1	S1, S2, L1, L2, L4, L5, L6, L8
I4	LHN LHS	Investigate potential to redesign stormwater outlets to minimise adverse effects on foredune, in particular those discharging near ▪ Ross Street ▪ Williams Street ▪ Lennox Street ▪ Foster Street ▪ Rutherford Street ▪ The southern end of the constructed levee at the southern end of Seven Mile Beach	**BSC**	Investigations complete	2	L1, L2, L4, L5, L6, L7, L8, L9
I5	LHN LHS	Seek to utilise dredge spoil from the Richmond River on an opportunistic basis to nourish and improve the amenity of Seven Mile Beach if required.	**BSC** OEH (support)			
I6	LHS	Upgrade constructed levee on basis of investigation under Management Action I1. Upgrade to include importation and stabilisation of additional sand to ensure that the crest elevation of the constructed levee is returned to the design level of RL 5.5 mAHD along its full length and maintained at that level.	**BSC** OEH (support)	Levee core upgraded as necessary Crest elevation of levee is RL 5.5 mAHD	3	S1, S2, L1, L2, L4, L5, L6, L7, L8, L9, P1
I7	BB	Install rock revetment, earth backfill and track works to prevent loss of walking track at southern end of Boulder Beach.	**BSC**	Works in place	3	S1, S2, L1, L2, L4, L5, L6, L8
I8	LHN LHS	Redesign and install new stormwater drains if investigation determines redesign is feasible. (Note: can be carried over to following years if investigation results in multiple and/or expensive redesigns).	**BSC**	Works in place	3-4	L1, L2, L4, L5, L6, L8
I9	All	Implement Precinct Plans.	**BSC**	As per management actions in Precinct Plans	Various	Various
Short-term (5-10 years)						

Action	*Beach units*	*Recommended Coastal Zone Management Action – Longer-Term Works*	*Responsibility (in bold)*	*Performance measure*	*Cost bracket*	*Funding (Table 4.1)*
ST1	LHN	Following suitable beach erosion event, upgrade or reconstruct existing buried rock wall, or install a new seawall between Byron Street and the SLSC and Lake Ainsworth Sport and Recreation Centre on the basis of investigations under Management Action I2. Upgrade to include importation and stabilisation of additional sand to ensure that the crest elevation of the dune above the existing buried rock wall is at or above RL 6.0 mAHD.	BSC OEH (support)	Seawall upgraded as necessary Dune crest is RL 6.0 mAHD	5	S1, S2, L1, L2, L4, L5, L6, L7, L8, L9, P1
ST2	LHN LHS	Seek to utilise dredge spoil from the Richmond River on an opportunistic basis to nourish and improve the amenity of Seven Mile Beach if required.	BSC OEH (support)			
ST3	All	Implement Precinct Plans.	BSC	As per management actions in Precinct Plans	Various	Various
Medium-term (10-25 years)						
MT1	LHN LHS	Conduct detailed investigations to ensure continuing adequacy of protective measures.	BSC OEH (support)	Investigations complete	2	S1
MT2	LHN LHS	Implement maintenance measures of dunes, seawalls and levee as required on basis of monitoring program	BSC OEH (support)	Implemented as required	2-3	S1, L1, L2, L4, L5, L6, L7, L8, L9
MT3	LHN LHS	Seek to utilise dredge spoil from the Richmond River on an opportunistic basis to nourish and improve the amenity of Seven Mile Beach if required.	BSC OEH (support)			
MT4	LHS	Design and install boardwalk on existing seawall between Rayners Lane and Byron Street if public foreshore access is constrained too frequently.	BSC	Boardwalk installed	4	State and Federal funding L1, L2, L4, L5, L6, L7, L8, L9
MT5	LHN LHS	Investigate and determine the feasibility of marine, estuarine and/or terrestrial sources of sand for larger scale beach nourishment in the future in order to provide for beach amenity under projected sea level rise induced long term recession impacts. Investigation to include concept design of beach nourishment works, statutory planning and policy requirements, planning, comparing costs, and social and environmental impacts at source and destination locations.	BSC	Identification of suitable source. Design of beach nourishment works.	3	S1, L1, L2, L4, L5, L6, L7, L8, L9
MT6	LHN LHS	Conduct nourishment of beach as necessary (if feasible)	BSC OEH (support)	Nourishment conducted	5	tbc
Long-term (25+ years)						
LT1	LHN LHS	Conduct re-nourishment of beach as necessary (if feasible)	BSC OEH (support)	Re-nourishment conducted	Variable	tbc

Note: Responsibility for actions remains with BSC and OEH provides guidance and technical support. Other State Government agencies may be required to participate as necessary.

Project Team

The project team members included:

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Appendix A - Legislative Requirements

A1 Introduction

The purpose of this Appendix is to list the overriding current State Government legislation pertaining to the preparation of CZMPs and describe how this plan meets these requirements.

A2 Legislation and Guidelines

Section 1.2.2 of the CZMP describes the relevant legislation and guidelines:

- Coastal Protection Act 1979, and in particular
  - Section 3 Objects of this Act
  - Section 55C Matters to be dealt with in coastal zone management plans
- Guidelines for Preparing Coastal Zone Management Plans (OEH, 2013), and in particular
  - Section 1.5 Coastal Management Principles

A3 Compliance

The following tables describe how this CZMP meets the above requirements:

Section 3 – Objects of CP Act 1979	*CZMP Measure to address Section 3 Objects*
a) To protect, enhance, maintain and restore the environment of the coastal region, its associated ecosystems, ecological processes and biological diversity, and its water quality	Consideration of environmental systems undertaken during Ballina Coastline Management Study – Stage 1 Values Assessment (Geolink, 2000) and Stage 2 Management Options Assessment (Geolink, 2008).
b) To encourage, promote and secure the orderly and balanced utilisation and conservation of the coastal region and its natural and man-made resources, having regard to the principles of ecological sustainable development	Consideration of resources and sustainability undertaken during Ballina Coastline Management Study – Stage 1 Values Assessment (Geolink, 2000) and Stage 2 Management Options Assessment (Geolink, 2008).
c) To recognise and foster the significant social and economic benefits to the State that result from a sustainable coastal environment, including: i) benefits to the environment, and ii) benefits to urban communities, fisheries, industry and recreation, and iii) benefits to culture and heritage, and iv) benefits to Aboriginal people in relation to their spiritual, social, customary and economic use of land and water	Consideration of all benefits undertaken during Ballina Coastline Management Study – Stage 1 Values Assessment (Geolink, 2000) and Stage 2 Management Options Assessment (Geolink, 2008).
d) To promote public pedestrian access to the coastal region and recognise the public's right to access	Adoption of and reference to Precinct Plans that make full consideration of ongoing management of beach access points.
e) To provide for the acquisition of land in the coastal region to promote the protection, enhancement, maintenance and restoration of the environment of the coastal region	Consideration of all options undertaken during Ballina Coastline Management Study Stage 2 Management Options Assessment (Geolink, 2008).
f) To recognise the role of the community, as a partner with government, in resolving issues relating to the protection of the coastal environment	Extensive community consultation conducted – refer Section 1.5
g) to ensure coordination of the policies and activities of the Government and public authorities relating to the coastal region and to facilitate the proper integration of their management activities	Extensive consultation conducted and Government agencies participated with Community Reference Groups – refer Section 1.5
h) to encourage and promote plans and strategies for adaptation in response to coastal climate change impacts, including projected sea level rise	Climate change impacts considered with Ballina Coastline Hazard Definition Study (WBM, 2003) and Updated Coastal Hazard Areas for Ballina Shire (BMT WBM, 2011)
i) to promote beach amenity.	CZMP actions comprise short term and long term investigations and opportunities to beach nourishment for beach amenity purposes.

