Eurobodalla Open Coast CMP

Stage 1 – Scoping Study

Contact Information

Rhelm Pty Ltd
ABN: 55 616 964 517
50 Yeo Street
Neutral Bay NSW 2089
Australia

Lead Author:
Emma Maratea
emma.maratea@rhelm.com.au

Document Control

Ver	Effective Date	Description of Revision	Prepared by:	Reviewed by:
00	24 March 2021	Working Draft for Council and DPIE Review	Luke Evans Sarah Parton James Davies Courtney Smith	Emma Maratea Sean Garber
01	15 April 2021	Draft Scoping Study got Council and DPIE Review	Luke Evans Courtney Smith	Emma Maratea Sean Garber
02	31 May 2021	Updated Draft Scoping Study	Luke Evans Courtney Smith	Emma Maratea Sean Garber
03	27 July 2021	Final Scoping Study	Luke Evans Courtney Smith	Emma Maratea Sean Garber
04	15 June 2022	Final Scoping Study: Minor Update	Emma Maratea	-
05	2 December 2022	Final Scoping Study: Minor Updates following CMP Public Exhibition	Emma Maratea	-

Prepared For: Eurobodalla Shire Council

Project Name: Eurobodalla Open Coast Coastal Management Plan

Rhelm Reference: J1412

Document Location: C:\Dropbox (Rhelm)\J1400-J1499\J1412 - Eurobodalla CMP\4. Reports\Stage 1_Scoping Study\RR_01_1412_05.docx

COPYRIGHT NOTICE

DISCLAIMER

Acknowledgements

Acknowledgement of Traditional Owners

Eurobodalla Shire Council pays its respects and recognises Aboriginal people as the original inhabitants and custodians of all land and water within the Eurobodalla and respects their enduring cultural and spiritual connection to it.

The Open Coast Coastal Management program recognises the ongoing and vital role played by the Aboriginal people in protecting Eurobodalla's cultural history, mythology and health.

At the time of adoption, no Sea Country plans have been completed for Eurobodalla, but Eurobodalla Shire Council recognises that this Coastal Management Program is one of many pathways to management of the Coast, and commits to undertaking management alongside the traditional custodians, the Aboriginal people.

Acknowledgment of Financial Assistance

Eurobodalla Shire Council has prepared this document with financial assistance from the NSW Government through its Coastal and Estuary Grants Program. This document does not necessarily represent the opinions of the NSW Government or the NSW Department of Planning, Industry and Environment (DPIE).

Artwork: Rockpools by Bronwyn Smith

Document Guide

Executive summary	Page iii	Summary of the Scoping Study.
Purpose, vision and objectives of the CMP	Section 2	The vison reflects the local context while remaining consistent with the states overarching vison of managing the coastal environment in a manner consistent with the principles of ESD for the social, cultural and economic well-being of the people of NSW. The objectives are consistent with the Coastal Management Act, SEPP, and align with community expectations.
Strategic context for coastal management	Section 3	Overview of the context of coastal management, including: • the coastal processes and history of significant coastal events • community demographics, values, and projections • Aboriginal cultural heritage and use • coastal related tourism, industries and aquaculture • legal and planning context.
CMP scope (issues and areas)	Section 4	Identifies the geographic scope of the CMP. Provides a list of key issues for consideration in the CMP.
Current management arrangements	Section 5	Identifies existing land tenure and governance, and current coastal management arrangements.
Roles and responsibilities	Section 6	Proposes the governance structure for the CMP.
Community and stakeholder engagement strategy	Section 6	A summary of relevant previous community and stakeholder engagement undertaken. The engagement plan for all relevant stakeholders for Stages 1, 2, 3 and 4 of the CMP.
First pass risk assessment	Section 7	A qualitative risk assessment using available information to help inform the scope of the CMP.
Preliminary business case	Section 8	A preliminary business case to gain support and commitment to undertake additional studies and activities that are required to prepare the CMP.
Forward plan	Section 9	A summary of the subsequent stages of the CMP process and a summary of recommended studies, investigations and assessments proposed, which forms the forward plan.

Executive Summary

Planning for the Eurobodalla coastal zone has started under the NSW Government's coastal management framework. This involves the preparation of Coastal Management Programs (CMPs). A CMP is a plan of action for Council, public authorities and land managers responsible for management of the coastal zone to:

- address coastal hazard risks
- preserve habitats and cultural uses
- encourage sustainable agricultural, economic and built development in the coastal zone
- maintain or improve recreational amenity and resilience
- adapt to emerging issues such as population growth and climate change.

A CMP is prepared in five stages:

- Stage 1: Identify the scope of a CMP
- Stage 2: Determine risks, vulnerabilities and opportunities
- Stage 3: Identify and evaluate options
- Stage 4: Finalise, exhibit, certify and adopt the CMP (including integration of actions into Council Integrated Planning and Reporting (IP&R) Framework)
- Stage 5: Implementation monitoring and reporting.

This document completes Stage 1 for the open coast area of the Eurobodalla Local Government Area (LGA) including 140km of beaches, headlands and shorelines, from South Durras Beach in the north, to Akolele on the shoreline of Wallaga Lake in the South (refer Figure i).

Further information on the study area can be found in **Section 1.2**.

Coastal Management Purpose, Vision and Context

The purpose of the CMP, as defined in the Coastal Management Act 2016, is to set the long-term strategy for the coordinated management of land within the coastal zone with a focus on achieving the objectives of the Coastal Management Act 2016.

A CMP will provide a strategic and collaborative approach for relevant land managers to implement a range of credible, evidence based actions to address current and future risks, not only from coastal hazards, but for a broad range of community, stakeholder, economic, climate change, catchment processes and environmental issues and values. Certification of a CMP would allow Council to access significant State Government funding to implement coastal management actions on a priorities basis for the coastline, estuaries and catchments of the study area.

The vision established for coastal management of the Eurobodalla open coast is:

> *A healthy and resilient open coast for Eurobodalla, managed in flexible, adaptive and innovative ways to the benefit of all locals, visitors, and traditional owners of the land, now and into the future. The significant Aboriginal cultural, economic, recreational and natural values of the Eurobodalla open coast is recognized and considered in a holistic approach to managing existing and emerging coastal threats.*

Figure i Study Area

Supporting the vision are a series of coastal management objectives which have been developed to align with those in the Coastal Management Act 2016, as further detailed in **Section 2.3**.

The strategic context for coastal management in the Eurobodalla open coast has been defined in **Section 3** of this scoping study to set the environmental, social/cultural, economic and legal/planning context for coastal management.

A key outcome of this scoping study was understanding how the community value the coastal zone. A prioritised list of eleven key values was identified through review of previous community consultation undertaken within the coastal zone and across the LGA. A discussion on coastal values is provided in **Section 3.5** and **Section 4.3.1**.

Theme		Values
	**Healthy environment**	Natural character and geodiversity Biodiversity and ecosystem integrity Clean waters, beaches and coastal environment
	**Recreational and social values**	Accessibility, property protection and safety Amenity and recreation Public space to gather, socialise and participate in community activities Education / scientific Non-Aboriginal heritage
	**Aboriginal cultural heritage and use**	Aboriginal cultural heritage and use
	**Economic values**	Tourism Fishing (recreational, cultural, commercial) Agriculture and urban lands Support for aged care and assisted living

Threats to the Coastal Zone

Threats to the coastal zone (refer **Section 4.3.2**) have been considered across a range of planning timeframes and pathways.

A first-pass risk assessment process was applied to better understand the severity of known threats in the study area, at present and in the future. More detailed information on the risk assessment process and outcomes is provided in **Section 7**.

The level of risk associated with each threat over a 100 year timeframe is shown below in **Table i** for those threats not related to coastal hazards.

Cultural heritage sites may be under threat at numerous known and unknown locations along the coast. This is not shown on the hazards map but is included in EGC Threat 4.

Table i Non-Coastal Hazard Risks for 2100

ID	Threat	Future Risk (+100 years)
Recreational Activities Threats		
RA Threat 1	Conflict over resource access and use (e.g. beach users and dog walkers)	**Medium**
RA Threat 2	Habitat (physical) and wildlife disturbance (e.g. from overuse, overcrowding, foreshore development, commercial and recreational fishing methods, etc)	**High**
RA Threat 3	Poorly located, poorly maintained and/or inappropriate access and supporting facilities	**Medium**
RA Threat 4	Anti-social behaviour and unsafe practices	**Medium**
RA Threat 5	Passive recreational use (swimming, surfing, bush walking, etc)	**Medium**
RA Threat 6	Active recreational use (recreational boating, motorised watercraft, camping etc) - recreational activities needing associated infrastructure	**High**
RA Threat 7	Commercial and recreational fishing	**High**
Coastal Development Threats		
CD Threat 1	Coastal development resulting in loss of plant and animal species (habitat disturbance or loss)	**High**
CD Threat 2	Water pollution from urban stormwater and treated effluent discharge	**Medium**
CD Threat 3	Pollution of water, beach sand and other habitat areas with litter, solid waste, marine debris and microplastics	**Medium**
CD Threat 4	Coastal development encroaching onto natural coastal processes to exacerbate hazard impacts and loss of beaches	**High**
Engagement and Governance Threat		
EGC Threat 1	Lack of compliance with regulations (by users) or lack of compliance resources (by agencies)	**High**
EGC Threat 2	Insufficient community and visitor awareness of the values and threats to the coastal environment, and lack of engagement with managing this environment	**High**
EGC Threat 3	Insufficient or inappropriate governance and management of the coastal environment	**High**
EGC Threat 4	Insufficient involvement of Traditional Owners in the management of cultural heritage and use within the coastal environment	**High**

A key input to the first pass risk assessment was an understanding of the exposure of the entire Eurobodalla coastline against the coastal hazard threats relevant to the open coast. To achieve this, the coastline was separated into smaller coastal compartments, a total of 46 each with similar foreshore character, and the exposure of each coastal compartment was then estimated based on available coastal hazard information (such as coastal hazard mapping from within WRL, 2017 and SMEC, 2010). Where no existing data or study was available, a high level estimate of the erosion, recession and inundation exposure was developed. This screening level hazard exposure was interpreted with observations made by the study team during the site visits (16th – 18th March 2021) to provide a first pass assessment of the exposure and risk profile against the 10 coastal hazard threats (**Section 4.3.2**).

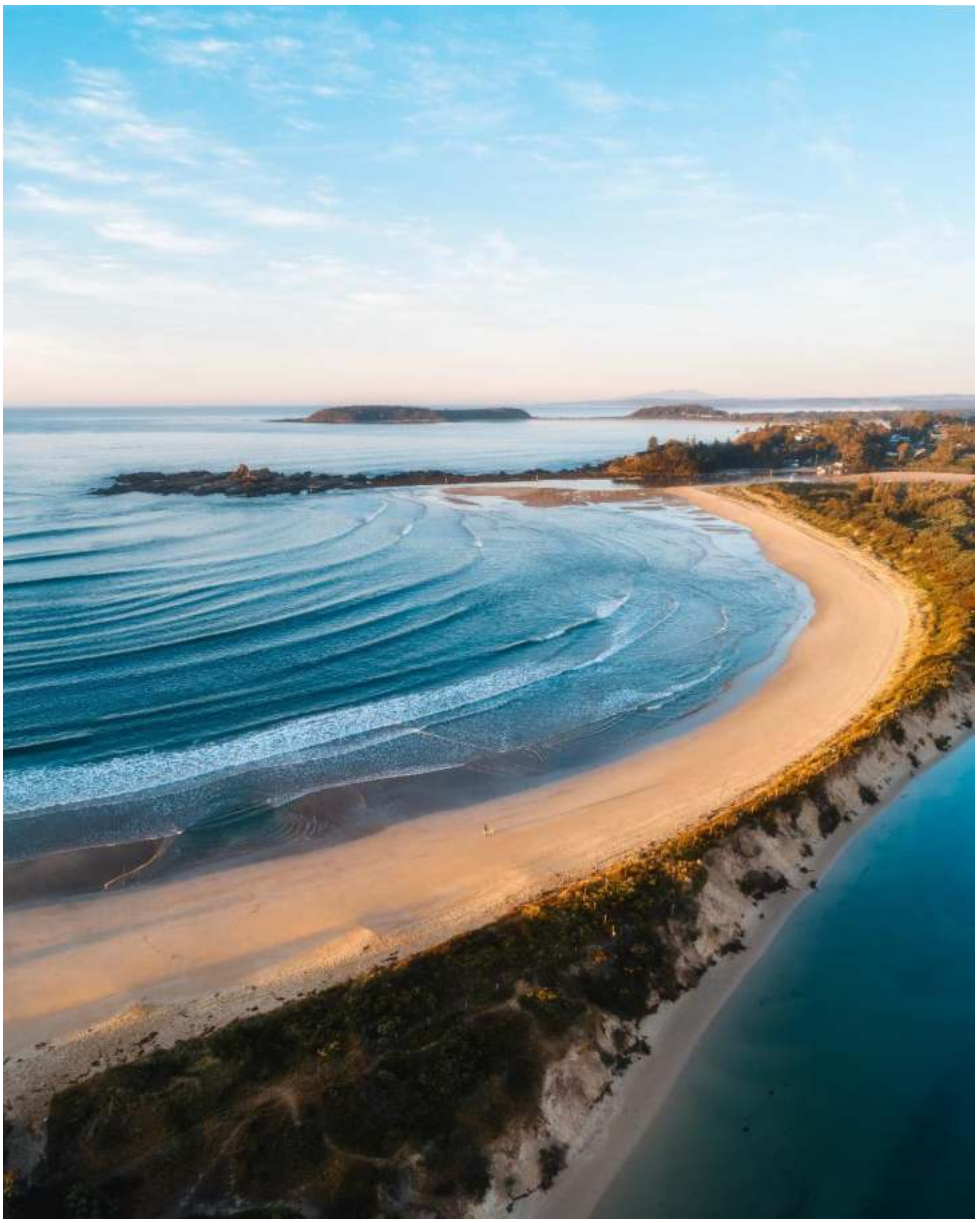


Photo: Tomakin by Eurobodalla Coast Tourism

The first pass risk assessment of coastal hazards provided guidance for each location as to whether:

- Red: Additional data or analysis is required in Stage 2 of the CMP to better define the risk prior to undertaking Stage 3- identification and evaluation of management options.
- Yellow: No additional hazard analysis is required in Stage 2 as data is sufficient. There are however identified management issues relating to coastal hazards that will require addressing through the assessment of management options in Stage 3.
- Green: The coastal hazard risk is sufficiently low that no further assessment of risk or risk management is required at that location.

The mapping of these outcomes is shown on **Figure ii**.

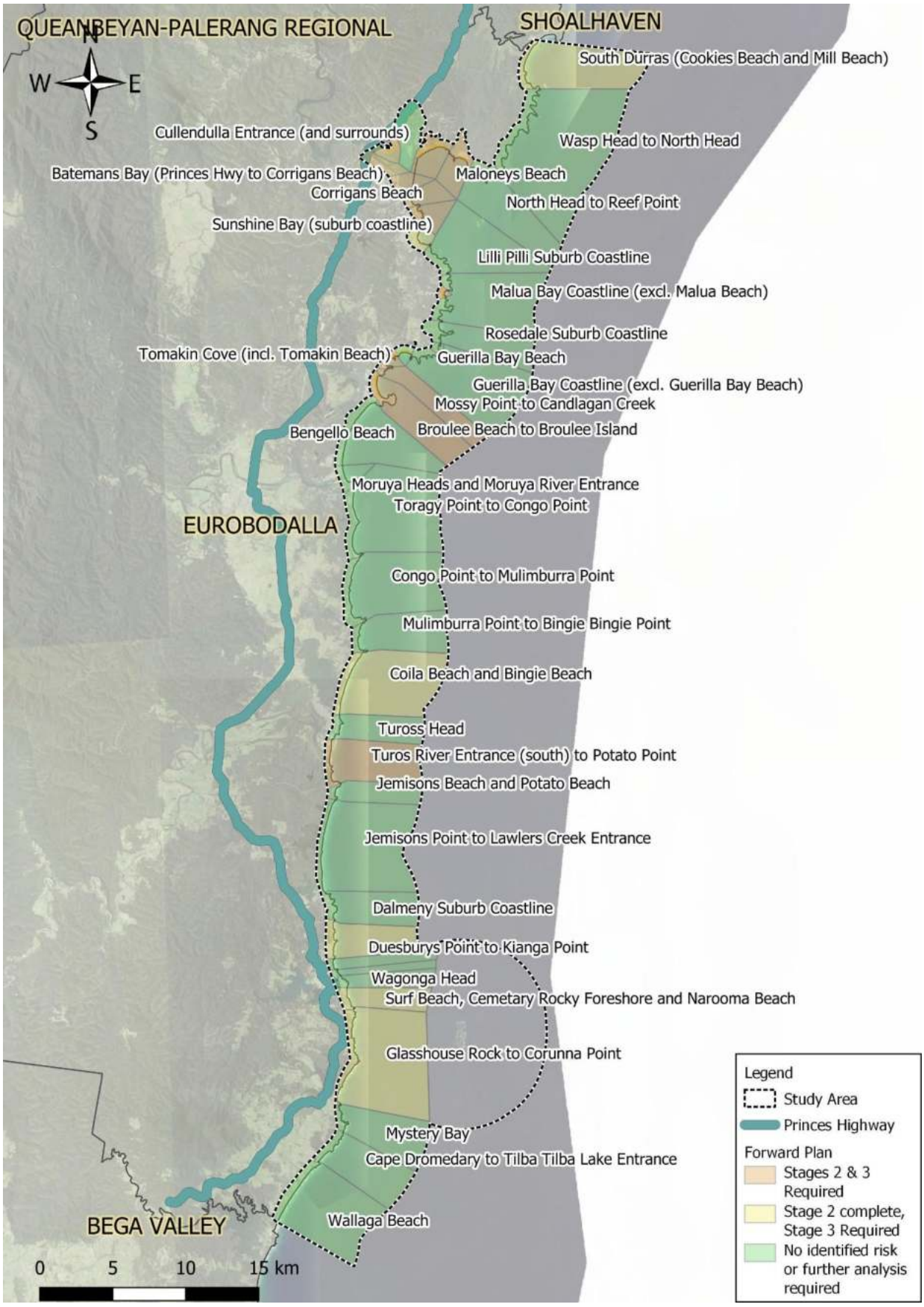


Figure ii Mapping of First Pass Risk Assessment Outcomes

Existing Management Arrangement, Roles and Responsibilities

Federal, State and Local level organisations are involved in governing the coastal zone with their governance role largely tied to land tenure (refer **Section 5.1** for further detail). The study area comprises a mixture of land tenure and land management arrangements including private freehold land, Council public land (community and operational land), Crown (unreserved), Crown land that is reserved or dedicated (called Crown Reserves and Crown Dedications), state conservation areas / national parks / nature reserves / Aboriginal Areas, marine park, road reserve, and railway lands. Key agencies involved in the CMP process include:

- Eurobodalla Shire Council
- NSW Department of Planning, Industry and Environment – Environment, Energy and Science (DPIE – EES)
- NSW Department of Planning, Industry and Environment – Planning (DPIE - Planning)
- NSW Department of Planning, Industry and Environment- National Parks and Wildlife Service (NPWS)
- Transport for NSW- Roads and Maritime (Roads and Maritime)
- Department of Regional NSW – Crown Lands (Crown Lands)
- Department of Regional NSW - Local Land Services (LLS)
- Department of Regional NSW - Fisheries (DPI Fisheries) (including Marine Parks).
- Department of Premier and Cabinet – Heritage NSW

A variety of coastal and catchment management arrangements are currently in place including State Government (e.g. CM SEPP) and Council coastal planning controls (Local Environmental Plans and Development Control Plans); a draft Emergency Action Sub-Plan, entrance management plans, and a variety of management plans that have been prepared by Council, public authorities and other major land holders in response to management issues. A review of these management arrangements is provided in **Section 5**.