Section 55C Matters to be dealt with in Coastal Zone Management Plans		*CZMP Measure to address Section 55C Matters*
(1)(a)	protecting and reserving beach environments and beach amenity, and	Consideration of all options undertaken during Ballina Shire Coastline Management Study, Stage 1 Values Assessment (Geolink, 2007) and Stage 2 Management Options Assessment (Geolink, 2008)
(1)(b)	emergency actions carried out during periods of beach erosion, including the carrying out of related works, such as works for the protection of property affected or likely to be affected by beach erosion, where beach erosion occurs through storm activity or an extreme or irregular event, and	BSC has, separate to this CZMP, an Emergency Action Subplan for Coastal Erosion (Geolink, 2012)
(1)(c)	ensuring continuing and undiminished public access to beaches, headlands and waterways, particularly where public access is threatened or affected by accretion, and	Adoption of and reference to Precinct Plans that make full consideration of ongoing management of beach access points.
(i)(d)	where the plan relates to a part of the coastline, the management of risks arising from coastal hazards, and	Considered under Ballina Coastline Hazard Definition Study (WBM, 2003) and updated Coastal Hazard Areas for Ballina Shire (BMT WBM, 2011)
(i)(e)	where the plan relates to an estuary, the management of estuary health and any risks to the estuary arising from coastal hazards, and	BSC has participated in a separate CZMP for the Richmond River estuary.
(i)(f)	the impacts from climate change on risks arising from coastal hazards and on estuary health, as appropriate, and	Climate change impacts under with Ballina Coastline Hazard Definition Study (WBM, 2003) and Updated Coastal Hazard Areas for Ballina Shire (BMT WBM, 2011)
(i)(g)	where the plan proposed the construction of coastal protection (other than temporary coastal protection works) that are to be funded by the council or a private landowner or both, the proposed arrangements for the adequate maintenance of the works and for managing associated impacts of such works (such as changed or increased beach erosion elsewhere or a restriction of public access to beaches or headlands).	CZMP actions comprise monitoring, dune management and Investigation and protective works into the long term.

Guidelines for Preparing Coastal Zone Management Plans		*CZMP measure to address principle*	
Principle 1 Consider the objects of the *Coastal Protection Act 1979* and the goals, objectives and principles of the NSW Coastal Policy 1997	Principle 2 Optimise links between plans relating to the management of the coastal zone	▪ Ensure no overlap of CZMP with existing plans – refer Section 1.4	
	Principle 3 Involve the community in decision-making and make coastal information publicly available	▪ Extensive community consultation conducted – refer Section 1.5	
	Principle 4 Base decisions on the best available information and reasonable practice; acknowledge the interrelationship between catchment, estuarine and coastal processes; adopt a continuous improvement management approach	▪ Based on adopted Coastal Hazard Definition Study (WBM, 2003) ▪ Formal peer review of WBM (2003) and technical stakeholder meeting of 18 October 2010 ▪ Revision of recession hazard areas for Lennox Head (BMT WBM, 2011) ▪ Ongoing monitoring program to refine hazard estimates and direct management actions (Section 3.4.3.3) ▪ Upgrade Lennox Head seawall when opportune or as required, implement small scale beach nourishment when opportunity arises (i.e. entrance bar dredging, lower estuary dredging) and monitor success, investigate larger scale sand nourishment for future application if required (Section 3.4).	
	Principle 5 The priority for public expenditure is public benefit; public expenditure should cost-effectively achieve the best practical long-term outcomes	▪ GeoLINK (2006) identified a wide range of values ascribed by the public to the Ballina coastline, including: – Ecological values; – Cultural heritage and social values; – Landscape and visual amenity values; – Recreational and tourism values; and – Economic values.	▪ GeoLINK (2007) considered how coastal hazards may threaten these values and identified a wide range of possible management measures, including: – Planned retreat; – Beach nourishment; – Seawalls (with and without beach nourishment); – Groynes (with and without beach nourishment); and – Dune management works, such as vegetation, 4WD and pedestrian access, stormwater outlets, and dune strengthening by sand capture fencing.
	Principle 6 Adopt a risk management approach to managing risks to public safety and assets; adopt a risk management hierarchy involving avoiding risks where feasible and mitigation where risks cannot be reasonably avoided; adopt interim actions to manage high risks while long-term options are implemented	▪ High, medium and low risk areas identified – refer GeoLINK (2007) ▪ Risk avoidance (planned retreat) considered (Section 3.3 to 3.7) ▪ Low-cost short-term management actions (dune management) recommended as interim measure (Table 4.3) ▪ Assessment of level of current mitigation from existing protective structures to direct nature and extent of subsequent works (Section 3.4.3.4) ▪ Investigation of short-term smaller scale nourishment opportunities and longer term larger scale sand sources and feasibility (Section 3.4.3.1 and 3.4.3.2) ▪ Monitoring of coastline evolution via data capture and analysis (Section 3.4.3.3)	

	Principle 7 Adopt an adaptive risk management approach if risks are expected to increase over time, or to accommodate uncertainty in risk predictions	▪ Detailed investigation of existing mitigating structure (buried rock wall) in high risk area (Byron Street to Lake Ainsworth Sport and Recreation Centre, Lennox Head) to determine nature and extent of mitigating influence (Section 3.4.3.4) ▪ Staged implementation of management measures for high risk area (Section 2.1.2) ▪ Investigation of short-term smaller scale nourishment opportunities and longer term larger scale sand sources and feasibility (Section 3.4.3.1 and 3.4.3.2) ▪ Monitoring of coastline evolution via data capture and analysis (Section 3.4.3.3) ▪ Formal trigger points established for high-cost long-term management actions
	Principle 8 Maintain the condition of high value coastal ecosystems; rehabilitate priority degraded coastal ecosystems	▪ Protection of Littoral Rainforest EEC at Boulder Beach ▪ No *high value* coastal ecosystems under immediate threat ▪ Implement Precinct Plans (Table 4.3)
	Principle 9 Maintain and improve safe public access to beaches and headlands consistent with the goals of the NSW Coastal Policy	▪ Adoption of and reference to Precinct Plans that make full consideration of on-going management of beach access points (Table 4.3)
	Principle 10 Support recreational activities consistent with the goals of the NSW Coastal Policy	▪ Recreational values identified in GeoLINK (2006) and management of associated coastal hazard threats considered in GeoLINK (2007). Management response in CZMP developed to support Precinct Plans and beach nourishment investigation (Section 2.2 and 2.3)

Appendix B

Appendix B - Plates

Plate A.1 Cobble field at Boulder Beach. (exposed following January 2008 storms). View south (left) and north (right) from immediately seaward of clearing at end of access track, taken at mid to high tide.

Plate A.2 Cobble field at Sharpes Beach (exposed following January 2008 storms). View south (left) and north (right) from immediately seaward of car parking area, taken at mid to high tide.

Plate A.3 Sand capture fencing on Seven Mile Beach dunes immediately north of Byron Street.

Appendix C - Beach and Surf Measurements - A Simple and Low-Cost Method

By Dean Patterson

C.1 Introduction

A simple method for reliable measurement of wave heights and longshore sand transport was derived by the writer during the 1980s. It was used for many years by the (then) Beach Protection Authority of Queensland as the basis for its volunteer beach observation program (COPE) at locations along the Queensland coast.

Calculation of the rate of sand transport along the beach at a given time can be expressed as a simple relationship derived from theory as:

$S = 1860\ H^2.\ V$ (m^3/day)

Where
S = Longshore sand transport rate per day
H = Wave breaker height (m)
V = Average longshore current speed (m/s)
The constant (1860) has been calibrated to Gold Coast COPE data where the annual average net transport is about 500,000 m^3/yr. It corresponds well with conventional CERC equation values.

It is necessary then to estimate H and V to calculate S.

C.2 Measurement Method

C.2.1 Wave Height (H)

Measurement of the breaker wave height is based on the principle that looking at the horizon gives a very close horizontal line of sight. Thus, standing at the beach with eye level such that the crest of the wave as it first breaks lines up with the horizon will place eye level at the height of the wave crest above sea level.

By standing in the wave swash at a location that is close to mean sea level at the time, a direct measurement of the wave crest height (a_c) can be made with a graduated measuring pole (see Illustration B1). If the waves are too high to view the crest from the swash area, then the pole needs to be located at mean sea level and the observation made from further back, as shown in Illustration B1. To do this, someone else has to hold the pole or it needs to be pushed firmly into the sand with its zero at mean sea level.

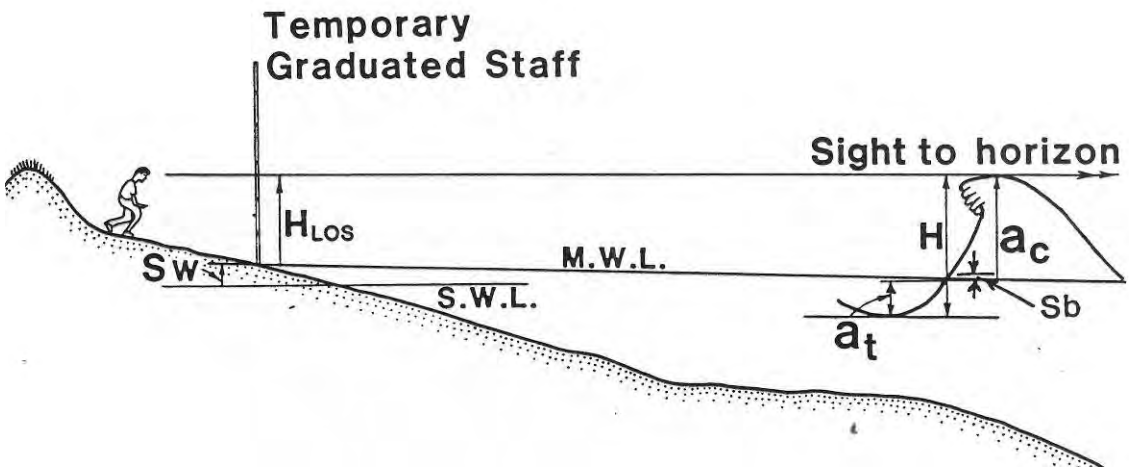

Illustration C.1 Wave height measurement

This measured wave crest height does not include the wave trough (a_t) that extends below mean sea level, or the slight setup of the water level at the beach (S_w). It is thus less than the total wave height. It has been shown that the wave crest height as measured by this line of sight method (HLOS) is about 0.7H.

However, the waves will vary in height at a given place over time and also spatially as the observer looks at different places along the beach at a given time. It is necessary to get an average wave height by following the measurement procedure for about 5 minutes and averaging the crest heights measured. Alternatively, it has been found that the average is about 0.65 times the maximum wave crest height measured over about 5 minutes.

Therefore, we can adopt as the mean value of the trough to crest wave height H:

$H = (0.65\ H_{max})/0.7 = 0.93\ H_{max}$

This wave height has been shown to correspond reasonably closely with the breaking significant wave height.

C.2.2 Longshore Current (V)

The longshore current needed is the movement of water along the shore in the surf zone between the wave break point and the beach. It can be measured by throwing a suitable float into the surf zone and measuring how far it travels along the beach in a given time. The float needs to be one that is a bit submerged so it doesn't wash too quickly back to the beach in the waves.

A float can be made from a piece of hardwood or a plastic pipe partly filled with sand and with the ends blocked. It needs to be of a shape and size that can be thrown far enough into the surf zone to measure the average current. Some have even been cast using a fishing rod where the surf zone is very wide.

It is OK to throw the float to the outer part of the surf zone and let it wash back across the surf zone over a few minutes.

Measure the distance along the beach (D metres) in one minute and get the current as:

$V = D/60$ (m/s)

Note that there are sometimes rips that would carry the float out to sea. These should be avoided. Also, it helps to retrieve the float by attaching it to a hand held fishing line. The line actually helps a little in getting the average current.

C.2.3 Longshore Sand Transport (S)

By taking the measurements every day and using the formula for S (which gives cubic metres per day), the amount of sand being transported along the beach can be accumulated over time. The seasonal patterns can be identified, as can the rate per year. Each year will be a bit different, so really useful results need to be extended over a number of years.

If the measurements are made only once per week, then the formula for S needs to be multiplied by 7 to determine the transport rate for the week. However, this is not as accurate because it will not identify the variability during the week when the measurements are not being made. It has been found that a large proportion of the sand transport can occur in just a few days when the waves are high and the current strong. Missing those days will cause a significant error in the total rate for the year.

Appendix D

Appendix D - Community Reference Group Terms of Reference

Aims

- To provide a forum for discussion and exchange of information on topics related to the preparation of the Ballina Shire Coastline Management Study and Management Plan.
- To assist the Ballina Shire Council to identify issues related to the preparation of the Ballina Shire Coastline Management Study and Management Plan.
- To act as a feedback mechanism between stakeholders and the Ballina Shire Council.
- To provide recommendations to the Ballina Shire Council Group Manager, Civil Services for analysis and report to Council.

Terms of Reference

The functions of the Ballina Shire Coastline Management Study and Management Plan Community Reference Group and its technical advisers are to:

- Meet regularly as required to provide input on the project.
- Represent the needs and interests of members or member groups as well as considering the needs and interests of other stakeholders within the broader community.
- Identify any emerging issues related to the project.
- Consider technical reports and other information related to the project that are provided by Ballina Shire Council, its technical advisers and its members or member groups.
- Assist the Ballina Shire Council in its endeavours to maintain an appropriate community consultation program during ongoing development and implementation of the various components of the project.
- Assist Ballina Shire Council to maintain an adequate record during the project development and implementation process and make the record publicly accessible.
- The group will report to the Manager of Council's Civil Services Group.

Role of the Community Reference Group

The role of the Community Reference Group is consultative. The group will share ideas and information in order to assist Council in the formulation of the Ballina Shire Coastline Management Study and Management Plan. All contributions from the group will be considered in light of the objectives of the project and statutory and policy requirements.

Community Reference Group Membership

Invitations for membership of the Community Reference Group will be forwarded by Ballina Shire Council. Additional requests for membership will be required in writing to the General Manager, Ballina Shire Council.

Nominees may represent local organisations, government agencies and interest groups, but individuals may also nominate.

The Community Reference Group will include technical staff from the project team. Ballina Shire Council may identify the need for additional input from other stakeholder groups. Ballina Shire Council may arrange for additional invitations for membership or may arrange for guests to provide specialist advice from time to time.

Appendix E - Community Information Flyers

COMMUNITY PARTICIPATION

Community participation will be an important part of the development of both the Coastline Management Study and the Coastline Management Plan.

Stage 1 – Coastline Management Study – Values and Issues Assessment
Before management objectives and options to reach those objectives can be set, the project team needs a good understanding of the issues and values held by the community regarding the Ballina coastline. These issues and values are likely to be ecological, aesthetic, cultural, recreational, social and economic in nature.

Stage 2 Coastline Management Study – Management Objectives and Options Assessment
The Coastline Management Study will set out management objectives, and options to meet those objectives, in response to the coastal hazards (identified in the Hazard Definition Study), the community issues and values (identified in Stage 1 above), and the NSW Coastal Policy.

Stage 3 – Coastline Management Plan
This plan will result from the prioritisation of management options and the adoption of those most preferred in achieving the management objectives and resolving the identified issues.

HOW TO GET INVOLVED

A series of open days and workshops will be held as part of each of the stages listed above. Ballina Council has initiated a Community Reference Group to assist with this coastline management project, however, the open days and workshops will ensure the whole community has the opportunity to participate in the development of the plan.

Further project information can also be accessed via Ballina Shire Council's website at www.ballina.nsw.gov.au

If you would like to be informed directly of opportunities to contribute, or you already have some comments or ideas about the coastline of Ballina Shire, please get in touch with the project team via the following details.

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Coastal Zone Management Plan for the Ballina Shire Coastline
0766-100x

Ballina Shire Coastline Management Study and Management Plan

NSW Government DEPARTMENT OF NATURAL RESOURCES

ballina

INTRODUCTION

Ballina Shire Council is developing a Coastline Management Plan, and welcomes community participation in the process.

The plan needs to consider coastal hazards such as erosion and storms, balance short-term priorities with long-term actions, and accommodate the full range of social, economic, recreational, ecological and aesthetic values held by the community.

OUTLINE OF THE PLAN

The Ballina Coastline Management Plan, when developed, will make provision for:

- Protecting and preserving beach environments and beach amenity;
- Emergency actions during periods of coastal storms and beach erosion;
- Managing longer term erosion threats; and
- Ensuring continuing public access to beaches and headlands, particularly where public access is threatened.

The plan must respond to the issues raised in the recently completed Ballina Coastline Hazard Definition Study. This study has highlighted coastal erosion threats, both short-term beach erosion and longer-term shoreline recession.

Work with us on the future of our coast

Mayor, Councillor Phil Silver

"We have a wonderful stretch of coastline in the Ballina Shire, and we want to make sure it is protected into the future. Our coast has a wealth of assets and is used, not only by Ballina Shire residents, but also by visitors from far and wide. The combination of increasing pressure associated with a growing population and the ever-present threats associated with erosion and storm activity mean we cannot sit back and take our coastline for granted."

"Council is working with the State Government, under the framework of the NSW Coastal Policy, to ensure that our coastline remains a valuable asset for all future generations. Consultants, GeoLINK and WBM Oceanics, will continue the work started by Council to produce a Management Plan that balances short and long term actions and deals with the issues of continued use and protection of our coastline."

BACKGROUND

Ongoing concern regarding coastal erosion threats to property and infrastructure in the Shire has prompted various coastal erosion investigations and structural works. This has included a Beach Management Plan for Lennox Head.

In 1999, Ballina Shire Council commenced a program, advocated by the NSW Coastal Policy, to formalise management of the Shire's coastline. To date, this has included:

Ballina Coastline Hazard Definition Study – Completed by WBM Oceanics in 2003, this study describes the Shire's prevailing coastal processes and coastal hazards, and will directly inform the Ballina Coastline Management Plan.