Forward Plan

To address the threats identified as high or extreme risk, a range of coastal management measures will be identified and assessed as part of Stage 3 of the CMP. However, before management measures can be developed, several additional studies are required to better understand the vulnerabilities of the coastal zone to the key threats identified.

A forward plan, supported by a business case, has been developed that identifies the program of works required through Stages 2 to 4 of the CMP, provided in the table below. Detailed information on the business case can be found in **Section 8** and **Appendix D** whilst **Section 9**Error! Reference source not found. provides further detail on the forward plan.

The total cost of completing stages 1 to 4 of the CMP is estimated to be $275,000. The costs and anticipated timing of the actions listed in the forward plan for subsequent stages are estimated to be:

- Stage 2 $76,000 Completion September 2021
- Stage 3 $121,000 Completion February 2022
- Stage 4 $45,500 Completion June/July 2022

As the lead agency, Council has the ability to apply for a variety of grants to assist with the cost of implementation. All actions recommended in the forward plan to complete the CMP are eligible for funding from state government, which was provided in May 2020 .

Table ii CMP Forward Plan

Recommended Studies / Components	Cost Estimate
Stage 2: Risks, Vulnerabilities and Opportunities	
Coastal Erosion Assessments	$ 15,000
Coastal and Coastal Connected Waterways Inundation Assessment	$ 15,000
Geotechnical Assessments	$ 28,000
Community and Stakeholder Engagement Strategy (CSES): CEMAC briefing, community workshops, website updates, meetings.	$ 18,000
Estimate Stage 2 Subtotal	**$ 76,000**
Stage 3: Identify and Evaluate Options	
Option identification and modelling	$ 37,000
Risk assessment, MCA and financial analysis	$ 26,000
Concept and decision pathway diagrams and beach mapping	$ 18,000
Land use planning recommendations and planning proposal consideration	$ 10,000
Community and Stakeholder Engagement Strategy (CSES): CEMAC briefing, website updates, meetings, public input to options.	$ 9,000
Broader engagement of stakeholders and community.	$6,000
Activities involving engagement of Aboriginal cultural knowledge holders.	$6,000
Stage 3 reporting	$ 9,000
Estimate Stage 3 Subtotal	**$ 121,000**
Stage 4: Prepare and Exhibit CMP	
Prepare CMP (draft) document, including: Executive summary; Introduction; A snapshot of issues; Actions to be implemented by the local council; Actions to be undertaken by public authorities; A business plan; A coastal zone emergency action subplan; Mapping; Reference list; and Supporting documentation.	$ 15,000
Finalising the CMP (with Community and Stakeholder public exhibition feedback).	$ 7,500
Community and Stakeholder Engagement Strategy (CSES): CEMAC / Councillor briefing, website updates, meetings, public information sessions, public exhibition submissions.	$ 23,000
Activities involving engagement of Aboriginal cultural knowledge holders.	TBC
Estimate Stage 4 Subtotal	**$ 45,500**

Stakeholder and Community Engagement

A range of stakeholder and community engagement activities have been undertaken to assist in the preparation of the Scoping Study and to develop a robust Community and Stakeholder Engagement Strategy for the future stages of the CMP.

Engagement activities undertaken as part of this Scoping Study are further detailed in Section 1.5.

The Engagement Strategy sets out our strategy to engage with the broader community and stakeholders as required by the CM Act 2016 and the Coastal Management Manual 2018, including:

- Government Agencies
- Local and state Government working groups and committees:
  - Coastal and Environment Management Advisory Committee (CEMAC)
  - North Batemans Bay Coastal Agency taskforce
- Local Aboriginal community:
  - Local Aboriginal Advisory Committee
  - Local Aboriginal Land Councils (LALC's)
  - Elders and members of the community who can speak on behalf of Country
- The broader Eurobodalla community, facilitated through community groups for each location, where available.
- A wide range of demographics, contacted through community associations including schools, surf clubs, Landcare and other users of the coast.
- Affected Landholders
- Community associations and business representatives

A Community and Stakeholder Engagement Strategy has been developed for this CMP Scoping Study and is provided in **Appendix A**. The strategy outlines:

- Which individuals and organisations should be involved in the review, preparation and implementation of the CMP
- How and when they may be offered engagement opportunities
- How their input may be incorporated into the planning process.

Table of Contents

Appendices

List of Maps

List of Tables

List of Figures

Acronyms and Abbreviations

AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
BMP	Batemans Marine Park
CAMBA	China–Australia Migratory Bird Agreement
CM Act	NSW *Coastal Management Act 2016*
CMA	Catchment Management Authority
CMP	Coastal Management Program
CM SEPP	NSW *State Environmental Planning Policy (Coastal Management) 2018*
CZMP	Coastal Zone Management Plan
DCP	Development Control Plan
DEC	Former NSW Department of Environment and Conservation
DO	Dissolved Oxygen
DPE	Former NSW Department of Planning and Environment
DPI	NSW Department of Primary Industries
DPIE	NSW Department of Planning, Industry and Environment
EAC	East Australian Current
EMP	Estuary Management Plan
EPA	NSW Environment Protection Authority
EPI	Environmental Planning Instrument
ESC	Eurobodalla Shire Council
Ha	Hectares
HEV	High Environmental Value
ICAM	Incident Cause Analysis Method
ICOLLs	Intermittently Closed and Open Lakes and Lagoons
IPR	Integrated Planning and Reporting
JAMBA	Japan Australia Migratory Bird Agreement
km^2	Square kilometres
LEP	Local Environmental Plan
LGA	Local Government Area
LLS	Local Land Services
m^2	Square metres
m^3	Cubic metres
m/s	Metres per second
m^3/s	Cubic metres per second
MEMA	NSW Marine Estate Management Authority

NPWS	NSW National Parks and Wildlife Service
NRAR	NSW Natural Resources Access Regulator
NSW	New South Wales
OEH	Former NSW Office of Environment and Heritage
PoM	Plan of Management
ROKAMBA	Republic of Korea–Australia Migratory Bird Agreement
RFS	NSW Rural Fire Service
RMS	Former NSW Roads and Maritime Services
SEPP	State Environmental Planning Policy
STP	Sewage Treatment Plant
TARA	New South Wales Marine Estate Threat and Risk Assessment Report
TEC	Threatened Ecological Community
TfNSW	Transport for NSW
WRL	Water Research Laboratory

Glossary*

Australian Height Datum (AHD)	A common national surface level datum approximately corresponding to mean sea level.
Average recurrence interval (ARI)	The average time between which a threshold is reached or exceeded (e.g. large wave height or high water level) of a given value. Also known as Return Period.
Benchmarks	A standard by which something can be measured or judged. For example, predicted amounts of sea level rise to incorporate into planning considerations.
Cadastre, cadastral base	Information in map or digital form showing the extent and usage of land, including streets, lot boundaries, water courses etc.
Catchment	The land area draining through the main stream, as well as tributary streams, to a particular site. It always relates to an area above a specific location.
Climate change	A process that occurs naturally in response to long-term variables, but often used to describe a change of climate that is directly attributable to human activity that alters the global atmosphere, increasing change beyond natural variability and trends.
Crest level	The level in metres Australian Height Datum (mAHD) of the top of a particular foreshore type.
Coast	A strip of land of variable width that extends from the shoreline inland to the first significant landform that is not influenced by coastal processes (such as waves, tides and associated currents).
Coastal hazard	Coastal hazards, as defined by the CM Act, include beach erosion, shoreline recession, coastal lake or watercourse entrance instability, coastal inundation, coastal cliff or slope instability, tidal inundation, and erosion and inundation of foreshores caused by tidal waters and the action of waves, including the interaction of those waters with catchment floodwaters.
Coastal inundation	Coastal inundation occurs when a combination of marine and atmospheric processes raises the water level at the coast above normal elevations, causing land that is usually 'dry' to become inundated by sea water. Alternatively, the elevated water level may result in wave run-up and overtopping of natural or built shoreline structures (e.g. dunes, seawalls). In the case of an estuary, coastal inundation may be caused by a combination of processes including high tides, storm surge and wave run-up onto the foreshore.

Coastal processes	Coastal processes are the set of mechanisms that operate at the land-water interface. These processes incorporate sediment transport and are governed by factors such as tide, wave and wind energy.
Coastal Zone	The coastal zone, as defined by the CM Act, means the area of land comprised of the following coastal management areas: (a) the coastal wetlands and littoral rainforests area, (b) the coastal vulnerability area, (c) the coastal environment area, (d) the coastal use area.
Design storm event	A significant event to be considered in the planning process.
Development	As defined in the *Environmental Planning and Assessment Act 1979*. New development refers to development of a completely different nature to that associated with the former land use, e.g. the urban subdivision of an area previously used for rural purposes. New developments involve re-zoning and typically require major extensions of existing urban services, such as roads, water supply, sewerage and electric power. Infill development refers to the development of vacant blocks of land that are generally surrounded by already developed properties and is permissible under the current zoning of the land. Conditions such as minimum floor levels may be imposed on infill development. Redevelopment refers to rebuilding in an area, e.g., as urban areas age, it may become necessary to demolish and reconstruct buildings on a relatively large scale. Redevelopment generally does not require either re-zoning or major extensions to urban services.
Environmental Planning Instrument	Environmental Planning Instruments is the collective name for Local Environmental Plans (LEPs), State Environmental Planning Policies (SEPPs), and Regional Environmental Plans (REPs). The *Environmental Planning and Assessment Act 1979* and the *Environmental Planning and Assessment Regulation 2000* are also included in this classification.
Estuary	The CM Act defines an estuary as any part of a river, lake, lagoon, or coastal creek whose level is periodically or intermittently affected by coastal tides, up to the highest astronomical tide.
Extreme Ocean Water Level	The highest elevation reached by the sea/ocean as recorded by a tide gauge during a given period (after MHL, 2018).
Extreme Storm Event	Storm for which characteristics (wave height, period, water level etc.) were derived by statistical 'extreme value' analysis. Typically, these are

	storms with average recurrence intervals (ARI) ranging from one to 100 years.
Foreshore	The part of the shore, lying between the crest of the seaward berm (or upper limit of wave wash at high tide) and the ordinary low water mark, that is ordinarily traversed by the uprush and backrush of the waves as the tides rise and fall; or the beach face, the portion of the shore extending from the low water line up to the limit of wave uprush at high tide. The CM Act defines the foreshore as 'the area of land between highest astronomical tide and the lowest astronomical tide'.
Foreshore Crest/Edge	Generally, the landward limit of the foreshore. In some cases, it may be located higher than the upper limit of wave wash at high tide.
Foreshore type	The nature of the foreshore at any given location, e.g. retaining wall, sandy beach, rocky foreshore.
Flood	A general and temporary condition of partial or complete inundation of normally dry land areas, including inundation as a result of sea/ocean storms and other coastal processes or catchment flows.
Flood risk	Potential danger to personal safety and potential damage to property resulting from flooding. The degree of risk varies with circumstances across the full range of floods. Flood risk is divided into three types, existing, future and continuing risks as described below: Existing flood risk is the risk a community is exposed to as a result of its location on the floodplain. Future flood risk is the risk a community may be exposed to as a result of new development on the floodplain. Residual flood risk is the risk a community is exposed to after floodplain risk management measures have been implemented.
Geographical information system (GIS)	A system of software and procedures designed to support the management, manipulation, analysis and display of spatially referenced data.
High Tide	The maximum height reached by a rising tide. The high water is due to the periodic tidal forces and the effects of meteorological, hydrologic, and/or oceanographic conditions.
Highest astronomical tide (HAT)	The highest level which can be predicted to occur under average meteorological conditions and any combination of astronomical conditions. In Australia HAT is calculated as the highest level from tide predictions over the tidal datum epoch (TDE), this is currently set to 1992 to 2011. The HAT and the Lowest Astronomical Tide (LAT) levels will not be reached every year. LAT and HAT are not the extreme water levels which

	can be reached, as storm surges may cause considerably higher and lower levels to occur.
Longshore gradients	A flux in the rates of sediment transport which are a result of difference in longshore currents from the influence of natural immobile features, man-made structures and differences in wave climate.
Mean high water mark (MHWM)	The line of the medium high tide between the highest tide each lunar month (the springs) and the lowest tide each lunar month (the neap) averaged over out over the year. In NSW, the methods for determining the position of the MHWM are outlined in the *Crown Directions to Surveyors - No. 6 Water as a Boundary.*
Mean High Water Springs (MHWS)	The MHWS is the highest level which spring tides reach on the average over a period of time (usually several years).
Mean Low Water Springs (MLWS)	The MLWS is the lowest level which spring tides reach on the average over a time period (usually several years).
Mean Sea Level (MSL)	MSL is a measure of the average height of the sea or ocean's surface such as the halfway point between the mean high tide and the mean low tide. At present, mean sea level is approximately equivalent to 0 mAHD (reported as 0.03 mAHD in MHL, 2019).
Plan of Management	For non-Council Crown land managers (CLMs) a Plan of Management (PoM) is a document that defines the value, use, management practices and intent for the broad public purpose for which the land has been reserved or dedicated, prepared in accordance with the *Crown Land Management Act 2016* (CLM Act) and adopted by the minister administering the CLM Act. Every local council in NSW participates in the management of Crown reserves as an appointed CLM. For Council CLMs a PoM is the key strategic planning and governance tool that councils must have in place for the management and use of community land. PoMs set out objectives and performance targets for community land and authorise use of the land, including tenures and development on the land. A PoM is required for Crown reserves managed as community land under both the CLM Act and the *Local Government Act 1993*. A PoM must also include consideration of Aboriginal rights and interests in Crown land. Land reserved under the *National Parks and Wildlife Act 1974* (NPW Act) also requires a PoM (i.e. national park, state conservation area, nature reserve, Aboriginal area, etc). In this instance PoMs are legal documents developed and maintained in accordance with the NPW Act to guide how a park will be sustainably managed. PoMs contain information about the natural environment, Aboriginal heritage, history, and recreational opportunities of the reserved land.

Probability	A statistical measure of the expected frequency or occurrence of flooding.
Risk	The chance of something happening that will have an impact on objectives, usually measured in terms of a combination of the consequences of an event and likelihood of occurrence.
Sea level rise	A rise in the level of the sea surface that has occurred or is projected to occur in the future, as measured from a point in time. The rise can be reported as a global mean or as measured at a specific point or estimated for a specific part of the sea or ocean.
Shoreface	The zone between the mean low water mark and some distance beyond the breaker zone. The shoreface encompasses a zone in which littoral sand transport processes occur, i.e. longshore sand transport and cross-shore sand transport.
Shoreline	The intersection between the sea and the land. The line delineating the shoreline is often approximated as the Mean High Water Mark, however, the definition can vary depending on the application.
Storm surge	The increase in coastal water level caused by the effects of storms. Storm surge consists of two components – the increase in water level caused by the reduction in barometric pressure and the increase in water level caused by the action of wind blowing over the sea surface (wind set-up).
Storm tide	An abnormally high water level that occurs when a storm surge combines with a high astronomical tide. The storm tide must be accurately predicted to determine the extent of coastal inundation.
Tidal inundation	The inundation of land by tidal action under average meteorological conditions and the incursion of sea water onto low lying land that is not normally inundated, during a high sea level event such as a king tide or due to longer-term sea level rise. For planning controls, it is defined as the land that is inundated up to the level of Highest Astronomical Tide (HAT).
Wave run-up	The vertical distance above mean water level reached by the uprush of water from waves across a beach or up a structure.
Wave set-up	The rise in the water level above the still water level when a wave reaches the coast. It can be very important during storm events as it results in further increases in water level above the tide and surge levels.
Wind waves	Waves resulting from the action of the wind on the surface of the water.

*Many of the glossary terms here are derived or adapted from the *Coastal Management Glossary* (OEH, 2018d).

1 Introduction

Eurobodalla's Open Coast Coastal Management Program (CMP) will apply to the open coast areas of the Eurobodalla Shire Council local government area. This area can be generally referred to as the 83 beaches, rocky shores and coastal headlands between South Durras in the North and the entrance to Wallaga Lake in the South that are within the management control of Council (noting extensive areas of National Park which are outside the management control of Council).

The Eurobodalla Shire coastline has endured a long history of coastal storms and coastal erosion, in addition regions of the coastline have been identified as undergoing long-term coastal recession. Also, as a result of pressures from population growth, development and tourism, concerted effort has been and continues to be required to manage coastal hazards and the estuaries, maintain beach amenity, beach access, the natural environment, social and cultural values. Coastal hazards, as defined in the *Coastal Management Act 2016* (CM Act), include beach erosion, shoreline recession, coastal lake or watercourse entrance instability, coastal inundation, coastal cliff or slope instability, tidal inundation, and erosion and inundation of foreshores caused by tidal waters and the action of waves, including the interaction of those waters with catchment floodwaters.

Eurobodalla Shire Council (Council) has a central role in managing the coastal zone of the local government area (LGA) under the provisions of the New South Wales (NSW) *Coastal Management Act 2016* (CM Act).

1.1 Coastal Management in NSW

Local Councils in NSW are to undertake management of their coastal areas in accordance with the coastal management framework (**Figure 1-1**), underpinned by the CM Act and *State Environment Planning Policy (Coastal Management) 2018* (CM SEPP). To achieve this, Councils are required to develop CMPs. The NSW Coastal Management Manual (OEH, 2018) provides information and guidance to Councils in preparing their CMPs.

Figure 1-1 Coastal Management Framework (Adapted from OEH, 2018a)

CMPs are intended to manage coastal issues, vulnerabilities, and risks as well as help foster opportunities for coastal communities. A CMP is prepared in five stages, as shown in **Figure 1-2**.

This Stage 1 Report details the preparation of the Scoping Study (Stage 1 of the CMP process).

The area covered by a CMP may be at a regional scale (e.g. for issues in coastal environment areas or coastal use areas) or sediment compartment scale (for issues in coastal vulnerability areas), meaning that a CMP may need to be prepared in cooperation with adjoining Councils, to ensure that actions are undertaken at an appropriate scale to address the issues.

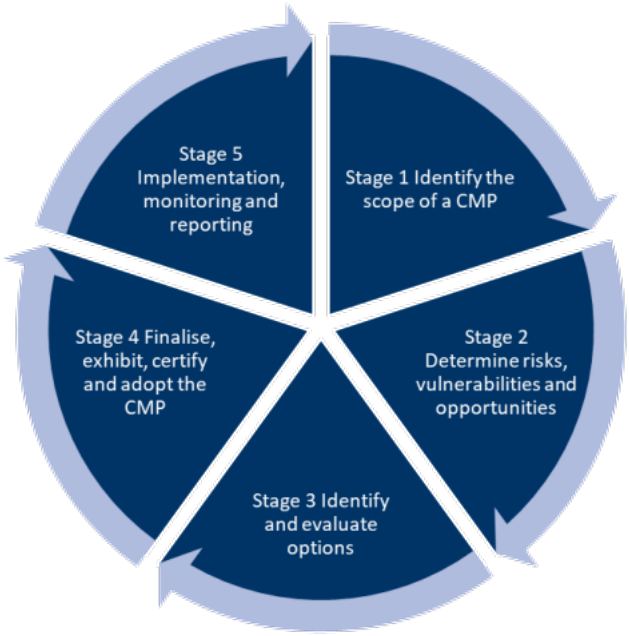


Figure 1-2 The Five Stages of a CMP (Adapted from OEH, 2018a)

1.2 Study Area

The study area covers the full extent of the coastline within the Eurobodalla Shire Council LGA, extending from the South Durras headland in the north to the entrance of Wallaga Lake in the south.

The study area for the Eurobodalla Open Coast CMP is shown on **Map RG-01-01**.

The coastal region of the LGA is diverse, with a range of land uses and ecological zones occurring along the coastline, incorporating:

- The major residential and business district of Batemans Bay and its immediate surrounds;
- Significant regional centres, such as Moruya, Tuross Head and Narooma;
- Smaller, relatively isolated townships and development such as Meringo, Bingie, Potato Point and Mystery Bay;
- Extensive areas of National Parks;
- Batemans Marine Park;
- Numerous beaches and ICOLLs; and,
- Coastal wetlands and littoral rainforests.

The study area incorporates the open coast, and the entrances to estuaries within the LGA. A separate Estuary Management Plan covers the estuary / ICOLL and catchment areas of the Moruya River, Mummuga Lake and Wagonga Inlet (Salients, 2020). The management of the remaining estuaries and ICOLLs will be addressed in future Estuary Coastal Management Plans.

1.3 Scoping Study Requirements and Report Structure

The required components of a Scoping Study as specified in the Coastal Management Manual Part B (OEH, 2018c) and their location in this report are outlined in **Figure 1-3** below.

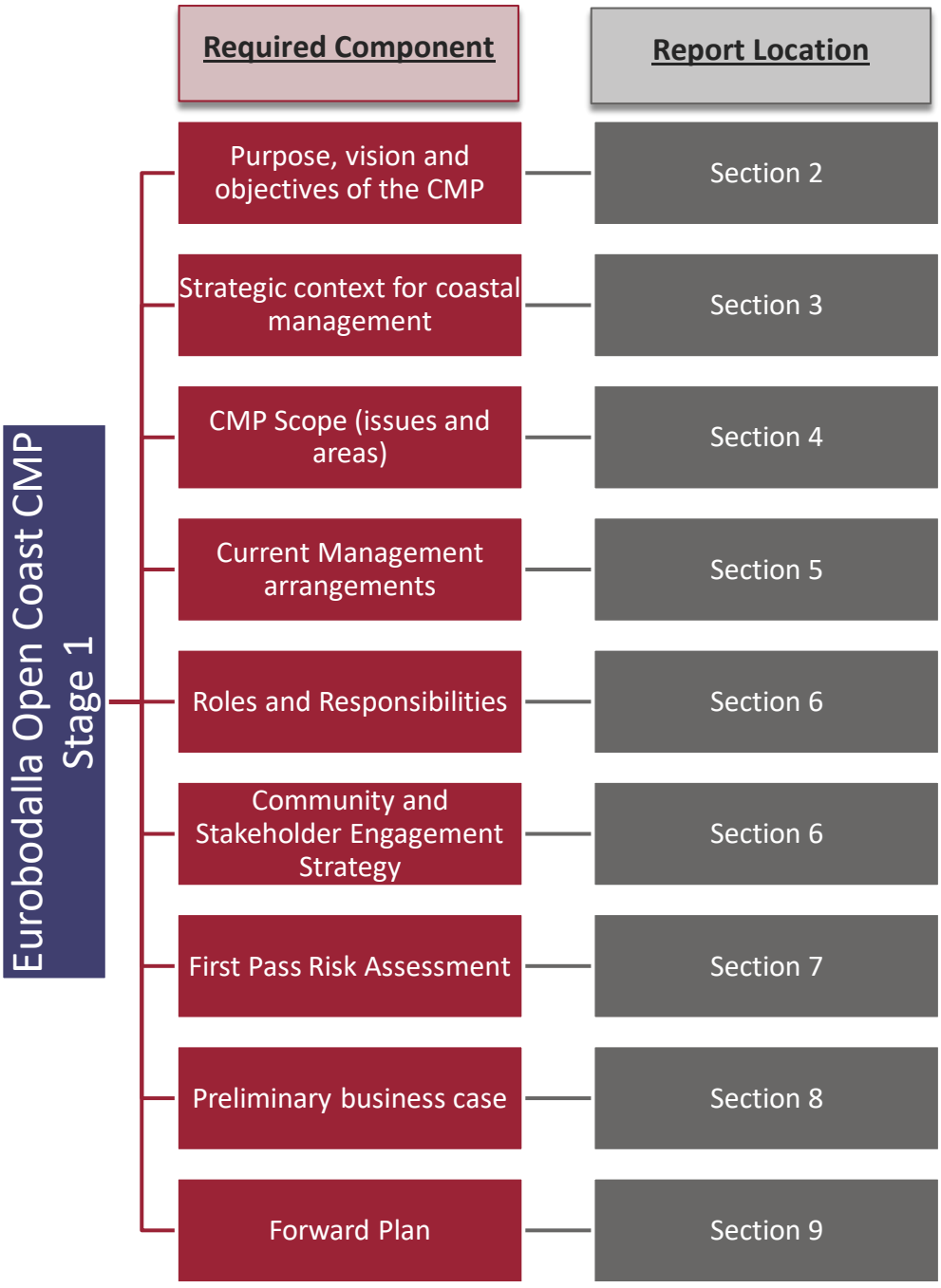


Figure 1-3 **Components of CMP Scoping Study and Structure of this Report**

1.4 Background to Eurobodalla Coastal Management

The management of the open coast of Eurobodalla is a complex and significant undertaking. A summary of the major activities undertaken relating to coastal management by both Council and the community in the past decade are shown in **Figure 1-4**. The figure shows that coastal management actions have been consistently a part of Council and the communities work in this period. It also highlights that the current study builds on a significant body of previous work.

Council initially received grant funding for the Batemans Bay Coastal Zone Management Plan and the Eurobodalla Coastal Zone Management Plan in 2010 and 2012 respectively. A variation was accepted by then OEH for the merger of these two studies into a single, LGA wide study in 2013.

The project further experienced three major suspensions due to:

- the removal of advice regarding appropriate sea level rise considerations;
- the introduction of the draft NSW Coastal Management Bill; and,
- Some members of the Surfside community requesting a Batemans Bay Independent Coastal Impact Assessment.

In 2013, the NSW Government withdrew advice relating to appropriate considerations of sea level rise. The NSW Government did not however withdraw the legal requirement to consider climate change and sea level rise, leaving it to local councils to determine their own approach.

As such, the CZMP process was placed on hold between July 2013 and November 2014 while Council determined the most appropriate approach for considering sea level rise within the LGA with State Government financial and technical assistance. This work was completed with the adoption of the South Coast Regional Sea Level Rise Policy and Planning Framework (Whitehead & Associates, 2014)

In 2015, the NSW Government introduced the draft *NSW Coastal Management Bill*. The Bill was supported by a new draft Coastal Management Manual and a new Coastal Management State Environmental Planning Policy. The Bill introduced the proposal to replace CZMPs with CMPs. The draft Bill proposed that all councils would need to transition CMPs before the end of 2021.

Eurobodalla Shire Council made the decision to transition early to the new framework in order to:

- Avoid the expense of having to re-work the plan soon after adoption to ensure compliance with the new legislation;
- Ensure that long-term certainty is provided for the community on coast al management; and,
- To achieve a certified program as soon as possible in order to access NSW Government funding for coastal residents. This funding is only available for projects identified in a certified CMP.

The project was then again placed on hold by Council from February 2019 to May 2020 while an Independent Coastal Impact Assessment for Batemans Bay was undertaken by Transport for NSW at the request of some Surfside Community members. Due to the numerous coastal studies and works occurring, the NSW Government additionally announced the formation of an interagency task force to coordinate and integrate works and studies. The Batemans Bay Coastal Agency Taskforce was established to provide coordination, guidance and support to Council on coastal management including addressing coastal hazards at Northern Batemans Bay.

Following the conclusion of the independent assessments and based on recommendations made by the taskforce in 2019, additional grant funding was made available to recommence and complete the Open Coast CMP, drawing on the findings from the Batemans Bay Independent Coastal Study and previous Council studies.

Photo: South Durras March 2021 by Emma Maratea

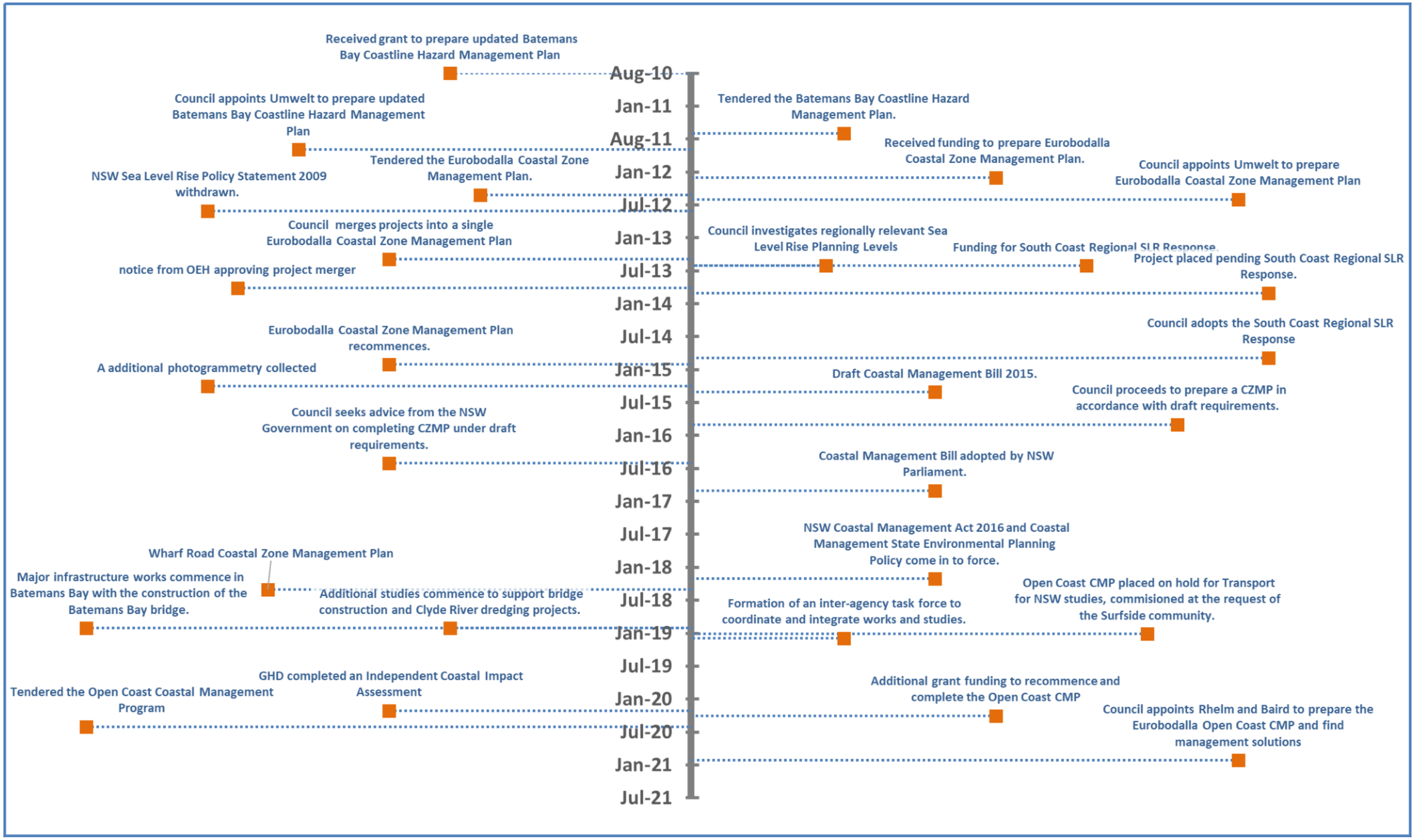


Figure 1-4 Timeline of Eurobodalla Coastal Management Studies and actions over the past decade

1.5 Community and Stakeholder Engagement

A range of stakeholder and community engagement activities have been undertaken to assist in the preparation of the Scoping Study and to develop a robust Community and Stakeholder Engagement Strategy (**Section 6.3**) for the future stages of the CMP.

Engagement activities undertaken as part of this Scoping Study include:

- Detailed investigation of previous coastal community engagement activities to identify values and management issues associated with the study area
- Community interest registration (via Council's website)
- Meeting with Aboriginal community representatives on Country to scope the CMP, understand cultural values, management issues and set objectives for coastal management within the context of Aboriginal cultural and existing community connections.
- NSW government agency and adjoining Council discussions

1.5.1 Previous Community Engagement Activities

Council has undertaken a range of community engagement and consultation processes as part of its coastal management programs.

A brief overview of key engagement activities previous undertaken to date includes:

- **2015**: conducted two field-based user surveys during peak holiday periods at popular beaches, and five information sessions along the length of the Eurobodalla Shire.
    - The community surveys and information sessions indicated the popularity and importance of the coast to residents, visitors, and the economy.
    - The surveys also highlighted a strong desire from the community to preserve the natural landscapes of the local coastline.
- **2017**: presented the results of the Eurobodalla coastal hazard assessment at community workshops and drop-in sessions.
- **2018**: Council staff met with stakeholders and hosted four public drop-in sessions to hear from community members about what is important to them. This included waterfront property owners with properties at immediate risk of hazards such as coastal erosion, and groups such as Coastwatchers, Coastal Alliance, and the Batemans Bay Chamber of Commerce.
- **2019 / 2020**: Concerns were raised by some Surfside residents and the Batemans Bay independent coastal assessment was undertaken by Transport for NSW.
- **2020**: Community consultation was undertaken as part of the Moruya River, Mummaga Lake and Wagonga Inlet Coastal Estuary Management Plan (Salients, 2020). The coastal values and threats identified as part of this process are shown in **Figure 1-5** and **Figure 1-6.**

Figure 1-5 Top 6 values identified as part of the Moruya River, Mummaga Lake and Wagonga Inlet Estuary Management Plan Community Consultation

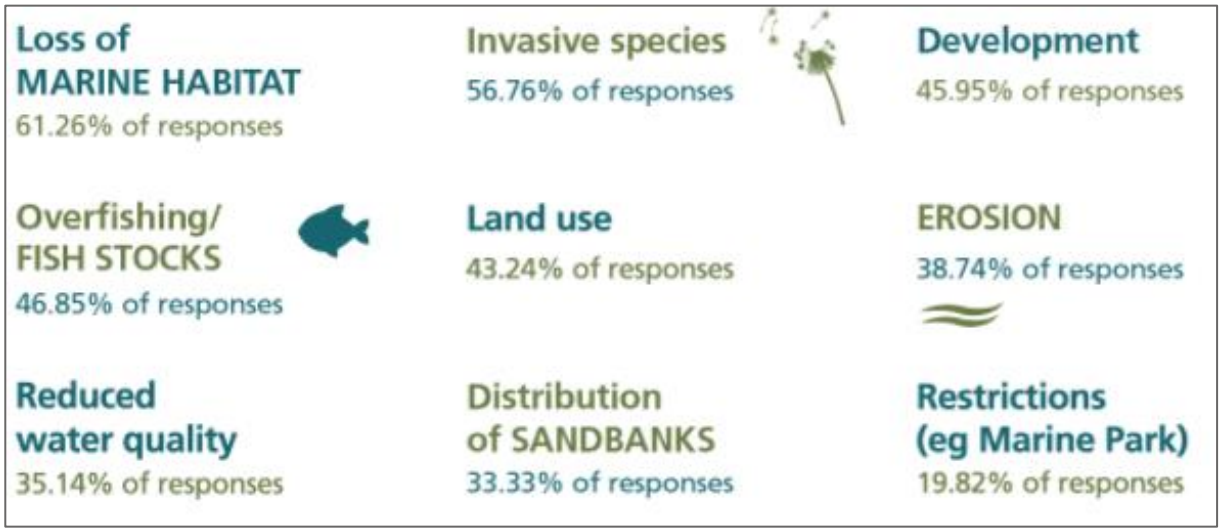


Figure 1-6 Top threats identified as part of the Moruya River, Mummaga Lake and Wagonga Inlet Estuary Management Plan Community Consultation

1.5.2 Community and Stakeholder Engagement for the Eurobodalla Open Coast CMP

Further community and stakeholder engagement will be undertaken as part of the current CMP. An Engagement Strategy has been prepared, and is provided in **Appendix A**.

The Engagement Strategy sets out our strategy to engage with the broader community and stakeholders as required by the CM Act 2016 and the Coastal Management Manual 2018, including:

- Government Agencies
- Local and state Government working groups and committees:
  - Coastal and Environment Management Advisory Committee (CEMAC)
  - North Batemans Bay Coastal Agency taskforce
- Local Aboriginal community:
  - Local Aboriginal Advisory Committee
  - Local Aboriginal Land Councils (LALC's)
  - Elders and members of the community who can speak on behalf of Country
- The broader Eurobodalla community, facilitated through community groups for each location, where available.

- A wide range of demographics, contacted through community associations including schools, surf clubs, Landcare and other users of the coast.
- Affected Landholders
- Community associations and business representatives

A summary of the engagement activities undertaken as part of this Scoping Study is provided in **Sections 1.5.3 to 1.5.5**.