Ballina Coastline Interim Measures and Action Plan – This interim plan was completed in 2005 and deals with threats to development and emergency responses in regard to immediate coastal hazards (e.g. severe storms) and will guide Council with development applications in the erosion hazard zones until the final Coastline Management Plan is implemented. Development Control Plan No. 17, Coastal Hazard Protection, Lennox Head resulted from this study.

The Ballina Coastal Reserve Plan of Management – This plan was finalised in 2003 and rationalises all Crown Lands and Crown Reserves into a single Coastal Crown Reserve for the purpose of Public Recreation and Coastal Environmental Protection.

THE DEVELOPMENT OF A COASTLINE MANAGEMENT PLAN

Development of the Ballina Coastline Management Plan will be guided by the Coastline Management Manual, established under the NSW Coastal Policy. This process ensures social, economic, recreational, aesthetic and ecological issues are considered along with coastal hazards.

Ballina Council has completed the first two steps required by the manual, namely the establishment of a Coastline Management Committee (this has been superseded with a Community Reference Group) and the preparation of a Hazard Definition Study (described above).

The next step is to prepare a Coastline Management Study. This study will establish management objectives and consider all the feasible options to meet those objectives, with regard to social, economic, recreational, aesthetic and ecological issues and coastal hazards.

The Coastline Management Plan then defines the best combination of options outlined in the study in order to achieve the objectives.

A draft of the Coastline Management Plan will be available for public comment before it is submitted to the Minister for Natural Resources for approval and gazettal, and the actions begin to be implemented

Aerial image source: Plateau Images. Note: indicative map only.

THE STUDY AREA

The study area extends from the boundary with Byron Shire Council at the northern end of Seven Mile Beach, to the boundary with Richmond Valley Council near Boundary Creek, south of Patches Beach. It includes the beaches of Seven Mile, Boulder, Sharps, Angels, Shelly and Lighthouse north of the Richmond River and South Ballina, Beswicks, Robins and Patches Beaches south of the river. It includes the headlands, bluffs and adjacent rocky shores and rock platforms of Lennox Headland, Iron Peg, Skennars Head, Black Head and Ballina Head.

This study area includes the southern part of the Cape Byron Marine Park, from the Ballina-Byron Shire boundary to Lennox Head.

The width of the study area is variable, and includes both marine and terrestrial areas around the shoreline. The terrestrial area may extend beyond the influence of coastal hazards and features such as beaches, dunes, headlands, marine derived water bodies and their surrounds to include lands within which existing or proposed human activities may impact on the shoreline or its immediate environment. Similarly, while the marine area is not subject to Council's planning control, it is important to consider marine processes, submerged lands and existing and proposed human activities that may impact on the shoreline and its immediate environment.

GeoLINK environmental management and design
BMT WBM
Coastal Zone Management Plan for the Ballina Shire Coastline
0766-100x

Ballina Shire Coastline Management Study and Management Plan

Newsletter No 2 November 2006

NSW Government
DEPARTMENT OF NATURAL RESOURCES

ballina

INTRODUCTION

Ballina Shire Council is preparing a Coastline Management Plan that will apply to the entire shire coastline. The plan will:

- consider coastal hazards such as erosion and storms;
- balance short-term priorities with long-term actions; and
- address the full range of social, economic, recreational, ecological and aesthetic values held by the community.

This is the second newsletter in a series that will keep residents of Ballina Shire informed of the development of the plan. The first newsletter, and further information about the plan, is available on Council's website http://www.ballina.nsw.gov.au/cmst/ballina003/nova.asp (look under 'environment' on the left-hand side of the homepage).

VALUES ASSESSMENT

One of the initial tasks in preparing the Coastline Management Plan is to identify the 'values' held by the community in relation to Ballina Shire's coastline. The term 'values' is very broad and includes:

- maintenance of the 'character' of certain areas;
- protection or improvement of the natural environment;
- ensuring public safety;
- provision of recreational amenity;
- protecting Aboriginal and European heritage;
- controlling access to minimise environmental impact; and
- sharing coastal areas appropriately among all users.

Ballina Shire Council has developed a series of DRAFT Precinct Plans as part of the Ballina Shire Coastal Reserves Plan of Management. These plans tailor the management of parts of the coastline to the needs of the community and the environment (i.e. the values) identified for that specific area.

Many members of the community have already contributed a great deal of their time highlighting values to Ballina Shire Council through the Precinct Plans process. The information provided overleaf includes very brief summaries of the values expressed by the community for each precinct.

NEXT STEPS

Once all of the community's values have been identified, they will be considered in relation to the coastal erosion hazard issues that were identified by WBM in the Ballina Coastline Hazard Definition Study (available on the Ballina Shire Council website). This will lead into the next stage of the Coastline Management Study where management objectives will be identified for the values / issues, based on our understanding of coastal hazards.

COMMUNITY INPUT

What do you think? Do the values outlined **overleaf** include your concerns and ideas? To ensure that the Coastline Management Plan is representative of the whole community, anyone who has concerns or ideas about the Ballina coastline should get in touch with the project team via the details below.

Also, the project team will be available to **meet with the public** and discuss the plan between **9am and 12pm** on **Saturday 18 November** near the pedestrian traffic lights on River Street in Ballina.

A Community Reference Group, made up of a broad range of community members involved in the coast, is providing community input into the project, however, it is important that everyone has an opportunity to contribute. Please take the time to talk to the Project Team on 18 November or send us your thoughts.

GET INVOLVED

If you would like to contribute to the management of Ballina's coastline, please contact the project team.

Rob van Iersel, Project Manager
T 6687 7666 (GeoLINK)
F 6687 7782 (GeoLINK)
E coastlinemanagement@geolink.net.au

Ballina Coastline Management Plan
PO Box 9, Lennox Head,
NSW 2478

SUMMARY OF VALUES IDENTIFIED IN THE BALLINA SHIRE COASTAL RESERVES PRECINCT PLANNING PROCESS

South Ballina Beach and Patches Beach

South Ballina Beach and Patches Beach were not considered under the precinct planning process. The Department of Lands is currently finalising the *Pied Oyster Catcher Threatend Species Management Strategy* for this important area of the bird's habitat. This process has identified a number values including 4WD access, horse riding and pipi gathering. Please get in touch with the project team to express your values for this part of the coast.

PROJECT CONSULTANTS

WBM OCEANICS AUSTRALIA

GeoLINK environmental management and design

Precinct One

- Retain the remote character of the area.
- Control use of the beach by dogs, horses, 4WD vehicles, and commercial activities.
- Implement dune stabilisation and revegetation works.
- Recognise and promote importance of Aboriginal heritage in the area.

Precinct Two

- Protect beach and dunes from stormwater erosion in front of Lennox Head village.
- Protect dunes and vegetation with rehabilitation, community education, and access control.
- Rehabilitate degraded tracks on Lennox Headland.
- Enforce prohibition of dogs and horses on all Precinct 2 beaches.
- Provide improved parking facilities at Lennox Point Surf Break carpark, Pat Morton Lookout and along Pacific Parade.

Precinct Three

- Protect beach from stormwater erosion, particularly at north end of Sharpes Beach around The Coast Road pedestrian underpass.
- Protect native vegetation and control erosion along foreshore paths.
- Formalise pedestrian access, and control 4WD access, to Sharpes Beach.
- Upgrade surf-life saving and public amenity facilities at Sharpes Beach.
- Improve traffic safety at entrances to car parks.

Precinct Four

- Construct interpretive trails radiating from Flat Rock Tent Park, to the sand 'Knoll' to the west and to the wetland area to the south.
- Up-grade parking and traffic facilities at Angels Beach and Black Head rock platform.
- Prepare locality plans identifying amenities up-grades at Black Head, Angels Beach and Flat Rock.
- Control erosion of tracks.
- Conserve native vegetation.
- Regulate dogs, horses, 'off road' and commercial activities in the precinct.

Precinct Five

- Ensure good water quality and access in Shaws Bay.
- Rationalise and formalise pedestrian beach access paths.
- Develop and implement detailed plans for facilities at Shaws Bay, Pop Denison Park, Shelly Beach and South east Finger Shaws Bay.
- Enforce issues relating to off-road vehicles, dogs, horses and commercial activity.

UPR 766580

Ballina Shire Coastline Management Study and Management Plan

Newsletter No. 3 May 2008

Council is seeking your input on the future of our coast

Introduction

Ballina Shire Council is working with the NSW State Government to develop a management plan that will ensure the Ballina coastline continues to provide the ecological, cultural, recreational and economic benefits residents and visitors currently enjoy. The project has reached a point where Council is now seeking the community's view in relation to the Ballina Coastline Management Study, and you are encouraged to provide comment.