1.5.3 Online Community Engagement

Council updated its website in February 2021 to provide information to the community regarding the current Open Coast CMP. This will continue to be updated at key stages throughout the CMP preparation to keep the community informed on the progress of the CMP and how they can provide input to the process.

The website included an opportunity for community members to register their interest in being involved in community representative groups. These groups will meet twice during the preparation of the CMP:

- The first time in August 2021 to discuss the outcomes of Stage 2 (coastal vulnerabilities) and to assist Council in identifying management issues and solutions to be assessed in Stage 3.
- The second meeting with the community representatives will be during the public exhibition period in May 2022.

1.5.4 Contacting Community Groups

Council directly contacted a range of community groups and organisations via email in May 2021 to alert them to the updated website, the opportunity to register interest and to provide an update on the progress of the CMP. This email list will continue to be used to send project updates throughout the preparation of the CMP.

1.5.5 Aboriginal Representatives

Culturally appropriate engagement with Aboriginal communities including traditional owners, Local Aboriginal Land Councils (LALCs) and other relevant knowledge holders is an integral part of preparing a CMP. It is essential to understand the cultural significance of the coastal landscape and the influence that coastal processes and environmental change may have on the values of physical and non-physical (i.e. tangible and intangible) elements of cultural heritage.

Appropriate consultation will promote effective engagement participation and facilitate the sharing and exchange of cultural and scientific knowledge, to support the strategic integration of Aboriginal cultural heritage conservation and adaptation management approaches into the Open Coast CMP.

Engagement with Aboriginal communities has occurred through the following activities:

- Providing an introduction to the CMP to Council's Aboriginal Advisory Committee, alerting them to the project's inception and the proposed engagement with Aboriginal communities. This was undertaken by Council on 15th March 2021.
- Contacting key Aboriginal community representatives to invite them to meet on Country to discuss Indigenous coastal values and management objectives: April - May 2021.
- Meeting on Country at several locations: May 2021.

2 Purpose, Vision and Objectives of the CMP

This chapter sets the purpose, vision and objectives of the CMP for coastal management in the Eurobodalla Open Coast study area. This has been achieved through development of a vision statement, which reflects the local context while remaining consistent with the states overarching vison of managing the coastal environment.

2.1 Purpose

The purpose of a CMP is defined in the CM Act as follows:

> *The purpose of a coastal management program is to set the long-term strategy for the coordinated management of land within the coastal zone with a focus on achieving the objectives of the CM Act. (CM Act, 2016)*

2.2 Vision Statement

A local vision statement that is consistent with the state's vision while reflecting the local context helps communities identify with the future of their coast, encourages a sense of community ownership of the actions in the CMP and fosters commitment to its preparation and implementation.

Vision statements from related studies and plans have been reviewed in the preparation of a vision statement for the Eurobodalla Open Coast CMP, as discussed in **Section 0**.

The following vision statement has been developed for the study area:

> *A healthy and resilient open coast for Eurobodalla, managed in flexible, adaptive and innovative ways to the benefit of all locals, visitors, and traditional owners of the land, now and into the future. The significant Aboriginal cultural, economic, recreational and natural values of the Eurobodalla open coast is recognized and considered in a holistic approach to managing existing and emerging coastal threats.*

Photos: Eurobodalla Coastline

2.2.1 Related Visions

Related visions from existing relevant documentation are listed in **Table 2-1**. The vision developed for this CMP is consistent with and supports these related visions for the Eurobodalla coastal zone.

Table 2-1 Related Visions for the Coastal Zone

Vision Source	Related Vision Statements
NSW Coastal Management Manual (OEH, 2018)	"Thriving and resilient coastal communities living and working on a healthy coast, now and into the future".
Coastal Management Act 2016	"Manage the coastal environment of New South Wales in a manner consistent with the principles of ecologically sustainable development for the social, cultural and economic well-being of the people of the State".
NSW Marine Estate Management Strategy 2018 – 2028 (MEMA, 2018)	"A healthy coast and sea managed for the greatest wellbeing of the community, now and into the future".
South Coast Regional Strategy 2006 – 2031 (Department of Planning, 2007)	"A sustainable, attractive and liveable future for the South Coast. Sustainable: Development and growth achieves economic and social goals, whilst protecting the Region's sensitive natural environment. Attractive: The distinctive coastal character of the Region's towns and the beauty and significance of the Region's rural, cultural and natural landscapes are protected."
South East Local Strategic Plan 2016 – 2021 *(*South East LLS, 2016)	"Resilient communities in productive healthy landscapes".
South East Catchment Action Plan 2013 – 2023 (South East LLS, 2014)	"Sustainable communities, profitable industries, resilient landscapes."
Economic Development Strategy 2019-28 (ESC, 2019)	"To foster economic growth and improve the socio-economic wellbeing of the community by taking advantage of our valued natural assets to build a vibrant and diverse economy."
Eurobodalla Destination Action Plan 2018 to 2021 (Wray, 2018)	"Cooperate and support each other to achieve a strong and innovative visitor economy that preserves our natural environment, fosters support and pride from our community, celebrates and offers distinctive and quality visitor experiences related to our natural and marine assets, regional food, culture and heritage, and welcomes and cares for our visitors."
One Community – Eurobodalla Community Strategic Plan 2017 (ESC, 2017)	"Friendly: We are happy, supportive and welcoming. A liveable community has pride of place, ease of access, community harmony, and a mobile and healthy population that is encouraged and motivated to participate in community life. There is a feeling of safety and security, a strong vibrant cultural base, and places to relax, study and play which means people are happy with their work life balance.

Vision Source	Related Vision Statements
	Responsible: We make balanced decisions that benefit current and future generations. A sustainable community is characterised by appreciation of our natural surroundings that support our economy and lifestyle. It has responsible planning and management practices to maintain our biodiversity and unique character, and is supported by the actions we agree to, to minimise our impact and make best use of valuable resources. Thriving: We are successful and sustainable in growth and development. A productive community works together to enable positive investment and employment opportunities. An innovative, diverse and resilient economy ensures that funding, planning and support for infrastructure and economic development exists to grow and enhance business confidence, market strength and industry diversity. Proud: We build community spirit, and our Eurobodalla leads the way. A collaborative community is engaged, informed, proactive and involved. It has responsible decision making and a sound financial position supported by capable leaders, functional assets and efficient operations to meet the changing needs of the community."
Eurobodalla Local Strategic Planning Statement 2020 – 2040 (ESC, 2020)	"Eurobodalla is committed to creating great places through more liveable, sustainable, productive and collaborative communities. Liveable community – having a pride of place, ease of access and feeling of safety and security. Sustainable community – showing an appreciation of the natural surroundings. Productive community – working towards facilitating positive investment and employment opportunities and strengthening tourism development. Collaborative community – demonstrating engaged, informed and involved community members."

Overall, these visions identify a variety of key descriptors and directives relevant to the study area, including:

- **Environment** – healthy, beautiful, sensitive, significant, protected, preserved, managed, resilient, valued
- **Social/cultural** – sustainable, thriving, resilient, attractive, culture is protected, proud, supported, celebrated, welcoming, caring, engaged, informed, proactive, involved, collaborative, productive, safe, secure
- **Economy** – thriving, profitable industries, economic growth is fostered, vibrant, diverse, strong, innovative, successful, productive, resilient
- **Governance** – sustainable, managed, reasonable, balanced decisions, responsible decision making, sound financial position, capable leaders, functional, efficient.

These were considered in the preparation of the vision statement provided in **Section 2.2**.

2.3 Objectives

2.3.1 Goals for Coastal Management

A review of Council's existing plans and strategies and previous community engagement was undertaken by Umwelt (2018) and identified five key goals for coastal management in the LGA. These goals are used in the preliminary risk assessment to evaluate various consequences. These goals also allow the performance of the CMP implementation to be evaluated in Stage 5.

Council's Goals in Coastal Management

Council's success in managing its coastal zone will be assessed against five criteria. Management decisions and implementation will:

- *sustain the natural coastal environment*
- *maintain public access, amenity, use and safety on the coast and the lifestyle enjoyed by local people*
- *help build the local coast dependent economy*
- *improve council and community resilience to coastal change*
- *support community involvement in looking after the coast and decisions about its management*

2.3.2 Coastal Management Objectives

The purpose of a CMP is to set the long-term strategy for the coordinated management of the coastal zone with a focus on achieving the objects of the CM Act. A review of Council's coastal management goals against the CM Act Objectives (**Table 2-2**) shows there is consistency between the two. This ensures that a CMP driven by these goals will plan for, and implement, actions that will help achieve coastal management objectives at a local level, consistent with the objects of the CM Act.

Table 2-2 Coastal Management Goals and CM Act Objectives

Council's goal for the coast	Related CM Act Objectives
Sustain the natural coastal environment.	a) To protect and enhance natural coastal processes and coastal environmental values including natural character, scenic value, biological diversity and ecosystem integrity and resilience e) To facilitate ecologically sustainable development in the coastal zone and promote sustainable land use planning decision-making h) To promote integrated and co-ordinated coastal planning, management and reporting j) To ensure co-ordination of the policies and activities of government and public authorities relating to the coastal zone and to facilitate the proper integration of their management activities l) To facilitate the identification of land in the coastal zone for acquisition by public or local authorities in order to promote the protection, enhancement, maintenance and restoration of the environment of the coastal zone m) To support the objects of the Marine Estate Management Act 2014

Council's goal for the coast	Related CM Act Objectives
Maintain public access, amenity, use and safety on the coast and the lifestyle enjoyed by local people.	b) To support the social and cultural values of the coastal zone and maintain public access, amenity, use and safety
Help build the local coast dependent economy.	d) To recognise the coastal zone as a vital economic zone and to support sustainable coastal economies
Improve council and community resilience to coastal change.	e) To facilitate ecologically sustainable development in the coastal zone and promote sustainable land use planning decision-making f) To mitigate current and future risks from coastal hazards, taking into account the effects of climate change g) To recognise that the local and regional scale effects of coastal processes, and the inherently ambulatory and dynamic nature of the shoreline, may result in the loss of coastal land to the sea (including estuaries and other arms of the sea), and to manage coastal use and development accordingly i) To encourage and promote plans and strategies to improve the resilience of coastal assets to the impacts of an uncertain climate future including impacts of extreme storm events j) To ensure co-ordination of the policies and activities of government and public authorities relating to the coastal zone and to facilitate the proper integration of their management activities
Support community involvement in looking after the coast and decisions about its management	c) To acknowledge Aboriginal peoples' spiritual, social, customary and economic use of the coastal zone k) To support public participation in coastal management and planning and greater public awareness, education and understanding of coastal processes and management actions

3 Strategic Context for Coastal Management

This chapter sets the strategic context for coastal management in the Eurobodalla Open Coasts study area. This is achieved through a high-level interpretation of existing published materials. It sets the environmental, social/cultural, economic and legal/planning context for coastal management.

3.1 Existing Information Relevant to Coastal Management

There is a great deal of information from a range of sources relating to the physical processes and management of the Eurobodalla Shire coastline. A critical review of this information was conducted to determine content and currency of the reports that are directly or indirectly relevant to:

- Understanding the physical, environmental, social and economic features and processes occurring within the study area;
- Identifying key values (or benefits), and known issues or threatening processes that may be reducing or undermining these values; and,
- Determining existing management actions or strategies for managing the threats, and if possible, the effectiveness of these actions.

The data and information reviewed included:

- Technical studies and academic literature;
- Planning documents (e.g. strategic, operational and natural resource, CMPs, CZMPs); and,
- Spatial mapping and data.

A full listing of documents and review of their adequacy or relevance to preparing the CMP is provided in **Appendix B**.

This section overviews strategic directions established for the coast in regional or local planning documents, legislation and policies relevant to the study area, governance matters related to the coastal zone, environmental / social / cultural and economic characteristics of the study area and future pressures affecting the coastal zone. Additionally, this contextual information supports the vision, objectives and need for developing a CMP (**Section 2**).

Outcomes of the data and information review have been used to summarise information contained in the following sections and was also used to develop the first pass risk assessment (**Section 7**), in particular, to help identify coastline values and threats in conjunction with community and agency feedback obtained through the community survey and workshops of previous studies undertaken by Council. The information also helped to determine the adequacy of existing management, and of existing information to manage known threats at present and in the future and the appropriate priorities to be assigned to management tasks.

3.2 Strategic Direction

The strategic direction for the study area is formulated through acknowledging existing visions, strategies and directives outlined in existing documentation by state, regional and local strategic planning documents, some of which are shown in **Figure 3-1**. These related visions are discussed and listed in **Section 0**.

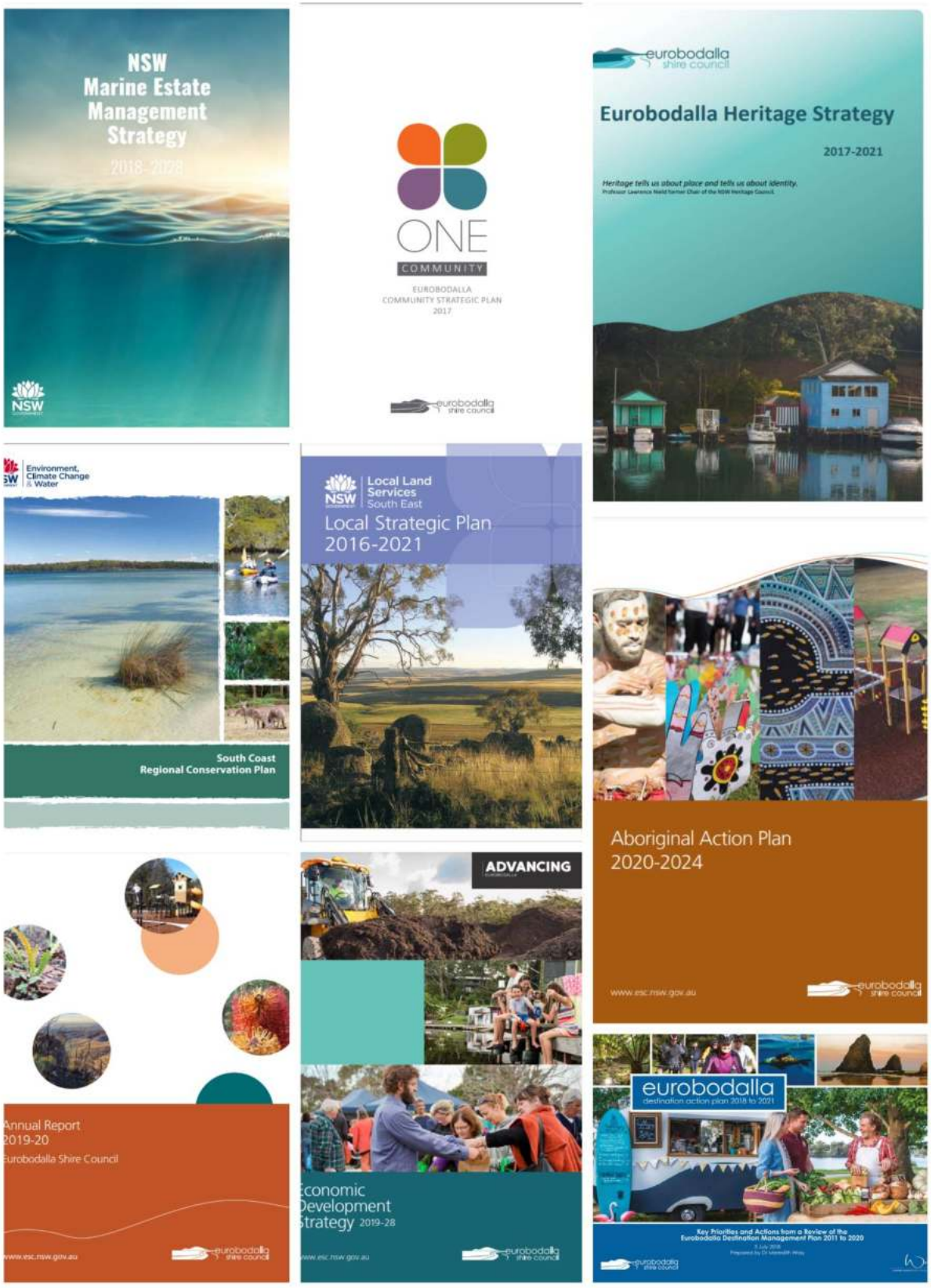


Figure 3-1 **Some of the Strategies and Plans that set the Strategic Context of the CMP**

3.3 State, Regional and Local Level Plans and Strategies

The key State level plan for the Eurobodalla Shire coastline is the NSW Coastal Management Framework, as explained in **Section 1.1**. An outline of the state, regional and local level plans and strategies relevant to coastal management in the study area are listed in summary in **Table 3-1**, with additional strategies and plans added and discussed where required. All plans and strategies reviewed are listed and a summary of each document provided in **Appendix B**.

Table 3-1 Strategies and Plans that set the Strategic Context of the CMP

Plans and Strategies	Summary of Relevance to the CMP
NSW Marine Estate Management Strategy (2018-2028)* (MEMA, 2018) and *Marine Estate Management Act 2014	The Strategy sets the overarching framework for the NSW Government to coordinate the management of the marine estate over the next decade in accordance with the objects of the *Marine Estate Management Act 2014* and the NSW Government's vision for the marine estate. The Strategy outlines how to manage threats to the environmental assets, as well as to the social, cultural and economic benefits the community derives from the marine estate. It identifies evidence-based management priorities and sets policy directions to manage the marine estate as a single continuous system. This CMP aligns with the objectives of the Strategy.
***New South Wales Marine Estate Threat and Risk Assessment Report* (TARA; BMT WBM, 2017)**	The Marine Estate Management Authority (MEMA) completed an evidence-based threat and risk assessment for the NSW marine estate. The assessment identifies, assesses and prioritises threats and risks to the environmental assets and the social and economic benefits of the marine estate. Threats and their associated risks were assessed at a state and regional scale with Eurobodalla being part of the South Region. All identified threats and risks as outlined in the TARA have been considered during the preparation of this study (see **Section 4.3.2**), with particular note given to Table 5-4 in the TARA (Ranked Priority Threats for the South Region).
National Parks and Wildlife Service Plans of Management	NPWS manages a substantial area of land within the study area including the: • Budawang National Park; • Murramarang National Park; • Deua National Park; • Eurobodalla National Park; and, • Wadbilliga National Park. These areas are managed under various Plans of Management developed by NPWS. These plans identify their extent, values and sensitivities and provide extensive management information for the environment and community use of the areas. Further details on the Plans of Management are provided in **Table 3-2**.

Plans and Strategies	Summary of Relevance to the CMP
Plans of Management (Crown Lands)	Crown land areas are regulated under the *Crown Land Management Act 2016* by DPIE – Crown Lands. Unreserved Crown Land is managed by DPIE – Crown Lands. Reserved and dedicated Crown Land is managed by the entity appointed by DPIE – Crown Lands to manage the Crown Reserve or Dedication. Where Council is appointed to manage a Crown Reserve or Dedication, management of that land is governed by both the *Crown Land Management Act 2016* and *Local Government Act 1993*. Council is required to prepare Plans of Management under the *Local Government Act 1993* for Crown Reserves and Dedications it manages.
South East and Tablelands Regional Plan 2036 (DPE, 2017)	This Plan guides the NSW Government's land use planning priorities and decisions over the next 20 years. It is an overarching framework to guide more detailed land use plans, development proposals and infrastructure funding decisions. The Implementation Plan that accompanies this Plan includes a series of priority actions and identifies medium- and longer-term actions to coincide with population and economic change. A priority for Eurobodalla in the Plan is to 'protect and enhance the natural environment to ensure ecosystems remain resilient'. Direction 16 in the Plan is to 'protect the coast and increase resilience to natural hazards'. A specific action under this direction is 'update coastal zone/estuary management plans and prepare new coastal management programs to identify areas affected by coastal hazards'.
South Coast Regional Strategy 2006 – 2031 (Department of Planning, 2007)	This Strategy sets out a clear and certain land use plan for the South Coast, which balances the demands for future growth with the need to protect and enhance environmental values.
South East Local Strategic Plan 2016 – 2021 (South East LLS, 2016)	This Plan outlines Local Land Service's approach and commitment to building the sustainability of the South East Region's primary industries, natural environment and local communities. The Plan includes four goals, along with associated priorities and outcomes, actions and performance measures.
South East Regional Strategic Weed Management Plan 2017 – 2022 (South East LLS, 2017)	This Plan outlines strategic actions to guide collaborative weed management, resource allocation and investment in the South East region, providing a consistent basis for regional planning and delivery.

Plans and Strategies	Summary of Relevance to the CMP
South East Catchment Action Plan 2013 – 2023 (South East LLS, 2014)	The South East Catchment Action Plan (CAP) has been developed to guide investment in natural resource management in the South East region towards a vision of sustainable communities, profitable industries, resilient landscapes. The South East CAP combines the intent and priorities of four Minister approved CAPs into one common strategy that defines a vision, goals, strategies, targets and priority actions for the region. The four CAPs that contributed to the development of the South East CAP are: • Hawkesbury-Nepean Catchment Action Plan 2013 – 2023 • Lachlan (Kalare) Catchment Action Plan 2013 – 2023 • Murrumbidgee Catchment Action Plan 2013 – 2023 • Southern Rivers Catchment Action Plan 2013 – 2023
Eurobodalla Local Environmental Plan 2012	**Section 5.2.1** discusses the history of development of coastal management provisions in Council's LEPs and DCPs in response to changes in the coastal management framework.
Eurobodalla Development Control Plans (various)	Ensures development within the LGA is undertaken appropriately, refer **Section 5.2.1**.
Interim Coastal Hazard Adaption Code	Initiates the process of providing long term management options for the LGA and provides guidance on how coastal hazards will be considered in the assessment of development applications in Eurobodalla Shire until such time as the Eurobodalla Coastal Management Program is completed. Refer **Section 5.2.1**.
Economic Development Strategy 2019-28 (ESC, 2019)	The Strategy highlights a range of issues, challenges and opportunities for sustainable economic development in the Eurobodalla. The Strategy focuses on four key priorities: 1. Industry Assistance and Engagement 2. Investment Attraction 3. Workforce Development 4. Infrastructure and Place Enhancement.
Eurobodalla Destination Action Plan 2018 to 2021 (Wray, 2018)	A review of the Eurobodalla Destination Management Plan (EDMP) 2011 to 2020 was undertaken from September 2016 to March 2017 to prioritise opportunities and actions to develop a Destination Action Plan to guide the cooperative efforts of Council and industry to manage and grow Eurobodalla's visitor economy over the next four years. The Plan was further updated in May 2018 following the release of the Destination Southern New South Wales Regional Destination Management Plan in April 2018.

Plans and Strategies	Summary of Relevance to the CMP
Aboriginal Action Plan 2020 – 2024 (ESC, 2020)	This Plan is about building positive relationships within Eurobodalla. Council recognises that Aboriginal people within the region represent a strong and vibrant culture, founded on one of the planet's oldest living cultures, with a rich history and deep connection to Country. Aboriginal culture is strong and can help shape the identity of the broader community. The Plan includes a series of actions for implementation, some of the most relevant to this CMP being: • An Aboriginal identified position to be allocated on all Council advisory committees • Seek funding to support the cultural development of Aboriginal people to promote history and heritage • All Council activities undertaken on Australian, NSW or Local Government land or waters comply with the requirements of *Native Title Act 1993*.
Batemans Marine Park Operational Plan (Marine Parks Authority, 2010)	The Batemans Marine Park Operational Plan details management actions being undertaken by the Marine Parks Authority. The Marine Park covers the entire length of the Eurobodalla coast. These actions focus on meeting key objectives related to conservation of marine biodiversity, as well as provision of opportunities for ecologically sustainable use, public appreciation, enjoyment and understanding of the marine park. The operational plan has also been developed in consultation with the Batemans Marine Park Advisory Committee as required by the *Marine Parks Act 1997*.
One Community – Eurobodalla Community Strategic Plan 2017 (ESC, 2017)	All councils are required to develop short, medium and long term plans under the NSW Integrated Planning and Reporting (IPR) Framework. The Community Strategic Plan is a whole of community plan and is prepared by Council and the community. Its purpose is to identify the community's main priorities and aspirations for the future, and to provide strategies for achieving these goals. The planning process considers the issues and pressures that may affect the community.
Eurobodalla Local Strategic Planning Statement 2020 – 2040 (ESC, 2020)	The Eurobodalla LSPS is a strategic document, setting out a 20-year vision for land use planning in the Shire. It outlines how growth and change will be managed to ensure high levels of liveability, prosperity and environmental protection are achieved in Eurobodalla.

Table 3-2 National Park Plans of Management

National Park	Plan of Management	Relevant High Priority Actions
Budawang National Park	Morton National Park, Budawang National Park Plan of Management (NSW National Parks and Wildlife Service, 2001)	• Record location of threatened species • Control blackberry and serrated tussock • Prepare and implement introduced animal control plan • Prepare fire management plan
Murramarang National Park	Murramarang National Park, Brush Island Nature Reserve, Belowla Island Nature Reserve and Tollgate Islands Nature Reserves Plan of Management (NSW National Parks and Wildlife Services, 2002)	• Provide information about prohibition of landing on islands • Seek cooperative boundary management with NSW State Forests • Prepare introduced species control plan • Prepare fire management plan • Close Acheron Ledge vehicle tracks, construct walking track from Maloneys Flat • Complete Pebbly Beach upgrading and dune rehabilitation • Rationalise Snapper Point tracks • Improve and signpost Depot Beach and Shelley Beach tracks
Murramarang	Murramarang Aboriginal Area Plan of Management (NSW National Parks and Wildlife Services, 1998)	• Set up Aboriginal community consultation process • Increase plant species diversity on headland sand deposits • Control blackberry • Seek conservation agreement for Lot 1 DP 556738 4.2.4
Deua National Park & Wadbilliga National Park	Far South Coast Escarpment Parks Plan of Management (NSW National Parks and Wildlife Services, 2019)	• Implement the conservation management recommendations of the Far South High Coast Region Cultural Heritage Management Strategy 2003 – 2008 • Encourage and seek funding to undertake a traditional knowledge and naming project • Close and rehabilitate disturbed areas and illegal access tracks not required for public use or management. • Manage threatened species • Undertake pest species management and control • Provide and manage existing camping and picnic areas • Encourage continued community involvement in park management and investigate new opportunities for involvement

National Park	Plan of Management	Relevant High Priority Actions
Eurobodalla National Park	Eurobodalla National Park Plan of Management (NSW National Parks and Wildlife Services, 2000)	• Prepare interim lagoon opening strategies for Lakes Mummaga, Brou and Corunna, as well as Congo Creek. • Maintain liaison with Eurobodalla Shire Council regarding opening of Lakes Mummaga and Corunna. • Control introduced plant species, including noxious weeds • Develop and implement rehabilitation plans for disturbed areas • Prepare and implement a fire management plan for the park • Encourage joint management activities with Aboriginal communities • Develop a nature tourism and recreation plan for the park • Investigate management options for the site of Blackfellows Point Caravan Park. • Identify a site for a vehicle-based camping area near Lake Brou, and if appropriate, construct it. • Provide day-use facilities in accordance with the policies of this plan.

3.4 Legislative and Policy Context

The CM Act establishes the framework and overarching objectives for coastal management in NSW which focus on strategic, integrated and ecologically sustainable management of the NSW's coastal zone and includes a CM SEPP which covers the four coastal areas that the CM Act recognises as making up the "Coastal Zone". Additional legislation and policy governing the management of the study area is complex and includes several Commonwealth and State level Acts, Regulations and agreements, and numerous State, Regional and Local level plans and policies.

Table 3-3 provides a snapshot of the legislation and policy that have a major influence in the management of the Eurobodalla coastal zone.

Table 3-3 Relevant Legislation and Policy Documents

NSW Coastal Zone Legislation and Policy
Coastal Management Act 2016
Coastal Management SEPP 2018
Marine Estate Management Act 2014

Additional Key Legislation/Policy Supporting or Interacting with Coastal Management
Commonwealth
Environment Protection and Biodiversity Conservation Act 1999
Native Title Act 1993
Japan-Australia Migratory Bird Agreement
China-Australia Migratory Bird Agreement
Republic of Korea-Australia Migratory Bird Agreement
NSW
National Parks and Wildlife Act 1974
Environmental Planning and Assessment Act 1979
Mining Act 1992
Local Government Act 1993
Fisheries Management Act 1994
Heritage Act 1977
Protection of the Environment Operations Act 1997
Water Management Act 2000
Local Land Services Act 2013
Crown Land Management Act 2016
Aboriginal Land Rights Act 1983
Biodiversity Conservation Act 2016
Draft Environment SEPP
SEPP (Aboriginal Land) 2019
SEPP (Housing for Seniors or People with a Disability) 2004
SEPP (Infrastructure) 2007
SEPP (Koala Habitat Protection) 2019
SEPP No 19 – Bushland in Urban Areas
SEPP No 21 – Caravan Parks
SEPP No 36 – Manufactured Home Estates
SEPP No 50 – Canal Estate Development
SEPP No 55 – Remediation of Land

3.5 Coastal Values

An overview of coastal values has been developed for this CMP scoping study from a range of existing plans and strategies published by Eurobodalla Shire Council, publicly available information from Council and from State and Federal Government agencies, the State Heritage Inventory database and several recent (and historic) assessments of the values of the study area and surrounds. Coastal values have also been drawn from previous coastal management work and community engagement undertaken in the study area.

3.5.1 Flora, Fauna and Biodiversity Values

The study area consists of a wide variety of environments including open coastal waters, sandy/rocky shorelines, coastal dunes, estuaries and creeks, littoral rainforest and wetlands/heathlands, water dependent ecological communities, large expanses of offshore rocky reefs, saltmarshes, mangroves and sponge gardens. The entire Eurobodalla coastline is located within the Batemans Marine Park which covers over 850 km^2 of coastal marine habitat and extends from the most northerly point of Murramarang Beach near Bawley Point to the southern extent of Wallaga Lake entrance at Murunna Point and includes all rivers, estuaries, bays, lagoons, inlets and saline and brackish coastal lakes (with the exclusion of Nargal Lake). The Batemans Marine Park includes areas of habitat protection zones (with varying restrictions), sanctuary zones, general use zones and special purpose zones (DPI, 2018). The marine park also encompasses the Tollgate Islands and Montague Island, both of which are nature reserves.

The Eurobodalla Shire provides substantial biodiversity values within the coastal landscape due to the extensive areas of retained native vegetation that included large areas in public reserves as well as on private land. There is approximately 2,5000 km^2 of land within the Shire that is reserved and either subject to no developmental impacts, such as national parks, or subject to intermittent impacts such as clearing and regeneration of land. Residents and tourists are able to regularly see and hear threatened native species and enjoy the expansive areas of undeveloped land (Garret Barry Planning Services, 2015). The special fauna and biodiversity values of the region are listed in the discussion paper, and include:

- The threatened yellow-bellied glider
- Other gliders such as the greater glider and squirrel glider
- The Vulnerable grey-headed flying-fox
- Declining frog species such as the green and golden bell frog
- Rare and threatened bird species including the glossy black cockatoo and the gang gang cockatoo.

There are also a number of species that are native to the Eurobodalla Shire Council for which site management actions are funded by the State Government's Saving Our Species Program (ESC, 2015) further emphasising the biodiversity values of the habitat within Eurobodalla.

Montague Island Nature Reserve, situated within the study area just off the coast of Eurobodalla Shire, is also high value habitat as it is a breeding place for over 40 thousand sea birds, fur seal haul-out site and a nesting location for shearwaters species, crested terns, silver gulls and over eight thousand little penguins. Morwong, trevally, snapper, kingfish, albacore, yellowfin tuna and the grey nurse shark are amongst the marine species that gather off the shores of Montague Island.

Humpback whales, killer whales, dolphins, flying fish, hammerhead sharks and manta rays are also common sights within the marine park making it a popular for divers and whale watchers.

Threatened and protected species that have been sighted at the Batemans Marine Park include (DPI, 2021):

- Grey nurse shark; both Montague Island and Tollgate Island are critical habitat for the endangered grey nurse shark
- Black rockcod

- Great white sharks
- Marine sea mollusc Smeagol hilaris; a critically endangered species found only in a single location near South Durras
- The eastern blue devil fish
- Whales; humpback, southern right and killer whales
- Seabirds and shorebirds; little terns, hooded plovers, sooty and pied oyster catchers and albatross. The marine park is nesting and foraging habitat for these species.

High Environmental Value (HEV) vegetation was mapped for the South East Tablelands Planning Region in 2016 by the Planning Team South East Branch Regional Operations with input from the Planning Services unit of the OEH (now DPIE). According to the mapping approximately 2,516 km^2 of Eurobodalla Shire Council is HEV vegetation, accounting for around 73.4% of the LGA's total land area. The study area contains coastal feature of high environmental value, including littoral rainforest, many of which align with the listing for Threatened Ecological Communities (TECs) under both the NSW *Biodiversity Conservation Act 2016* and the *Commonwealth Protection and Biodiversity Conservation act 1999*. There is also high biodiversity value associated with the creeks, lagoons and inlets that have variable entrance conditions, termed as Intermittently Closed and Open Lakes and Lagoons (ICOLLs) the value of these areas is recognised in the CM Act and the CM SEPP.

Healthy and functioning ecosystems also support tourism and economic values, as the study areas pristine naturalness is one of the qualities that attracts tourists to the area. Council's Eurobodalla Destination Action Plan 2018 to 2021 (Wray, 2018) and the inclusion of Eurobodalla in the NSW Governments 'Unspoilt' tourism campaign (NSW Government, 2015) reinforces that the Eurobodalla's natural beauty, untouched environment and natural and marine assets are key drivers of local tourism and the local economy.

Furthermore, community consultation that has previously been undertaken for three Community Strategic Plans (CSP) in 2009/10, 2012/13 and 2016 found that what respondents most valued was Eurobodalla's beaches, coast and marine environment with 40% of some 3,000 identifying it as the outstanding value of the Shire amongst other responses including the natural environment which garnered 27% of responses (CSP, 2010). In the 2006 survey 61% of responses from a sample of 400 people of representative age and gender indicated that they strongly agree that maintaining and protecting the natural environment in Eurobodalla is important and that the natural environment is one of the most important drivers of quality of life in Eurobodalla.

3.5.2 Water Quality Values

The value of water quality in the study area is high and it underpins other values. Good water quality allows for primary and secondary recreation to take place within or on the water and also allows for healthy fishing and aquaculture industries. Good water quality also supports the flora, fauna and biodiversity values as a healthy aquatic environment is necessary for thriving aquatic ecosystems.

3.5.3 Cultural Heritage Values

3.5.3.1 Aboriginal Heritage

The people of the Yuin Nation are the traditional owners of the land encompassing Eurobodalla Shire Council. A study was conducted 2008 in close consultation with Aboriginal people living in the Eurobodalla Shire to collect and record information about the traditional Aboriginal occupation of the

coastal part of the Shire and also about the modern Local Aboriginal Land Council structure (Donaldson & Barry, 2008). According to this study the Aboriginal people's connection to the Eurobodalla coast dates back over 20,000 years and the focus on coastal resources increased substantially only after the sea level stabilised in its present state approximately 6,000 years ago. Physical evidence of Aboriginal inhabitants of the Eurobodalla coastline exists in the forms of shell middens, artefact scatters, scarred trees, ochre sites, ceremonial sites for both men and women, quarries, fish traps, grinding grooves and burial sites.

The evidence also includes the connections between these sites and the stories about how and why people moved from place to place or gathered for special events. Examples of traditional and historic Aboriginal walking routes along the coast include (Feary & Donaldson, 2011):

- tracks that linked all the Batemans Bay beaches such as North Head Batemans Bay to Cullendulla Creek, Cullendulla Creek to Corrigans Beach. A track along the north side of the Clyde River linked Shallow Crossing to Cullendulla Creek, Square Head and Yellow Rock
- people also walked south from Durras to the Batemans Bay beaches, chasing mullet
- families also reported that they walked long distances along the south coast, visiting relatives and fishing, or collecting bush tucker along the way. Examples are families walking from Wallaga Lake to Ulladulla.

Contemporary Aboriginal use of the entire coastline includes hunting, fishing and maintaining cultural associations through ceremonies, teaching and visiting sites.

A search of the NSW Heritage website (www.heritage.nsw.gov.au) listed five aboriginal places on the NSW State Heritage Inventory lists under the *National Parks and Wildlife Act* within the study area (Heritage NSW, 2021):

- Barlings Beach; an important camp site for Aboriginal people, intertribal meeting place where marriages were arranged and a traditional burial place. A battle between the local Aboriginal people and the Ngunnawal from Braidwood area took place at the site and many of the dead were buried on the beach. The area is used today as a place to collect resources and is used as a campsite for annual gatherings of a large number of Aboriginal families.
- Barunguba (or Montague Island); one of the most significant sites within the study area, it is used by local people for ceremonies and is an important teaching place for men. The island also features many artefacts and middens and is the subject of dreaming stories that link the island to the mainland.
- Mystery Bay Fish Trap Aboriginal Place; a significant resource gathering area, the fish trap demonstrates how the traditional owners caught fish. The surrounding site was also used as a semi-permanent campground outside of the government run reserves in the early 20th century.
- Ten Pelicans Lake Brou; a place of past and present connection containing a women's burial ground for Yuin women, some of which are ancestors of Yuin women today.
- Two Sisters; natural feature that is the subject of traditional stories.