Mayor's Foreword

Mayor, Councillor Phillip Silver

Ballina's coastline is a vital part of the culture, identity and economy of this area – residents enjoy it every day, and each year thousands of visitors are attracted to the area to experience our coastline. Our challenge is to manage threats to our coast in a way that will maximise the benefits for the whole community. Please do your part to ensure future generations will continue to enjoy our beaches and foreshores by having your say on the future management of our wonderful coastline. Please comment during the exhibition period.

Coastline Values

Ballina Shire Council has been working with consultants GeoLINK and BMT WBM, and community representatives, on the preparation of the Ballina Coastline Management Study. Part one of the study, the Values Assessment, identifies the ecological, cultural, heritage, recreational, and economic values of the Ballina coastline. It answers the question – what aspects of the coast are important to the community and for what reasons?

Coastline Erosion

The Ballina Coastline Hazard Definition Study (WBM, 2003) found that the Ballina coast is subject to three forms of erosion:

- Short term storm erosion (associated with major storm events, sometimes called 'storm bite');
- Long term erosion (associated with differences in the amount of sand entering and leaving beach 'compartments' as it moves northwards along this stretch of coast), and
- Climate change shoreline recession (associated with water encroaching inland as sea levels rise).

These processes occur naturally on most coastlines and only become problematic when they threaten coastal values, generally as a result of development near the coast.

Please turn over

Please turn over

Coastline Management Options

Part two of the Ballina Coastline Management Study, the Management Options Assessment, identifies where coastline values may be under threat from coastline erosion. It outlines the various means (e.g. seawalls, beach nourishment etc.) by which these erosion threats might be managed in order to protect values and suggests a preferred approach for each of Ballina Shire's beaches.

Community Consultation

Council recognises the coastline is important to the whole community for many different reasons. Therefore, the Ballina Coastline Management Study (Part One and Part Two) is on public exhibition between Thursday 29 May and Friday 27 June 2008. During this time Council's consultants, GeoLINK and BMT WBM, will be available at a Community Open Day in Lennox Head to discuss the management study and the project.

Coastline Management Plan

The Ballina Coastline Management Plan will be prepared following the exhibition of the management study. The management plan will draw on advice from the community, Ballina Shire Council and the NSW Government, as well as feedback from the exhibition of the Ballina Coastline Management Study. It will present a strategic plan for the implementation and funding the preferred management options for each beach in Balina Shire. This plan will also be publicly exhibited, but now is the ideal time to have your say about the Ballina Coastline Management Study which underpins future work on the project.

GeoLINK environmental management and design BMT WBM

Have your say

Review documents

All key documents are available on-line at www.ballina.nsw.gov.au (search for 'Coastline Management') and hard copies are available at Council's Community Access Points.

Community Open Day

GeoLINK and BMT WBM will be hosting a Community Open Day in Lennox Head on Saturday 14 June 2008 between 9am and 1pm at the Lennox Boulevard (near the newsagency). Interested members of the community are encouraged to attend.

Contact the project team

You can provide comments and advice at the Community Open Day or directly to GeoLINK via
telephone: 6687 5807,
email: coastlinemanagement@geolink.net.au
post: PO Box 9, Lennox Head, NSW, 2478.

Appendix F – Emergency Action Subplan for Coastal Erosion

Ballina Shire Coast

Emergency Action Subplan for Coastal Erosion

Introduction

1.1 Scope

This Emergency Action Subplan for Coastal Erosion (EAS) details actions to be carried out by Ballina Shire Council (Council), in response to a coastal erosion emergency event (refer glossary). A coastal erosion emergency event is defined as a situation in which:

- beach erosion is imminent, is occurring, or has occurred; and
- this beach erosion endangers, or threatens to endanger, the safety or health of people or destroys or damages, or threatens to destroy or damage, any property and which requires a significant and coordinated response.

In addition to erosion, inundation of land and property due to wave overtopping dunes due to large swell conditions and/or diminished dune profiles may also be secondary effect of a coastal erosion emergency.

The purpose of this EAS is to outline Council's intended actions before, during and after a coastal erosion emergency. The emergency may or may not have triggered Ballina Shire Council's Disaster Management Plan (DISPLAN) or the NSW State Storm Plan.

Note that the term "coastal erosion emergency event" in the context of this EAS is limited to hazards associated with beach erosion, and does not include events such as tsunamis or maritime emergencies. Also, Council at this time does not have a Local Emergency Management Plan prepared to the new EMPLAN format, and accordingly this EAS refers to the current DISPLAN.

The application of this EAS extends to the single coastal Crown Reserve north of the Richmond River having the appointment of Ballina Shire Council as the Reserve Trust Manager.

1.2 Background

Coastal erosion emergency events 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. Coastal erosion emergency events may also occur under relatively benign conditions where, due to the significant lowering of a beach profile as resulting from natural processes, waves are able to scour the back beach erosion escarpment resulting in landward recession of the escarpment. Coastal erosion and or inundation may exacerbate risk to development, infrastructure, and/or persons.

The key responsibilities of Council in managing coastal erosion emergencies are described with reference to the responsibilities of the other state emergency management authorities under the NSW State Storm Plan.

Once implemented, the long-term coastal hazards management actions outlined in the Coastal Zone Management Plan for the Ballina Shire Coastline (CZMP) (GeoLINK/BSC, 2015) are intended to reduce the threat of beach erosion and coastal inundation hazards in the Lennox Head village area. However, even once all these works are in place, management of risk to persons, coastal infrastructure, and beach access points associated with coastal erosion emergencies will be an ongoing responsibility of Council.

1.3 Consultation

This EAS has been reviewed by the NSW Office of Environment and Heritage (OEH) and the NSW State Emergency Service (SES) and has also undergone consultation with the public and local emergency services.

Public consultation has been undertaken with public exhibition of the EAS by Council during 28 July 2012 to 24 August 2012. There were no responses received by Council as a result of the public exhibition process.

Furthermore local emergency services were briefed regarding the contents of the EAS at the Ballina Local Emergency Management Committee (LEMC) meeting of 1 August 2012. A copy of the EAS was provided to the emergency services with opportunity for feedback during the public exhibition process. The service authorities and organisations in attendance during the LEMC briefing were: Ambulance Service, Australian Red Cross, Ballina Hospital Health Services, Department of Human Services, Department of Primary Industries, Fire and Rescue, Marine Rescue, Rural Fire Service, State Emergency Service and WorkCover. No responses were received from the local emergency services other than the SES where the plan was endorsed without need for change. Minor comments from OEH have been incorporated into the plan.

A Councillor Update of August 2012 considered the plan adopted as a result of no submissions being received .

1.4 Planning and Legislative Framework

This EAS has been prepared in response to a Direction issued by the Minister for Environment and Heritage under Section 55B of the Coastal Protection Act, 1979 (the CP Act) and as an integral component of the NSW coastal zone management planning process. This direction covers the Lennox Head area only, however this EAS has been prepared for the entire Ballina Shire coastline. This EAS details Council's response to a coastal erosion emergency in Ballina Shire, with particular reference to Section 55C(1)(b) and 55C(2)(a) of the CP Act.

In accordance with the CP Act, this EAS is consistent with plans prepared under the State Emergency and Rescue Management Act 1989 (SERM Act). The EAS provides additional detail not found in the Ballina Shire Local DISPLAN and the Ballina Shire Flood Emergency Sub Plan regarding Council's intended response to a coastal erosion emergency event. Also, this EAS details Council's intended response to an emergency which does not trigger the implementation of the DISPLAN.

At this stage Council does not have a Local Emergency Management Plan prepared to the new EMPLAN format, and accordingly this EAS refers to the current DISPLAN.

1.5 DISPLAN and Non-DISPLAN Events

The broad responsibilities of Council in response to a coastal erosion emergency event are determined by the presence or absence of a "severe weather warning" issued by the Bureau of Meteorology (BoM). If a warning has been issued the event is referred to as a DISPLAN event, otherwise it is referred to as a non-DISPLAN event.

DISPLAN Events

Issuing of a BOM severe weather warning triggers involvement of a number of agencies in accordance with plans made under the SERM Act. In the Ballina Shire these plans include the Local DISPLAN and the Flood Emergency Sub Plan. Under a DISPLAN event, the SES is the lead response agency with Council implementing the actions under this EAS, and any relevant actions under the DISPLAN and Flood Emergency Sub Plan, under the direction of the lead response agency, the SES.

The full extent of various agencies' responsibilities after a severe weather warning has been issued by BOM is found in the Ballina Shire Council DISPLAN and the Flood Emergency Sub Plan.

Non-DISPLAN Events

As described under Section 1.2 above, coastal erosion emergency events are most likely to arise under severe storm conditions which would generally trigger the issuing of a BOM severe weather warning in turn triggering the involvement of the SES as the lead response agency.