Council has also worked with local Aboriginal people and groups to develop reports and resources to support the celebration of Aboriginal history and culture in Eurobodalla, including:

- **Yuin Country Explored**: A 12-month project that delivered local Aboriginal arts and cultural activities commemorating the 250th anniversary of HMB Endeavour's voyage of Australia's east coast led by Captain Cook.
- **Aboriginal Heritage Study**: Completed between 2005 and 2008, the project aimed to improve understandings and protection of Aboriginal cultural heritage.
- **Caring for Ancestors: Wallaga Lake**: The project involved work to identify, mark and conserve the burial sites and make a plan of management for future use for the Wallaga Lake Aboriginal Cemetery, one of the oldest and largest in New South Wales.
- **EKEN Memorandum of Understanding**: Council works with the Eurobodalla Koori Employment Network to deliver NAIDOC Week events.

3.5.3.2 Maritime Heritage

A search of the Maritime Heritage Database (www.heritage.nsw.gov.au) identified more than 10 shipwrecks within the Batemans Marine Park and more have been identified within the study area. The most notable of these include:

- The Lady Darling (73 metres, 895 tonne iron steamer); sank off Mystery Bay in 1880 on a voyage from Newcastle to Melbourne;
- TSS John Penn (42.7 metre, 236 tonne steamer); Drove up against the rocks of Burrewarra Head in 1879;
- The Bodalla; wooden screw steamer that wrecked in 1924 when it ran aground at the entrance to the Wagonga inlet;
- The Monary; 521 tonne iron steamer that wrecked that ran ashore in 1879;
- The Kameruka; 515 tonne steel screw steamer that was wrecked in 1897 on Pedro Reef Moruya;
- The Rover; 97 tonne schooner that was wrecked in 1841 at Broulee Bay; and,
- The Dureenbee; a small fishing trawler that was attacked by a Japanese submarine off the coast of Moruya and destroyed in 1942.

All of the above stated shipwrecks were protected under the Historic Shipwrecks Act 1976 which was recently replaced by the *Underwater Cultural Heritage Act 2018*. This Act commits the Australian Government to the protection of underwater cultural heritage sites in Australian waters which represent some of the unique and irreplaceable physical evidence of our past (Department of Agriculture, Water and Environment, 2021).

3.5.3.3 State and Local Heritage

Eurobodalla's state and local heritage includes a diverse range of buildings, sites and objects. They give a sense of how previous generations lived, and they enrich the cultural and heritage values of the landscape.

The state Heritage Inventory lists four records of state heritage items protected under the *Heritage Act 1977* (section two item) and 390 items listed by local government and state agencies (section three item) within Eurobodalla Shire. Of the four items listed under the *Heritage Act 1977* only one is within the study area for this scoping study, the Montague Island Lightstation. The statement of significance for the lightstation states that it is highly significant being one of a collection of lighthouses which combine the natural values of the rugged coastline with the cultural values of a prominent landmark

and isolated outpost, and the lighthouse is heavily associated with the development of coastal shipping in the late 19th century.

Of the 390 items listed under section three of the State Heritage Inventory around 104 are positioned within the study area.

Photo: Bar Rock Lookout by Eurobodalla Coast Tourism

3.5.4 Recreational and Economic Values

3.5.4.1 Economic

This section gives a broader overview the economic context of the study area. The primary economic values identified for the region are of tourism, fishing and aquaculture.

Commercial fishing is largely restricted within the study area due to the Batemans Marine Park. Trawling, long lining and dredging are prohibited in all zones of the marine park, and purse seining, lift netting, garfish netting, and estuary mesh netting are only prohibited in habitat protection zones, and set lining is only permitted in general use zones. Locations where beach haul netting is permitted is limited to certain beaches and general use zones. Eurobodalla's agriculture, forestry and fishing industry is small in economic terms, contributing only 3% to the total GRP however it has a significant impact on other industries such as manufacturing and tourism (ESC Economic Development Strategy, 2019).

The Eurobodalla Destination Action Plan 2018 to 2021 indicates that tourism expenditure in Eurobodalla Shire Council was $385 million for the year ending June 2017. Tourism is a key driving force of the local economy (ESC Economic Development Strategy, 2019) and the tourism sector is founded on the natural and marine assets, local food, towns and villages, and events held within Eurobodalla (Destination Action Plan, 2018) which are all closely interlinked with the coastal environment. The destination plan also states that the emergence of regional food and the Eurobodalla's distinct and abundant natural and marine environments provide unique opportunities to grow the tourism sector within the region.

3.5.4.2 Recreation

The recreation values of the study area are felt by local residents and tourists alike. Eurobodalla Shire has 83 beaches, Narooma Surf beach, Dalmeny Beach, Tuross Head Main Beach, Moruya South Head Beach, Moruya North Beach, Broulee South Beach, Malua Bay Beach and Surf Beach are all patrolled by a mix of professional lifeguards and volunteer lifesavers. Surfers frequent many of Eurobodalla's beaches and surf schools also operate in Eurobodalla for those that would like to learn to surf. Boating and fishing are also popular recreational activities in the study area and Council's website also lists a number of marine facilities in the coastal area that allow residents and visitors to access the waterways and enjoy water based activities.

Recreation activities that underpin the tourism industry are largely centred around the Batemans Marine Park, beaches, estuaries and the national parks within Eurobodalla. Dolphin and whale watching is popular amongst tourists to the marine park, humpback whales tend to swim close to the shore at Montague Island as they migrate south, and there are six land based viewing spots on the mainland (DPI, 2021). Popular SCUBA diving and snorkelling spots within the marine park include Guerilla Bay, Broulee Island, Shelly Beach, Wagonga Inlet, Mystery Bay and Montague Island (where snorkelers can swim with the Australian and New Zealand fur seal colony). There are also locations where divers can view the endangered grey nurse shark in its natural habitat. Other activities that contribute to the overall recreation value of the study area include swimming, bush walking, dog walking, exercising, canoeing, kayaking, and wind surfing and the parkland attached to many of Eurobodalla's beaches include playgrounds and provide space for community members to gather and socialise.

3.6 Environmental Context

3.6.1 Coastal Processes

A review of coastal processes in the study area was performed to inform the objectives and strategies of the CMP based on the available data, studies and literature across the study area. The study area is comprised of a diverse range of environments including 83 open coast beaches outside of national parks, estuaries and their catchments, dunes, foreshores and the nearshore environment. The major embayment of Batemans Bay is the main population centre, with key human development and public assets within the coastal hazard risk area. At least 28 catchment systems reach the coast, including the Clyde, Moruya and Tuross Rivers and Wagonga Inlet, in addition to numerous ICOLLs and smaller streams (WRL, 2017). A summary of the key processes is provided below:

- The offshore wave climate is predominantly from the southeast, with a median H_s of 1.30m, and T_p of 9.5s (Shand et al., 2010).
- Infrequent East Coast Lows and storm systems lead to significant erosion, inundation and impacts to embayments and infrastructure. Key recent events were the 2015 and 2016 storms.
- The coast is defined by a series of sediment compartments along the Eurobodalla coast as defined in the NSW Coastal Management Act (2016), which are all located in the south coast region. Shoreline response is directly influenced by the sediment availability within each sediment compartment. Specific to the study area the following is noted:
    - Longshore sand transport rates vary longshore within the study area. Gradients in the longshore currents occur due to spatial differences in wave exposure and obliqueness, which result in the longshore differences in sediment transport.
    - Severe storm erosion of beaches and dune systems occur at several beaches.
    - Long-term recession is occurring at several beaches (e.g. Narooma Surf Beach, Cullendulla Reserve), whilst others are accreting (e.g. Broulee Beach, Malua Bay, Long Beach).
    - Sediment and shoreline dynamics are influenced by anthropogenic interventions, such as seawalls, managed entrance policies and artificial dune systems.
- Coastal inundation occurs at a number of locations, which can be caused in the short term by tides, storm surge, wave set-up and wave run-up, and in the longer term by climate change induced sea level rise.
- Flooding of rivers and associated embayments occurs as a result of rain events, often co-incident with coastal storm events and severe erosion.
- Batemans Bay has substantial anthropogenic modifications to the coastline, with significant inundation and dynamic erosion processes that occur on both the northern and southern side.
- Coastal hazard risk is likely to increase over time due to projected sea level rise and climate change scenarios.

A first pass risk assessment has been undertaken on the tidal, erosion and hazard lines for the Eurobodalla open coast. Further discussion on these extents and their associated risks is provided in the first pass risk assessment (**Section 7**)

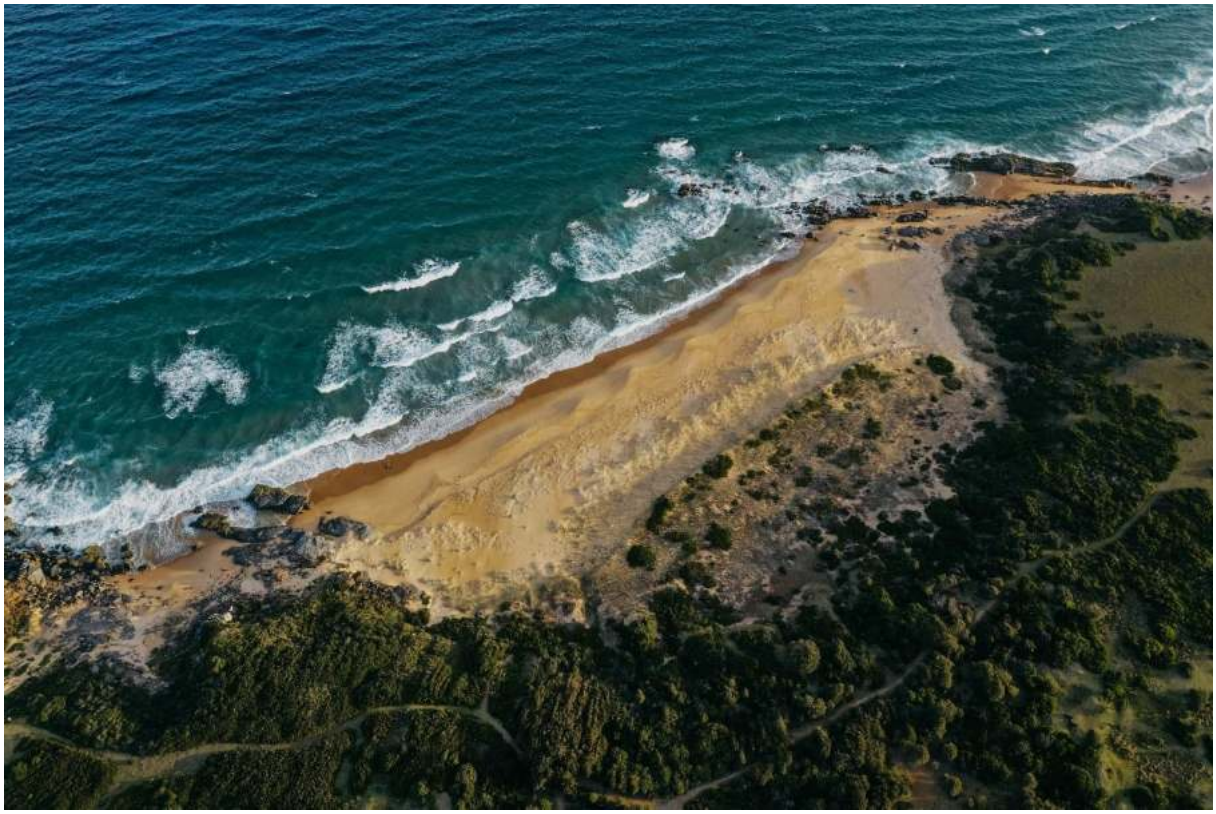


Photo by Eurobodalla Coast Tourism

3.6.1.1 Open Coast Waters

Beaches on the open coast are directly exposed to waves originating from the Tasman Sea, which enables coastal processes such as rips and currents, littoral drift and erosion to occur. The beaches are a mix of embayed beaches and long sandy barrier beaches between rocky headlands.

The erosion of beaches through cross shore sediment transport under coastal storm conditions is a key coastal process that affects all beaches within the study area and is considered within the concept of sediment compartments. These define an area of coast based on sediment movement, where sand may be eroded or deposited, moved offshore or along shore, but not transported out of the compartment. The shoreline behaviour, namely accretion, stability or recession, is contingent on the availability of sediment within the compartment. The study area has two primary coastal sediment compartments and six secondary compartments.

Over the long-term (years to decades), sediment transport is moderated through the local sediment budget (sediment sources and sinks) and can result in long-term shoreline recession in addition to the shorter term fluctuations due to storm erosion. This has been identified to occur within the Batemans Bay secondary compartment, Narooma and Tomaga compartments. Future SLR is likely to increase recession trends at some locations faster than others.

On a shorter timescale, coastal storm events can cause large, powerful sustained waves, which can result in significant beach erosion and coastal hazard risk to infrastructure and the environment. Severity of erosion depends on storm intensity, wave direction, impact of recent storms on the beach sediment budget, shoreline orientation, amongst other factors. During severe storm events, erosion of the frontal dune can occur, creating steep erosion escarpments. Recovery of the beach face from offshore sand deposits can take several months to years to occur, or, if severe enough, can lead to long-term recession of the beach face. However, it is noted that most beaches in the region have well vegetated coastal dune systems with significant sand volumes that can provide a buffer against erosion and allow short to medium term recovery. However, the future recovery profile of these beaches due to SLR is uncertain, in addition to the increased impacts on long-term recession.

3.6.1.2 Batemans Bay

As the largest population hub in the study area and at the entrance to the Clyde River, Batemans Bay has unique pressures and coastal processes that occur. Due to the shape of the bay, offshore swell waves can propagate into the harbour, causing erosion and coastal hazard risk. The four embayed beaches on the northern side of Batemans Bay face into the prevailing swell, whilst the eight embayed beaches on the southern side are more protected and have the lowest wave energy. Within the bay, beaches are vulnerable to elevated water levels associated with tides (and tidal anomalies), storm surges, wave set-up and catchment flooding. However, it is noted that flooding from the Clyde River in extreme events increases peak coastal inundation levels by less than 0.2m, with the risk decreasing with further distance from the river entrance.

There has been significant modification and development of the coastline and coastal dune system within Batemans Bay, including land filling, revetments, breakwaters and marinas. The northern side of the Clyde River has a relatively mobile sand bed, whilst the southern section is stable, with a training wall built in 1905 to maintain a southern deep-water channel. The training wall has contributed to the accumulation of sediments at Corrigans Beach, in addition to dredging and landfill placement and is likely to have influenced the ebb tide shoals and sand bars at the eastern end of the channel (WRL, 2017). Dredging for navigation is routinely undertaken at the Clyde River entrance, where sand has been used to nourish Corrigans and West Surfside beaches.

Despite significant breakwaters and revetments, the Batemans Bay CBD and nearby foreshores are very vulnerable to wave overtopping, inundation and coastal erosion. For example, Caseys Beach has significant wave overtopping, sea wall slumping and foreshore erosion, and is particularly vulnerable to waves propagating from the north. Inundation also occurs along Wharf Road, whilst flooding occurs at Corrigans Beach and Hanging Rock area. A lack of a frontal dune system has led to severe storm events causing erosion, particularly at Long Beach and Surfside, such as in 2018 and May 2021. At Wharf Road, a cyclical beach profile exists on the decadal scale, driven by river flood erosion, onshore sediment transport driven by waves/tides and sand supply from Clyde River via the offshore shoal. Inundation and coastal erosion at Wharf Road have been an ongoing issue and has been deemed a coastal erosion "hotspot" with significant private property, roads and reserves within the inundation area.

3.6.1.3 Estuarine Waters

The numerous estuaries, ICOLLS and small streams present in the study site are in a relatively natural state, with limited human interference through trained or managed entrances. The majority have vegetated healthy dune systems and sufficient sediment budget that provide protection against and

recovery from storm erosion. As some of these estuaries are nearby developed areas, reductions in foreshore inundation times have been provided through breakwaters and entrance management policies for opening ICOLLs, as well as maritime uses however, with environmental consequence. For example, Wagonga Inlet has a trained entrance, with two large breakwaters on the ocean side, and smaller breakwaters along the first seaward kilometre of the river. Moruya River is also trained on the northern side by a breakwater and smaller breakwater on the southern side, and several other estuaries are constricted in their movement by bridges and roads. Some ICOLLs have management policies indicating the water levels at which artificial opening of the entrance berm can occur, namely Tuross, Coila, Kianga, Little, Nangudga Lakes, Joes, Wimbie and Short Beach Creeks, and Surfside Beach.

The full list of entrances within the study area, identified in Umwelt (2018), include:

- Durras Lake entrance at South Durras
- Creek at the southern end of South Durras Northern Beach
- Small ICOLL behind South Durras Southern Beach
- Creek west of Maloneys Beach
- Surfside Creek west of Surfside
- Cullendulla Creek east of Cullendulla Beach
- Clyde River at Batemans Bay
- Joes Creek at Corrigans Beach
- Short Beach Creek at Casey Beach
- Creek behind Surf Beach
- Small creek at Wimbie Beach
- Reedy Creek at Malua Beach
- Creek north of Rosedale Beach
- Tomaga River between Mossy Point and Tomakin
- Candlagan Creek at the northern end of Broulee Beach
- Moruya River at Moruya
- Congo Creek at Congo
- Coila Lake north of Tuross Head
- Tuross Lake south of Tuross Head
- Mummaga Lake north of Dalmeny
- Duck Pond south of Dalmeny
- Kianga Lake at Kianga
- Wagonga Inlet and Little Lake at Narooma
- Nangudga Lake behind Island view Resort
- Wallaga Lake at Akolele

3.6.2 Ecology

The project area contains an extremely diverse range of ecological units, from terrestrial through to inter-tidal and marine. **Section 3.5.1** provides a description of the values of the flora and fauna and biodiversity of the study area, which is reflected in the percentage of the LGA's total land area that is mapped as High Environmental Value (HEV) vegetation, being 73.4%.

3.6.2.1 Threatened Flora and Fauna

The region is home to a diverse range of fauna including birds, bats, amphibians, marsupials, mammals and reptiles, as well as a diverse range of flora. Coastal forests and fringing estuarine vegetation provide important habitat for fauna, including numerous threatened species.

A search of the BioNet Wildlife Atlas on 27 July 2021 indicated that within the LGA, 158 fauna species and 119 flora species are listed under the NSW *Biodiversity Conservation Act 2016* and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* as either endangered, vulnerable and/or migratory species (for fauna). The majority of the listed 158 fauna species were birds (107), followed by mammals (33), reptiles (9), amphibians (8), as well as 1 insect.

In addition, 39 of the 107 listed birds in the LGA are migratory bird species listed on international agreements including the China–Australia Migratory Bird Agreement (CAMBA), Japan Australia Migratory Bird Agreement (JAMBA) and/or Republic of Korea–Australia Migratory Bird Agreement (ROKAMBA). Many of these listed bird species, in addition to numerous other birds and protected species, would use the coastal and estuarine waters of the study area, particularly for foraging.

3.6.2.2 Endangered Ecological Communities

Endangered ecological communities (EECs) are plant communities under threat from a range of activities. These communities are listed in the same way as threatened species, under the NSW *Biodiversity Conservation Act 2016* and/or the Commonwealth EPBC Act.

The search of the BioNet Wildlife Atlas on 27 July 2021 indicated 17 EECs are present within the LGA. Nine of these EECs are located within the study area, as listed in **Table 3-4** and shown on **Map RG-03-02**. The EEC mapping is based on the 'Endangered ecological communities (EECs) of the Shoalhaven, Eurobodalla and Bega Valley local government areas. VIS ID 3901' map in The Central Resource for Sharing and Enabling Environmental Data in NSW (SEED), produced by DPIE in 2015 (DPIE, 2015).

Table 3-4 Endangered Ecological Communities in the Study Area (Source: DPIE, 2013)

Common Name	NSW status	Comm. status
Bangalay Sand Forest	E3	-
Coastal Saltmarsh	E3	V
Freshwater Wetlands on Coastal Floodplains	E3	-
Littoral Rainforest	E3	CE
Lowland Grassy Woodland	E3	CE
River-Flat Eucalypt Forest on Coastal Floodplains	E3	CE
Swamp Oak Floodplain Forest	E3	E
Swamp Sclerophyll Forest on Coastal Floodplains	E3	-
Themeda Grassland on seacliffs and coastal headlands	E3	-

E3 = Endangered Ecological Community (*Biodiversity Conservation Act 2016*)

V = Vulnerable, E = Endangered and CE = Critically Endangered under the Commonwealth EPBC Act 1999

Littoral Rainforest, Coastal Wetland and Coastal Use SEPP Mapping is shown in **Map RG-03-03**.

3.6.2.3 Marine

The study area lies fully within the Batemans Bay Marine Park. The rocky reefs of Batemans Marine Park support an astounding diversity of flora and fauna (Marine Parks Authority, 2010):

- Many shallower rocky reefs are dominated by lush kelp forests consisting of species such as the common kelp (Ecklonia radiata), cray-weed (Phyllospora comosa) and different species of Cystophora and Sargassum
- The rocky reefs of BMP are home to a diverse array of fish with over 109 species being found during scientific surveys of shallow reefs
- On the deeper rocky reefs of marine park (~30 m) kelp forests become less common and are replaced by beds of colourful and unusually shaped sponges, ascidians and sea whips. Fish assemblages on these reefs are diverse with over 78 species being recorded in scientific surveys of deep reefs
- Seagrass habitats (mostly Zostera capricorni and Posidonia australis) are well represented in BMP. Seagrass beds are critically important to estuarine and lake systems because they greatly enhance local primary production and biodiversity, stabilize sediment, and provide a nursery habitat for many economically-important crustaceans and fish
- Threatened and protected species that have been sighted within the Batemans Marine Park are discussed in **Section 3.5.1**.

3.6.3 Beach Water Quality

The Eurobodalla coastline lies south of where the East Australian Current moves offshore. While this current contributes to warmer waters during summer and autumn, the coastal conditions are generally more influenced by the cooler waters that move north from Bass Straight (Marine Parks Authority, 2010).

These cool upwellings bring with them an abundance of phytoplankton, which can lead to algal blooms and significantly reduced oceanic water clarity (Marine Parks Authority, 2010).

The waters along the coast of Eurobodalla are more influenced by the cooler waters of Bass Strait that move north inshore from the continental shelf. Ocean temperature within the marine park can change rapidly when cold, nutrient rich upwellings influence the coast. These upwelling events have a large influence on phytoplankton abundances (often causing algal blooms) and significantly decrease oceanic water clarity.

The Beachwatch Partnership Program was set up in 2004 to assist coastal councils monitor and report water quality at waterbodies used for recreation. Beachwatch monitors 11 beaches within Eurobodalla Shire Council (ESC, 2021):

- Cookies Beach
- Caseys Beach
- Surf Beach
- Malua Bay
- Broulee North
- Bengello Beach
- Shelley Beach
- Tuross Main Beach
- Brou Beach
- Narooma shark net
- Narooma Main Beach

As of the time of writing this scoping study the most recent sample date was 15 March 2021. This sampling indicated the rating at all of the beaches tested within Eurobodalla as ‘good’ (4 out of 5 stars).

The beaches of Eurobodalla were also assessed as part of the *State of the Beaches 2019-2020* report (DPIE, 2020). The reported all beaches within Eurobodalla as good or very good, with the exception of Surf Beach, which was classed as poor.

The report also noted that the substantial fire damage experienced within the LGA, would likely lead to an increase in ash and debris being washed onto the beaches during rain and storm events, with the reduced water quality and risk of floating and submerged objects, potentially making swimming unsuitable following storm events (DPIE, 2020).

3.7 Social and Cultural Context

3.7.1 Population and Demographics

The current population of the Eurobodalla Shire is approximately 38,000 people. Whilst the population is growing very slowly, it is aging rapidly. Currently, people aged over 65 make up 31% of the population, compared to the NSW average of 16%. This demographic is also growing rapidly as the area's amenities attracts retirees (refer Section 3.8.3).

A somewhat unique aspect of the Shire is that 37% of ratepayers are not residents, but rather live somewhere else (mostly in Canberra) while maintaining a residence in the Shire. These ratepayers would typically live or visit the Shire during holiday, particularly summer holiday, periods.

Coupled with the influx of tourists (refer Section 3.7.2), the region's population balloons in the summer months from the 38,000 noted above to over 110,000. This highly variable and non-permanent population is a key driver of many aspects of the Eurobodalla social and cultural context.

3.7.2 Housing and Settlement

Settlement in the study area is characterised by small, dispersed towns and villages. If settlement disperses even further this has the potential to degrade natural environments, create infrastructure and service delivery inefficiencies, contribute to social isolation and car dependency (DoP, 2007).

The study area contains large areas of vacant land. The majority of this land is zoned as environmental or rural land. Portions of this vacant land is either zoned to allow further development along the coast or identified as land release areas. Existing urban development within the study area may be subject to intensification of development, where permissible. Some of these lands provide opportunities for growth around existing serviced centres with proximity to retain and commercial uses, infrastructure and jobs. Development of these lands has the ability to support additional population in and around centres of Batemans Bay and Moruya (DoP, 2007).

While the large regions of natural bushland are a key draw for the region, both in terms of residents and tourists, both housing and industry is expanding within the LGA, placing increased pressure on these ecosystems (Department of the Environment, Water Heritage and the Arts, 2008)

3.7.3 Tourism

Tourism is a major part of the social and cultural context of the study area. Tourism alone supports 13% of the total jobs in the community and represents 14% of Gross Regional Product, which is double the proportion of tourism jobs at a State level and two-and-a-half times tourism's economic contribution to the State (ESC, 2019).

The high daily and short stay visitation rates are expected to be somewhat variable across the year and cyclical depending on a variety of factors. These changes may be predictable in some instances, such as

an influx during Australian and overseas holidays, or due to specific events and attractions. While others will remain unforeseen; the bushfires and COVID pandemic being recent examples of unforeseen factors affecting visitor numbers.

Overall, these trends in tourism and visitation are of concern due to their likely long-term impact on existing core values associated with the study area (refer Section 3.5).

3.7.4 Recreation Context

The study area is utilised for passive recreation i.e. swimming, surfing, dog walking, bush walking, etc and active recreation i.e. recreational boating and fishing, motorised watercraft, etc. Community organisations and clubs recreationally use many of the beaches within the Eurobodalla; examples include Surf Schools and locally-based Surf Life Saving Club "Nippers".

Selected beaches are patrolled are by local Surf Life Saving clubs on weekends and public holidays from October to April. These patrols are complemented by professional and volunteer lifeguards during peak summer holidays.

Council, local clubs and charities are working together to improve accessibility to beach activities. Currently, Corrigans Beach, Malua Bay, Broulee and Moruya all have beach wheelchairs available. Moruya Surf Lifesaving Club also offers a Special Nippers program that offers beach experiences for children and adults with disabilities.

The Eurobodalla Coast is a popular fishing destination, and Council has invested in a number of marine facilities to assist residents and visitors, including:

- Boat ramps;
- Wharfs and jetties;
- Fish cleaning tables; and,
- Toilets and amenities.

The coastline is also home to a number of community run organisations including:

- Board rider clubs;
- Fishing clubs;
- Sailing clubs; and,
- Landcare and Coastcare projects.

Council also owns and operates three campgrounds at Moruya North Head, Dalmeny and Mystery Bay:

- The Mystery Bay campground overlooks the beach and is surrounded by National Park and is arguably one of the few remaining natural camping locations on the NSW south coast.
- The North Head campground sits on the Moruya River, south of Bengello/South Broulee beaches, conveniently located near Moruya Airport.
- Dalmeny campground has stunning views over the ocean, powered and unpowered sites and modern amenities, located next to the local shops.

Service and amenities along the coastline vary greatly, with services typically concentrated in more populous regions, or those with high tourist numbers during peak periods (refer **Map Series RG-03-04**).

3.7.5 Aboriginal Cultural Context

Aboriginal peoples of the Yuin people are the recognised Aboriginal Traditional Custodians of the study area and have lived in the coastal landscape within Eurobodalla Shire for at least 22,000 years.

The Yuin cultural area is generally stated to extend from the Shoalhaven River in the north, to the Victorian border in the south and to the eastern edge of the tablelands in the west. The Yuin area is made up of many language groups, including the Dharumba, Djirringanj, Dhawa and Dhurga. There were clans under the Yuin who lived by the coast or inland. The Brinja Yuin people occupied land from south of the Moruya River to the Wagonga Inlet.

Aboriginal people continue to have a strong connection to the Eurobodalla region, and counts a significantly higher rate of Aboriginal residents than the state overall (5.1% in Eurobodalla Shire, compared to 3.7% for NSW).

A number of Local Aboriginal Land Councils (LALC) operate within the study area, namely:

- Batemans Bay;
- Mogo;
- Cobowra;
- Bodalla;
- Wagonga;
- Merrimans

These LALC areas are shown on **Map RG-05-01**.

3.8 Economic Context

The natural environment is integral to the Eurobodalla LGA's character and contributes significantly to the local lifestyle and economy. Approximately 64% of residents consider the beaches, waterways and nature to be Eurobodalla's most valuable aspects, and it is the most significant attractor for people visiting the region (ESC, 2020).

3.8.1 Tourism

Tourism supports 1,881 total jobs (13% of total) in the community and represents 14% of Gross Regional Product (approximately $235 million), which is double the proportion of tourism jobs at a State level and two-and-a-half times tourism's average economic contribution to the State (ESC, 2019).

In the 5 years to 2017, Eurobodalla Shire averaged per year:

- 37,000 international visitors;
- 747,000 domestic overnighters; and,
- 461,000 domestic day visitors.

3.8.2 Non-Resident Rate Payers

As noted in Section 3.7.1, 37% of ratepayers are not residents of the Shire, but live the majority of the time elsewhere. As a result, upwards of 1 in every 3 households remain vacant for much of the year, and do not contribute to the local economy. Whilst they pay rates to Council, the community misses out on the local expenditure that households typically make (groceries, pharmacies, clothes shops, etc).

The cyclic nature of these households, coupled with tourists in peak periods, places a strain on the local economy, in ways such as:

- Business may not be able to offer full time positions as they cannot support staff in the quiet periods;
- Cashflow for businesses is highly variable throughout the year (or even the month); and,
- The demands of short-term residents are likely to vary from those of long-term residents, giving rise to a subset of businesses who do not cater to local residents.

3.8.3 Employment Profile

Employment indicators for the Eurobodalla Shire LGA were sourced from the 2016 census data, and Council's Economic Development Strategy (ESC, 2019). Key indicator with regards to employment in the region are summarised in **Table 3-5**.

The data in the table indicates that full-time employment is substantially lower in the Shire compared to the State, and part time employment and unemployment are substantially higher.

With regard to occupation and industry, the rate of professional employment is low compared to the state average. The major employers in the region (the top three being aged care, supermarkets and local government) employ a significantly greater number of people, as a percentage of total jobs, than these industries do more generally across the state.

As a result of these factors, household income in Eurobodalla is 63% that of the NSW average.

Table 3-5 Employment Summary [1]

Indicator	Eurobodalla Shire	NSW
Employed Full Time	46.4%	57.7%
Employed Part Time	40.5%	30.4%
Unemployed	10%	5%
Occupation – Professionals	15.9%	22.2%
Occupation – Trades	16.1%	13.5%
Occupation – Community and Personal Services	13.2%	10.8%
Industry of Employment (1st in Shire) – Aged Care	4.3%	2.0%
Industry of Employment (2nd in Shire) - Supermarkets	3.9%	2.4%
Industry of Employment (3rd in Shire) – Local Government	3.5%	1.3%
Median Household Income	$939	$1,486

3.8.4 Volunteering

The Eurobodalla Shire has a strong volunteer profile. Although data are not available for volunteer time specifically on coastal management, Council 2019-20 annual report noted that (ESC, 2020):

- There are 23 Landcare groups in the LGA with 300 active volunteers, and 2,000 one off participants that contributed 9,400 hours of volunteer labour.
- Volunteers in Council's resource management programs contributed 6,700 hours.

[1] The data presented in Table 3-5 is the official data from the ABS from the 2016 census. It is noted that other sources have reported Tourism as contributing 14% of GDP for the region. Tourism was not a reported category for the ABS statistics, and thus is not included in the table.

- 31 community and school groups collection 35 cubic metres of waste as part of Clean Up Australia day activities.
- 149 volunteers contributed to community and cultural development services including youth cafés, gallery exhibits, and community transport and social support services.
- The Shire has a strong tradition of volunteering in surf lifesaving and rural fire services.
- Special mention was made of those who volunteered time to help with bushfire recovery efforts.

This unpaid volunteering work is an import contributor to the economic fabric of the community.

3.8.5 Economic Indicators

Economic indicators for the region are mixed.

At an individual/household level, indicators are typically poor. The Eurobodalla region has an unemployment rate of 10%, making it the sixth highest in the state, and well above the state average of 4 to 5%. Household incomes are 36% lower than the State average, and the LGA also has a high proportion of welfare dependent residents (both old and young) including pensioners, and people on disability support (ESC, 2019).

Gross Regional Product (GRP) has also remained relatively static since 2003, with annual growth rates of less than 2% per annum. The year to 2019 recorded negative growth, likely due to the impact of bushfires on the tourism industry (ESC, 2019). The impacts of COVID are also expected to adversely affect growth in the region.

Elsewhere in the Shire however, there are positive economic signs. There is strong growth in the diversification of businesses and small-scale agriculture and tourism operations.

Furthermore, State and Federal Governments have committed to providing funding for major infrastructure projects (ESC, 2019), including:

- $2.4b from the Federal Government for the duplication of the Princes Highway
- $500m from the Federal Government for upgrades to the Princes Highway
- $150m from the NSW State Government for a new regional hospital.

The above points demonstrate that the economic context for the region is somewhat in flux, as Governments at all levels seek to develop assets and infrastructure to support and grow the local community.

3.9 Future Context

3.9.1 Climate Change and Adaption

The threat of climate change and its implications is expected to place stress on species, ecosystems and human settlements and industries.

The Intergovernmental Panel on Climate Change (IPCC) emissions scenarios used are described as Representative Concentration Pathways (RCPs) and range from very low (RCP2.6) to very high (RCP8.5) concentrations.

Following a joint project with Shoalhaven City Council ((Whitehead & Associates, 2014) Council adopted sea level rise estimates based on the RCP 6.0 pathway, namely:

- 0.23m by 2050 (from a 2014 baseline)
- 0.72m by 2100 (from a 2014 baseline)

The latest advice from IPCC (2019) on sea level rise calls for increases to the allowances in previous documents. The latest global sea level rise (above 1986 to 2005 baseline) projections for the 'likely' scenario are 0.43 m for RCP2.6 and 0.84 m for RCP8.5 by 2100 (see **Figure 3-2**).

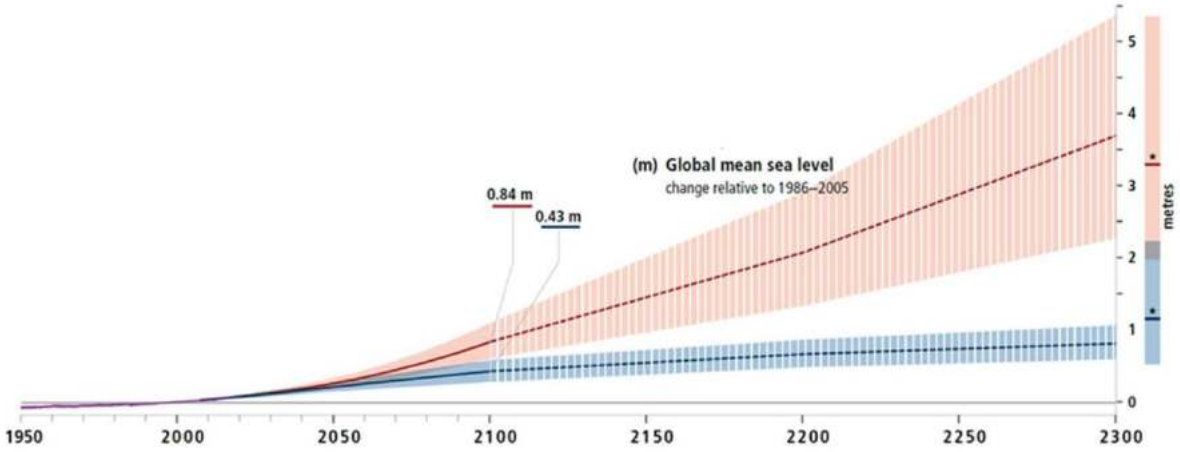


Figure 3-2 **Global sea level rise projections above 1986 to 2005 baseline: (blue) low (RCP2.6) and (red) high (RCP8.5) greenhouse gas emission scenarios (Source: IPCC, 2019)**

The number of hot days and warm nights per year and the length of heatwaves are also predicted to increase based on the same RCP scenarios as are sea surface temperatures (CoastAdapt, 2021). The number of very wet days and number of dry months per year are also expected to increase based on the same RCP scenarios (IPCC, 2019).

3.9.2 Water Quality

Higher water temperatures and increases in extreme hydrological events, including floods and droughts, are projected to affect water quality and exacerbate many forms of water pollution – from sediments, nutrients, dissolved organic carbon, pathogens, pesticides and salt, as well as thermal pollution with possible negative impacts on ecosystems, human health, and water system reliability and operating costs (Climate Risk, 2010). Increasing atmospheric carbon dioxide concentrations are causing a global decline in oceanic pH leading to ocean acidity. Again, having a potentially negative impact on coastal ecosystems, for example a reduction in calcium carbonate availability for the protective shells of some species.