However, remotely formed large swells can result in severe coastal hazards with little warning and under benign local conditions, especially if they are combined with high spring tides and imposed on beaches with temporarily diminished sediment profiles. Similarly, severe erosion may occur even on only a small to moderate swell where a beach or local beach area has a severely depleted sediment profile. In such circumstances it is possible for a coastal erosion emergency event to occur in the absence of a severe weather warning, in which case Council is the lead response agency in accordance with this EAS.

In the absence of a severe weather warning the SES are not formally mobilised under the SERM Act. However, at their discretion, the SES may still be able to provide assistance if requested to do so by Council.

Specific severe weather warnings relevant to coastal erosion

When a coastal erosion emergency is imminent or is occurring in the *absence* of a BoM severe weather warning, the preferred approach under this EAS is for the BoM to issue a severe weather warning relevant to coastal erosion, thereby triggering the SES as lead response agency. This process may be initiated by Council convening a meeting with the NSW Office of Environment and Heritage (OEH), the SES and BoM to request that the BoM issue a severe weather warning for the purposes of the SES adopting the role of lead response agency. If a severe weather warning is issued by BoM then the SES adopts the role of the lead response agency and Council is no longer responsible for managing the response, however Council is still responsible for implementation of this EAS and actions as required under the DISPLAN and the Flood Emergency Sub Plan.

Having the SES as the lead response agency is the preferred approach given Council's statutory limitations for the evacuation of people, and the capacity and expertise of the SES in conducting such actions.

Illustration 1.1 provides a flowchart of the process for establishing the lead response agency during an emergency.

Section 2 below describes the key roles and responsibilities during a coastal erosion emergency.

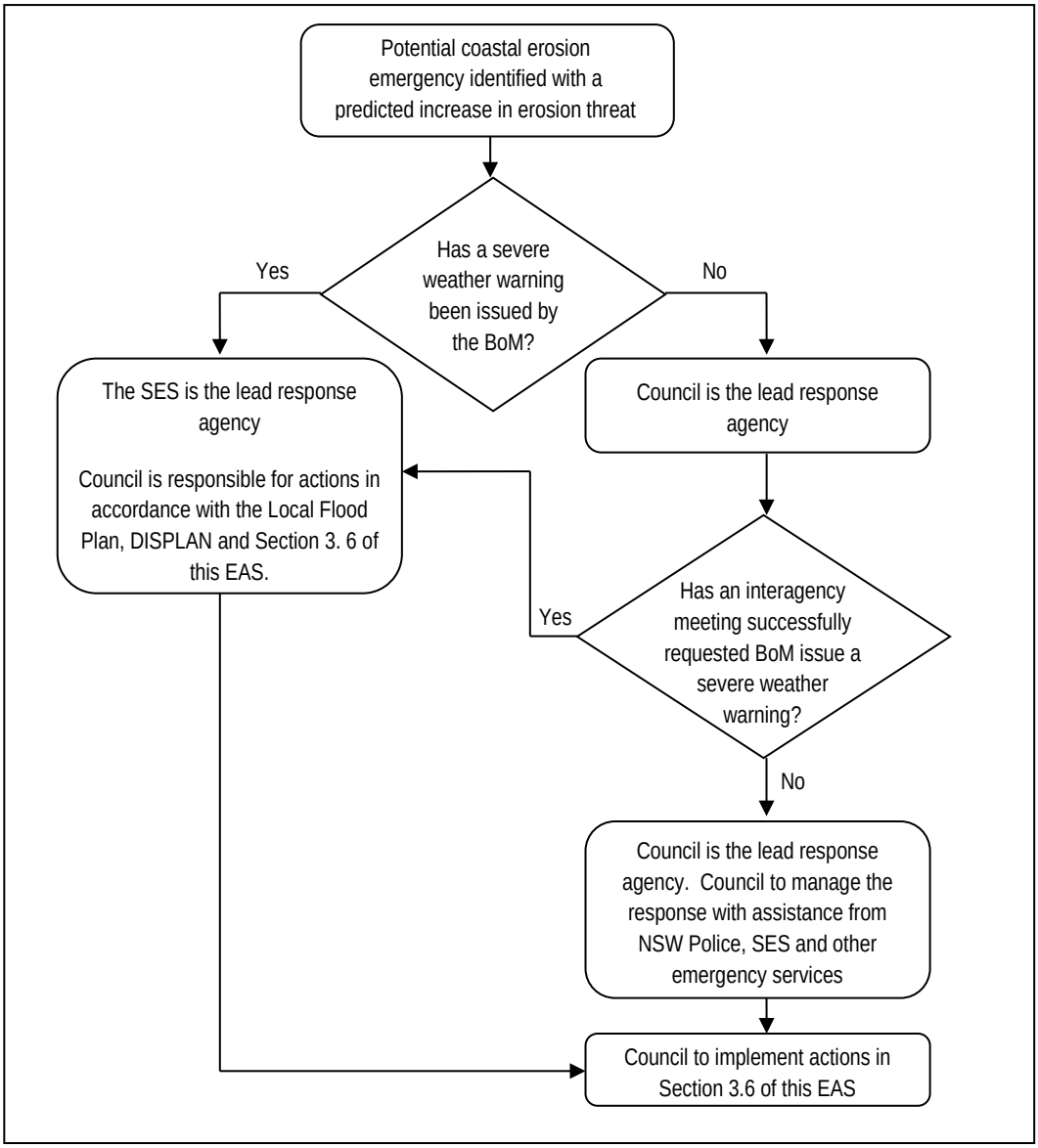

Illustration 1.1 Flowchart of establishment of lead response agency

1.6 Coastal Protection Works

Irrespective of whether Council or the SES is the lead response agency, Council has the prime responsibility and authority to implement coastal protection works subject to first gaining relevant approvals under the *Environmental Planning and Assessment Act, 1979*. Whilst the SES and Police have statutory powers to implement actions under the *State Emergency and Rescue Management Act 1989,* neither the SES nor the Police are generally authorised to undertake coastal protection works, however they may respond to a Council request for assistance in this regard at their discretion.

Refer to Section 3 for brief discussion on the limitations surrounding the extent and nature of coastal protection works that Council is able to install under this EAS, subject to first gaining relevant planning approvals.

Roles and Responsibilities

2.1 Roles and Responsibilities During Coastal Erosion Emergency Events

Six major agencies have roles and responsibilities during coastal erosion emergency events:

- Commonwealth Bureau of Meteorology (BoM);
- State Emergency Service (SES);
- Ballina Shire Council (Council);
- Office of Environment and Heritage (OEH);
- NSW Police Force; and
- NSW Ambulance Service.

Section 1.5 describes the process by which the SES or Council adopts the role of lead response agency, which is primarily influenced by the BoM issuing a severe weather warning.

The following tables outline the roles and responsibilities of agencies and Council in response to a coastal erosion emergency event. Table 2.1 outlines the broad roles and responsibilities between Council and the State Emergency Service and how they are distributed in relation to the presence or absence of a BoM severe weather warning. Table 2.2 outlines the roles and responsibilities of the six major agencies prior to or in the absence of a severe weather warning.

The roles of Council staff are presented in Tables 3.1 to 3.3 in Section 3. 6.

Table 2.1 Broad responsibilities in response to a coastal erosion emergency event with respect to the issuing of BoM severe weather warnings

<table>
<tr><th>Responsibility</th><th>Severe weather warning issued</th><th>No severe weather warning issued</th></tr>
<tr><td>Manage access to beaches, car parking areas and roads including closure if necessary</td><td rowspan="2"><u>Council</u> responsibility</td><td rowspan="3"><u>Council</u> responsibility
▪ Council, in cooperation with and supported by NSW Police, and possibly SES*, is the lead response agency</td></tr>
<tr><td>Implement coastal protection works</td></tr>
<tr><td>Disseminate warnings locally</td><td rowspan="3"><u>SES</u> responsibility
▪ SES is the lead response agency and acts in accordance with Ballina Shire DISPLAN and the Ballina Flood Emergency Sub Plan</td></tr>
<tr><td>Prevent entry of water to buildings</td><td></td></tr>
<tr><td>Evacuate residents and remove critical contents</td><td><u>Police, and possibly SES*,</u> as requested and assisted by Council</td></tr>
</table>

* Note: In the absence of a BoM warning, the SES, at their discretion, may assist Ballina Shire Council upon request.

Table 2.2 Agency responsibilities during a coastal erosion emergency event before or in the absence of a BoM warning (Council is lead response agency).

Agency	*Trigger for action*	*Responsibilities*
Bureau of Meteorology	Identification of damaging waves	▪ Monitor weather; and ▪ Issue warnings as appropriate.
Ballina Shire Council	Coastal Erosion Emergency event imminent or occurring	Council is lead response agency. ▪ Monitor and evaluate the coastal erosion escarpment at critical locations, sea and beach conditions as appropriate ▪ Manage access to beaches, car parks and roads including authorisation and application of closures if necessary; ▪ Implement coastal protection works as required and in accordance with relevant approvals; ▪ Implement the EAS communication strategy including dissemination of warnings; ▪ Prevent entry of water to buildings; and ▪ Request assistance from NSW Police and the SES if required (generally for evacuation of residents and enforcement of road closures, but may extend to other tasks).
NSW Police	Request for assistance from Council or SES*, or in response to emergency calls	▪ Evacuate residents and remove critical contents; and ▪ Enforce closures of roads, car parking areas, beach accesses and reserves
Office of Environment and Heritage	Request for assistance from Council	▪ Assist in the monitoring and evaluation of the coastal erosion escarpment, sea and beach conditions as appropriate ▪ Advise Council on implementation of hazard mitigation measures.
State Emergency Service	Request for assistance from Council	▪ Assist with evacuation of residents and removal of critical contents; ▪ Assist with closures of roads, car parking areas, beach accesses and reserves; and ▪ Monitor BoM for issuing of warnings.
NSW Ambulance Service	Emergency calls, Request for assistance from Council	▪ Provide medical treatment

* Note: In the absence of a BoM warning, the SES, at their discretion, may assist Ballina Shire Council upon request.

Emergency Actions

3. 1 Introduction

WBM (2003) and BMT WBM (2011) identifies no significant built assets at risk in the immediate beach erosion hazard area (immediate hazard area) throughout the Ballina Shire except for some road infrastructure in the Lennox Head village compartment. Coastal erosion events may, however, result in damage to beach access tracks, walking paths and beach-access points for vehicles and present a risk to the general public and residents of the coastal fringe.

3. 2 Implementation Safety and Other Constraints

The implementation of the actions detailed in 3.6 will be dependent upon a number of factors including:

- workplace health and safety of personnel;
- competing priorities and limited resources;
- obtaining necessary agreements and approvals from landowners such as Crown Lands or relevant State Government agencies; and
- Council budgetary and time constraints.

A key part of the role of the responsible staff members, refer 3.6, will be to consider these factors in order to prioritise actions in response to the extent and nature of each specific event.

3. 3 Lennox Head Village Coastal Erosion Emergency Actions

The potential threats to development in the Ballina Shire from coastal erosion emergency events are primarily located at Lennox Head village and the actions presented in this section relate primarily to this area.

3.3.1 Lennox Head Background

The adopted/intended long-term coastal hazards management response for the Lennox Head management area is one of protection via maintenance, repair and/or installation of coastal protection works. The long-term coastal hazards management strategy for Lennox Head Village are described in the CZMP.

In Lennox Head village, south of Byron Street, 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. If they are maintained appropriately, these measures are expected to provide protection of assets in the case of large coastal erosion events.

North of Byron Street there is a buried rock wall of which the design details are unknown. Council is currently investigating and reporting the features of the buried rock wall as part of actions documented in the CZMP. (Preliminary findings are the buried rock wall has not been engineered to a standard.)

In absence of design details WBM (2003) and BMT WBM (2011) adopted the conservative approach of estimating hazard areas based on a complete absence of any mitigating effects of the buried seawall. The immediate hazard area presented in BMT WBM (2011), a revision of that presented in WBM (2003), is seaward of the Pacific Parade roadway and all structures to the north including the Surf Club building and the Lake Ainsworth Sports and Recreation Centre. The carpark in the vicinity of the Ross Street / Pacific Parade intersection is however located partially inside the Immediate Hazard Area.

Thus, only limited built assets are identified as being under immediate hazard threat, however erosion *may* extend landward of the immediate hazard area under extreme conditions or prolonged erosive conditions.

Under such circumstances Pacific Parade may be damaged with the likelihood damage greatest near Byron Street and decreasing to the north.

Limited oceanic inundation may occur as a result of waves running up and overtopping low dunes and seawalls (WBM 2003). 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.

3.3.2 Practical Planning for Coastal Erosion Emergency Actions

Coastal erosion emergencies are likely to be characterised by little warning, potentially large but unknown threats, adverse oceanic and weather conditions, and intense local and regional demand for materials, plant and expertise. Long-term coastal protection works proposed for Lennox Head under the CZMP comprise large-scale complex structures that are to be designed, approved and installed under a planning and approvals process. The duration of this process will not allow such works to be installed in direct response to a specific coastal erosion emergency. Thus, installation of temporary or permanent coastal protection works under this EAS are limited to:

- Facilitating emergency evacuation of persons
- Maintenance or repair of the Lennox Beach Management Plan coastal protection works (south of Byron Street) in accordance with the approved works designs and only under circumstances where the occupational health and safety of personnel is not compromised.

3.3.2.1 Lake Ainsworth Sport and Recreation Centre to Byron Street

In the event that the buried rock wall is exposed due to beach erosion and damaged such that erosion proceeds landward of the wall, appropriate public risk management actions are to be undertaken in accordance with 3.6. Long-term actions to limit the extent of coastal erosion in this precinct are to be implemented under the CZMP.

No coastal emergency works are proposed for installation in this precinct under this EAS except for any temporary works required to facilitate emergency evacuation.

3.3.2.2 Byron Street to Dress Circle Drive

In the event that the Lennox Head Beach Management Works south of Byron Street (comprising seawalls and constructed dune levee) are damaged during a coastal erosion emergency they may require repair during (should conditions and access arrangements permit), or immediately following the event.

Actions relating to ensuring readiness to deliver coastal emergency works are listed in 3.6.

3. 4 Communication Strategy

The role of Council includes informing the community of Councils intended coastal erosion emergency responses under this EAS via implementation of this communication strategy.

The role of the lead response agency includes:

- advising the community at risk of the problem and actions they should take
- protection of life through the warning and evacuation of residents at risk

Thus it is the responsibility of the Council, via the Local Emergency Management Officer, and the SES to work together, and with other emergency services, to avoid confusion, duplication and inconsistency with respect to messages and warnings. This is critical before any coastal erosion emergency event is even forecast, when one is imminent and during an event.

While local radio will be the most effective and relied-upon medium immediately prior to and during a coastal erosion emergency event, various other media will be useful to disseminate information before and after the event, including:

- This Emergency Action Subplan;
- Council's website;
- Signage and barricades relating to closures;
- Local newspapers;
- Hard copy fact sheets/brochures; and
- Community group contacts.

3.4.1 Preparedness

Prior to a coastal erosion emergency event the main information to communicate will include:

- Conditions that could bring about a coastal erosion emergency event and the risks associated with beach erosion;
- The extent and location of potential threats as per those presented in WBM (2003), BMT WBM (2011) and summarised in the CZMP; and
- Council's proposed response to a coastal erosion emergency event, that is, to publicise this EAS.

3.4.2 Response

When a coastal erosion emergency event is imminent or occurring the main information to communicate will include:

- Contact details for Council, the SES and the Police to request help or further information;
- Weather and beach condition forecasts;
- Likely and current closures of beach access points, car parks, roads and reserves;
- Risks associated with the emergency e.g. collapse of sand dunes, wave overtopping; and
- Ways to minimise risk to personal and public safety e.g. avoid the hazard areas, heed safety warnings, do not interfere with or impede emergency response;

3.4.3 Recovery

Following a coastal erosion emergency event the main information to communicate will include:

- Extent of on-going closures and the likely timeframe for reopening; and
- Debriefing the community on the impacts of the event, the response during the event and further clean-up and repair actions to be undertaken.

3. 5 Critical Beach Access Points and Locations

Section 3.6 outlines a number of actions requiring the monitoring and inspection, and possible closure and repair, of beach access points and key locations. In Lennox Head alone there are 24 formal beach access points, with a further 28 in the remainder of the shire, including two at Robins and Patches beaches.

It is quite possible that a significant number of these beach access points and key locations will be threatened and possibly damaged. Thus, a system of prioritising them for inspection and repair may be necessary in response to the resourcing pressures and time constraints associated with a coastal erosion emergency event.

Allocation of resources will be up to the Local Emergency Management Officer, Engineering Works Manager and the Manager Open Spaces and Reserves based on their professional judgement in light of the nature and extent of each coastal emergency event. However key beach access points and locations requiring particular attention are likely to include the following (with reference to Council's numbering system of beach and bushland access tracks):

- Vehicle beach access point north of the Lake Ainsworth Sport and Recreation Centre (2);
- Vehicle beach access point at the Lennox Head SLSC (7);
- Car park near Ross Street in Lennox Head (8);
- Beach and dune near Byron Street in Lennox Head (16 to 18);
- Vehicle beach access point at the constructed levee south of Byron Street (near 22);
- Path at the southern end of Boulder Beach (38);
- Sharpes Beach car park (41 and 42);
- Shelly Beach SLSC (63); and
- Lighthouse Beach car park (66)

3. 6 Coastal Erosion Emergency Actions Tables

Intended emergency response actions are described in Table 3.1 to 3.3. If the DISPLAN is triggered, emergency response actions will be undertaken at the direction of the combat agency subject to the provisions of this EAS.

Table 3.1 Emergency response actions BEFORE coastal erosion emergency event

Shire Wide actions	Lennox Head North of Byron Street	Lennox Head South of Byron Street
General Manager ▪ Appoint Local Emergency Management Officer (LEMO) ▪ Appoint Coastal Response Team comprising: - General Manager; - LEMO; - Legal Officer; - Engineering Works Manager; - Manager Open Spaces and Reserves; and - any other staff members considered necessary to develop effective responses to coastal erosion emergency events Local Emergency Management Officer ▪ Implement coastal erosion emergency communication strategy (refer Section 3.4). ▪ Regularly monitor coastal weather conditions and forecasts. ▪ Regularly monitor beach conditions for erosion or potential erosion areas (as evidence by lowered beach profiles). Engineering Works Manager ▪ Maintain supplies (or access to supplies via stockists) of barricades, temporary fencing and signage as necessary for road and beach access closures, and general management of response to events. ▪ Maintain plant and staff necessary to implement closures. ▪ Identify and engage as necessary an experienced coastal/geotechnical engineer to provide timely advice during coastal erosion emergency event.	Manager Open Spaces and Reserves ▪ Regularly monitor beach conditions and access points for public risk.	Manager Open Spaces and Reserves ▪ Regularly monitor beach conditions and access points for public risk. Engineering Works Manager ▪ Regularly monitor condition of seawalls and levee south of Byron Street for structural adequacy and public risk. ▪ Establish and maintain arrangements with land owners to maximise access over private property to repair seawalls and levee south of Byron Street. ▪ Ensure planning approvals are in place to allow for the repair of the seawalls and levee south of Byron Street.

Table 3.2 Emergency response actions DURING coastal erosion emergency event

Shire Wide actions	Lennox Head North of Byron Street	Lennox Head South of Byron Street
Local Emergency Management Officer ▪ Notify Coastal Response Team of event coordinate Coastal Response Team and interagency meetings as required. ▪ Control and authorise closure of roads, car parking areas, beach access points and reserves under advice from Engineering Works Manager and Manager Open Spaces and Reserves as appropriate. ▪ Liaise with managers of Surf Life Saving Club and Lake Ainsworth Sport and Recreation Camp to monitor threats to their assets. ▪ When Council is lead response agency, coordinate Council staff, Police and SES* to – disseminate warnings and implement communication strategy, – close beach access points, car parks, roads and reserves, and – evacuate residents and remove critical contents. Engineering Works Manager ▪ Monitor and assess where roads and car parking areas may be unsafe and implement closures as necessary. ▪ Assist Manager Open Spaces and Reserves with closures of beach access points and reserves if necessary. ▪ Manage the safe disconnection of water and sewer services where necessary, and liaise with electricity service providers regarding disconnection where necessary. ▪ Where access is required to facilitate emergency actions or actions under the direction of the lead response agency, implement necessary temporary access works. Manager Open Spaces and Reserves ▪ Monitor and assess where beach access points and reserves may be unsafe and implement closures as necessary.	Engineering Works Manager ▪ Monitor potential dangers associated with exposure of buried rock wall of limited design north of Byron Street and assess for public risk. ▪ When Council is lead response agency, coordinate Council staff, Police and SES* to sandbag to prevent entry of water to buildings.	Engineering Works Manager ▪ Monitor condition of seawalls and levee south of Byron Street for structural adequacy and public risk. ▪ Coordinate repair of seawalls and levee south of Byron Street in accordance with planning approvals and within the constraints of Workplace Health and Safety and access over private land ▪ When Council is lead response agency, coordinate Council staff, Police and SES* to sandbag to prevent entry of water to buildings.

* Note: In the absence of a BoM warning, the SES, at their discretion, may assist Ballina Shire Council upon request

Table 3.3 Emergency response actions AFTER coastal erosion emergency event

Shire Wide actions	Lennox Head North of Byron Street	Lennox Head South of Byron Street
Local Emergency Management Officer ▪ Control and authorise reopening of roads, car parking areas, beach access points and reserves under advice from Engineering Works Manager and Manager Open Spaces and Reserves as appropriate. ▪ Formally document and record coastal erosion and response measures. ▪ When Council is lead response agency, coordinate Council staff, police and SES* to disseminate end of warnings, and return residents and critical contents. ▪ Implement Communication Strategy Engineering Works Manager ▪ In conjunction with Local Emergency Management Officer, inspect and assess roads and car parking areas for damage and public risk. ▪ Manage prioritised repair and reinstatement of damaged roads and car parking areas. ▪ Manage prioritised repair and reinstatement of damaged services. ▪ Provide documentary evidence of coastal erosion escarpment and response measures to Local Emergency Management Officer. ▪ Assist Manager Open Spaces and Reserves with clean-up and reinstatement of beach access points and reserves (e.g. removal of large items with plant). ▪ Review EAS to ensure it achieved its performance objectives and revise it to address any identified shortcomings. Manager Open Spaces and Reserves ▪ Assess public risk associated with erosion scarps on beaches and provide and maintain warning signage and bunting as necessary. ▪ Manage prioritised repair and reinstatement of reserves and beach access points in line with long term beach access strategy.	Engineering Works Manager ▪ Inspect for exposure of buried rock wall of limited design north of Byron Street and assess for public risk. Manage restriction of public access and restorative works as necessary. ▪ When Council is lead response agency, coordinate Council staff and SES* to remove sandbags.	Engineering Works Manager ▪ Inspect seawalls and levee south of Byron Street for structural adequacy and public risk. ▪ Coordinate repair of seawalls and levee south of Byron Street in accordance with planning approvals. ▪ When Council is lead response agency, coordinate Council staff, police and SES* to sandbag to prevent entry of water to buildings.

* Note: In the absence of a BoM warning, the SES, at their discretion, may assist Ballina Shire Council upon request.

Glossary

Beach	Has the same definition as the CP Act: *means the area of unconsolidated or other readily erodable material between the highest level reached by wave action and the place where tidal or lake waters reach a depth of 10 metres below Australian Height Datum.*
Beach erosion	The offshore movement of sand from the sub-aerial beach during storms or an extreme or irregular event.
Coastal protection works	Activities or works to reduce the impact of coastal hazards on land adjacent to tidal waters and includes sea walls, revetment and beach nourishment.
Lead response agency	The agency identified in the NSW Emergency Management Plan as the agency primarily responsible for responding to a particular emergency.
CP Act	*Coastal Protection Act 1979*
DISPLAN	The Ballina Shire Council Local Disaster Plan prepared by the Ballina Shire Local Emergency Management Committee in compliance with the *State Emergency and Rescue Management Act, 1989* Section 29(1).
EAS	Ballina Shire Emergency Action Sub Plan for Coastal Erosion
Coastal erosion emergency event	A situation in which beach erosion is imminent, occurring or has occurred, and the beach erosion endangers, or threatens to endanger the safety or health of people or destroys or damages, or threatens to destroy or damage any property and which requires a significant and coordinated response.
Emergency Coastal Protection Works	Emergency coastal protection works are defined under section 4C of the Coastal Protection Act 1979 and that may be placed by or on behalf of a landowner to reduce the impact of beach erosion in compliance with the requirements of that section. Such works are <u>not</u> permitted in Ballina Shire as of 06/06/2012 and outlined in the Code of Practice under the *Coastal Protection Act 1979* (DECCW 2011).
LEMO	Local Emergency Management Officer (refer DISPLAN)
Flood Emergency Sub Plan	Ballina Shire Flood Emergency Sub Plan, SES, 2013
OEH	Office of Environment and Heritage (formerly DECCW – Department of Environment, Climate Change and Water)
SERM Act	*State Emergency and Rescue Management Act 1989*
SES	State Emergency Service
State Storm Plan	New South Wales State Storm Sub Plan – A sub plan of the New South Wales Emergency Management Plan

References

GeoLINK/BSC (2015), *Coastal Zone Management Plan for the Ballina Shire*, prepared for Ballina Shire Council, GeoLINK, Lennox Head, and revised by Ballina Shire Council.

BMT WBM (2011). *Updated Coastal Hazard Areas for Ballina Shire: Stage 1 – Preliminary Update*. Prepared for Ballina Shire Council. BMT WBM, Brisbane.

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