3.9.3 Population and Demographics

As discussed in Section 3.7.1, the population of the Eurobodalla region is relatively stable, but the over 65 demographic is increasing rapidly, while younger residents are leaving in search of job opportunities. While Council is aware of this, and it engages in improving local prospects of young people, these actions will take time to develop and implement, and longer still to have an effect.

The over 65s have very different needs and wants compared to other demographics, and these will shape the region for as long as this group remain such a large part of the community.

The demand of healthcare and aged care services can be expected to increase as a result of this demographic shift.

The South East and Tablelands Regional Plan 2036 (DPE, 2017) predicts that the Eurobodalla LGA will grow by 2,200 people by 2036, requiring an additional 3,000 dwellings, due to its ageing population and decreasing household size.

Planning for population growth over the next 20 years will need to balance impacts on the environment and other assets that existing residents enjoy. While there is sufficient land zoned to accommodate the anticipated growth, development must be environmentally sensitive (DPE, 2017).

Photo: South Durras by Emma Maratea

4 Scope of the CMP

This chapter identifies the key management issues for the study area and identifies and maps the spatial extent of coastal management areas that are included in the CMP.

Each council has different experience, issues, challenges and opportunities in coastal management. The scope of a CMP may be specific to local circumstances, the community and coastal environment and may depend on a range of other factors.

This scoping study reviews and defines the geographic scope of the CMP for Stages 2 to 4.

This scoping study also provides a review of the four coastal management areas mapped in the CM SEPP within the study area. Management issues for each management area are identified across a range of planning timeframes, and consider the vulnerabilities and risks associated with a range of future scenarios, likelihoods and consequences.

4.1 Geographic Scope

The coastline of the Eurobodalla Shire is a dynamic and highly varied region. Important physical features defining the structure of the ESC coast include:

- A very narrow coastal shelf (Batemans Shelf, which also extends along the coast of Shoalhaven City Council and part of Bega Shire). This affects the exposure of the coast to waves from the southern ocean.
- Steeply dipping metamorphic rocks – high cliffs and bluffs, narrow multifaceted shore platforms, as well as extensive offshore areas of reef and shoal (see Batemans Marine Park Bioregion Assessment)
- Clear, deep ocean waters close to the coastline.
- A mix of highly embayed pocket beaches and long sandy barrier beaches between rocky headlands.
- Five of the State's 17 sensitive coastal lakes listed under Schedule 1 of the Coastal Management SEPP. While the lakes are not within the study area, the entrances will be considered as part of this CMP.
- Major river estuaries including the Clyde River at Batemans Bay, Moruya River, Tuross River and Wagonga Inlet at Narooma. Similar to the coastal lakes, the rivers and their catchments are largely outside the scope of the study, but their entrances will be considered in this CMP.
- In addition to the listed sensitive lakes and major river estuaries listed above, there are several other intermittently closed and open entrances that occur along the coast. These entrances cross the berm on the sandy beaches within the open coast study area. The entrances will be considered as part of this CMP.

The spatial extent of the CMP is shown in **Map RG-01-01.** The study area is considered to extend from the northern to the southern boundaries of the LGA, namely from the southern bank of the Durras Lake entrance in the north, to the northern bank of the Wallaga Lake Entrance in the south.

To the east, the study area extends 3 nautical miles into the Tasman Sea, which is in accordance with the CM Act.

The western boundary is more complex and is currently being determined. At present, the western boundary is determined from:

- SEPP Management Areas that relate to the open coast (not coastal estuaries and waterways).
- The Coastal Vulnerability Area has not been mapped at this stage, however, the study area includes the extent of coastal hazards (erosion, recession and inundation), where known.

4.2 Costal Management Areas

The coastal zone, as defined by the CM Act, means the area of land comprised of the four coastal management areas as intended to be mapped in the CM SEPP. It is noted that to date only three of the four have been mapped in the CM SEPP with the Coastal Vulnerability Area planning proposal usually to be determined via the CMP or as an action. All four coastal management areas have been included in the scope of the CMP, as shown in **Map RG-03-03**, being:

- **Coastal Wetlands and Littoral Rainforests** – There are no Coastal Wetlands located within the open coast CMP study areas. There are small areas of Littoral Rainforests that extend into the study area. Specific information relating to littoral rainforests within the study area can be found in **Section 3.5.1**.
- **Coastal Vulnerability Area** – The study area has a range of vulnerabilities. Specific information relating to coastal vulnerability can be found in **Section 3.6.1.** It is noted that as there is presently no mapping for the Coastal Vulnerability Area within the CM SEPP. Part of preparing a CMP will include draft mapping of a Coastal Vulnerability Area, with Council to consider the need for and proposed timing associated with CM SEPP mapping updates.
- **Coastal Use Area** – The study area has a range of existing uses and a series of planned future uses. The extent of the use area requires further consideration as part of the CMP process.
- **Coastal Environment Area** – The coastal environment area maps natural features of the coast such as coastal waters of NSW, estuaries, beaches, dunes, coastal lakes and lagoons and undeveloped coastal headlands and rock platforms. The focus of this CMP is on the open coast, and as such the Environmental Areas associated with the estuaries and their catchments has not been included in the CMP Study Area. The extent of the Environment Area requires further consideration as part of the CMP process.

The CM SEPP states that where coastal management areas overlap, and more than one set of development controls may apply the following hierarchy of management objectives applies:

i. Coastal wetland and littoral rainforest area
ii. Coastal vulnerability area
iii. Coastal environment area
iv. Coastal use area.

Ultimately, a key purpose of the CMP is to provide direction on:

- Whether an update is required to the mapping that accompanies the CM SEPP in its current form; and,
- The methodology, determination, and timing of adoption of a Coastal Vulnerability Area map.

This Scoping Study has identified the need for the Coastal Vulnerability Area to be mapped to include the areas of the open coast that are vulnerable to coastal erosions, shoreline retreat, and inundation.

Further, this Scoping Study has identified the need to consider the possible revision of the Coastal Use Area and the Coastal Environment Area as an outcome of Stage 2 assessments and ongoing engagement with stakeholders and the community in Stages 2, 3 and 4.

4.3 Key Management Issues Considering Values and Threats

Key management issues within the study area have been identified as an outcome of the literature review provided in **Section 3**, consideration of the *New South Wales Marine Estate Threat and Risk Assessment Report* (TARA) (BMT WBM, 2017), and stakeholder engagement undertaken for previous studies.

In order to undertake the first pass risk assessment, the values of the coastline and threatening processes or issues affecting the coastline and its values require definition. Understanding the values of the coastline in terms of environmental, social, cultural and economic assets and benefits provides a pathway to understanding activities or processes that threaten them and need to be managed through a program of management (i.e. a CMP).

Photo: Mossy Point by Emma Maratea

4.3.1 Values of the Study Area

The values of the study area are expansive. Values relate to the physical assets of the coastline itself (e.g. the natural character and scenic beauty of the Eurobodalla coastline), the recreational and leisure activities that are highly prized by the community (residents and visitors), the way community interacts with the coastline, and the economic benefits of the coastline and the flow on effects through the LGA and further afield.

The key values of the study area have been identified through review of a range of community engagement undertaken by Council over the period 2009 to 2018. The outcomes these engagement activities are summarised in **Sections 4.3.1.1 to 4.3.1.5**.

Values can be defined in broad categories, being environmental, social/cultural and economic values of the study area. Building on the TARA (BMT WBM, 2017) and previous community and stakeholder feedback, a series of preliminary priority values of the study area are shown in **Figure 4-1**.

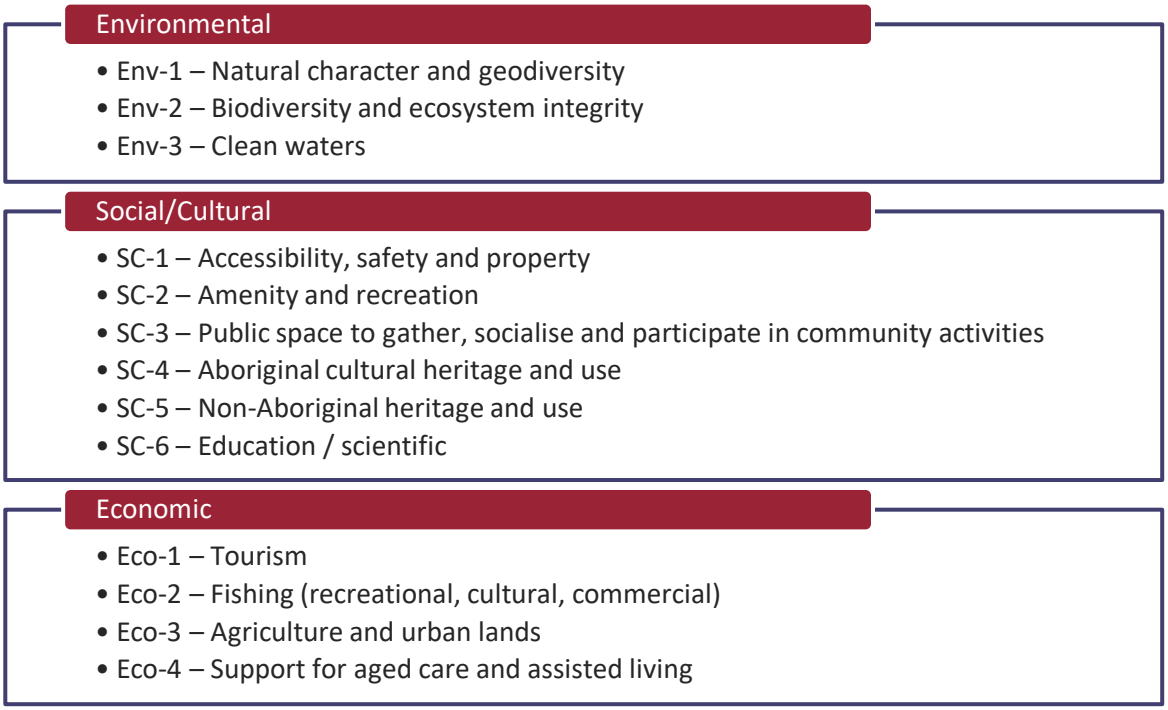


Figure 4-1 Priority Values of the Study Area

4.3.1.1 Values Identified in CMP Consultation

Preparation of Eurobodalla's CMP commenced in 2011. In the preliminary stages of preparing the CMP, ESC has conducted a range of community and stakeholder engagement activities. The details of these activities are discussed in **Section 1.5.1**.

The Batemans Bay Beaches and Foreshore Coastal Use Survey (2012) found the following, which related to values:

- More than 30% of respondents said that they used the beach/foreshore every day, and a further 26% said they used a beach/foreshore at least once a week, all year.
- By far the most common activities were walking (on the beach, or on a paved pathway), swimming and sitting and enjoying the view.

- Consistent with the structure of settlement around Batemans Bay and the daily or weekly use of beaches, nearly 90% of respondents said that they most frequently go the beach as pedestrians.
- The people who responded to the surveys raised the following aspects of coastal management as issues of concern to them:
    - keeping the beaches as natural as possible
    - open grassy foreshores in urban areas, but also maintaining natural habitats
    - limiting development
    - maintaining infrastructure and facilities – many people commented on limited or poor quality facilities at a number of beaches
    - promoting tourism to boost local economy
    - managing hazards and risks
    - keeping the lines of communication open and decisions that affect residents transparent.

4.3.1.2 Values Identified in Community Strategic Plans

The Community Strategic Plan is the highest-level plan that a council and its community will prepare. Its purpose is to identify the community's main priorities and aspirations for the future and to plan strategies for achieving these goals. In doing this, the planning process considers the issues and pressures that may affect the community and the level of resources that will realistically be available to achieve its aspirations. Eurobodalla Shire Council has undertaken consultation in the form of community surveys and/or workshops for three Community Strategic Plans, in 2009/10, 2012/13 and most recently, 2016. The surveys and workshops obtained around 3,000 responses from across the shire.

Some important findings of these community surveys that have been considered for the CMP include:

- protection of the natural environment has been a high priority in all surveys – linked to the concept of Eurobodalla Shire as the 'nature coast'
- there was a stronger focus on environmental sustainability in 2010 than 2004. The 2016 survey found that 75% of residents are concerned about the environment, particularly climate change, sustainability, littering and deforestation. Around 80% of residents report that they take active steps to reduce their energy and water consumption and to reduce waste.
- since the declaration of the Marine Park, a strong focus on the need to protect the coast, waterways and marine environment has been reported
- Aboriginal people have also expressed a desire to have a custodian role in managing natural areas.

4.3.1.3 Values Identified in Community Satisfaction Surveys

Surveys of community perceptions of well-being and of satisfaction with Council's performance were again conducted in 2016 (Micromex Research 2017). More than 400 people, across a sample representative of age and gender, participated in the surveys. There have been some changes to the focus of questions, so longitudinal comparisons are not possible for values. However, some important information about the community's perceptions of priority services provided by council (including strategic planning and management of beaches), and how well those services meet community needs and expectations is available in the survey results.

Results of the 2016 surveys that are relevant to management decisions about the coast are summarised in **Table 4-1.**

Table 4-1 2016 Community Satisfaction Survey Highlights

Percentage of respondents	Indicator
61%	Strongly agree that maintaining and protecting the natural environment in Eurobodalla is important. This is one of the four most important drivers of quality of life in Eurobodalla
18%	Strongly agree that 'I have the opportunity to have my say on important issues'
56%	Access council service information online (internet search) – far more than by any other means. Other than the very elderly (aged 75 years or older), people generally connect to the internet every day or all the time
10%	Of the population were involved in Landcare or another local environmental group
91%	People who had visited a beach over the previous 12 months. Of the options offered in the survey, visiting the beach was the second most likely activity.
79%	People who said they had used a shared pathway or had visited a natural area (including state forest and national park, noting that the ESC coast is approximately 40% national park)
State benchmark	The level of community satisfaction with council services was very close to the State benchmark for activities related to the coast, such as 'engagement and consultation with the community about council plans, projects and services'; and 'management and protection of the natural environment, including bush regeneration'
Change from 2012	There was an increase in the level of satisfaction with specific council services such as 'provision and maintenance of boating facilities such as boat ramps and fish cleaning tables'.
Gaps between importance and satisfaction rankings for the coast	There was a gap between the mean importance value attributed to council's management of waterways and beaches, creeks and wetlands, and the community satisfaction with council's management. A slightly smaller gap in community perception was recorded for council's management of stormwater and flood mitigation infrastructure. For coastal inundation and tidal inundation, this is relevant to the coast. In the analysis of survey results, both coastal and stormwater management were in the 'improve' category.
To improve	The analysis identified 'improving long term planning for Eurobodalla's future and service delivery', and 'improving engagement and consultation with the community' as two of the top measures to enhance satisfaction with council's performance. The preparation of the CMP is part of the response to both issues.

4.3.1.4 Values Identified in Coastal Reserve Plans of Management

Over the last ten years, Plans of Management have been prepared for many coastal foreshore reserves (Eurobodalla Shire Council, 2013), including:

- Barlings Beach Aboriginal Place
- Broulee Beaches Landscape Master plans
- Kyla Park foreshores
- Broulee and Mossy Point Reserves Community Land Plan of Management
- Dalmeny to North Narooma Coastal Reserves Assessment and Landscape Master Plans

- Plans of Management for beaches around Batemans Bay, including Long Beach, Catalina, Surfside and Corrigans Beaches.

Consultation with local residents and reserve users provided local information about the use and value of the reserve areas. Values for the coastline reported through the Plans of Management include a range of location specific matters that are addressed within the plans. The Plans of Management also refer to wider values regarding the coastal zone which generally include (but are not limited to):

- the open informal character of the reserves
- the 'Nature Coast' feel
- Unique, hardy and resilient environment, and
- views of ocean and surf.

These values are consistent with those expressed in the community use surveys for the Community Strategic Plan.

4.3.1.5 Values Identified in the Batemans Bay Regional Waterways Infrastructure Plan

A community user survey was conducted during the preparation of the Batemans Bay Regional Waterways Infrastructure Plan (Royal Haskoning 2015, for ESC). Surveys were conducted across four boat ramps to gain information regarding:

- the water-based activities undertaken in and around Batemans Bay and the Clyde River
- recreational vessels using the waterway
- issues or problems associated with existing boating facilities
- the issues and problems associated with exiting boating facilities and
- any suggestions for improved or new boating facilities.

Approximately 40% of the respondents identified issues affecting or creating a barrier to recreational use. Issues raised included:

- the lack of launching facilities suitable for boat launching and waterway access by people with a disability
- navigation issues
- lack of facilities or inadequate facilities, such as landing/launching areas with picnic tables and BBQs
- conflicts between recreational users, and
- the lack of access to Batemans Bay Town Centre and shops.

4.3.2 Threats to the Study Area

A substantial list of potential issues (threats) from the same sources as used for the values (i.e. TARA, CM Act, community and stakeholder feedback, etc.) was developed and then refined through the course of developing this CMP Scoping Study to 26 priority threats, under four themes, as shown in **Figure 4-2**.

The specific details of impacts associated with these threats is provided in the first pass risk assessment in **Section 7**. This assessment draws on coastal hazards studies, existing Council plans and programs, and specific issues identified by the community during previous engagement activities.

The Coastal Hazard threats generally align with the definition of 'coastal hazard' in the CM Act.

Photo of Eurobodalla Coast by Emma Maratea

Coastal Hazards

- CH Threat 1 – Beach erosion
- CH Threat 2 – Shoreline recession
- CH Threat 4 – Coastal inundation
- CH Threat 5 – Tidal inundation
- CH Threat 6 – Erosion and inundation of foreshores caused by tidal waters and the action of waves, including the interaction of those waters with catchment floodwaters
- CH Threat 7 – Coastal watercourse entrance instability
- CH Threat 8 – Coastal watercourse entrance modifications (interventions in natural opening regimes for ICOLLs)
- CH Threat 9 – Dune slope instability
- CH Threat 10 – Coastal cliff instability

Recreational Activities

- RA Threat 1 – Conflict over resource access and use (e.g. beach users and dog walkers)
- RA Threat 2 – Habitat (physical) and wildlife disturbance (e.g. from overuse, overcrowding, foreshore development, commercial and recreational fishing methods, etc.)
- RA Threat 3 – Poorly located, poorly maintained and/or inappropriate access and supporting facilities
- RA Threat 4 – Anti-social behavior and unsafe practices
- RA Threat 5 – Passive recreational use (swimming, surfing, bush walking, etc)
- RA Threat 6 – Active recreational use (recreational boating, motorised watercraft, camping etc) - recreational activities needing associated infrastructure
- RA Threat 7 - Commercial and recreational fishing

Coastal Development

- CD Threat 1 – Coastal development resulting in loss of plant and animal species (habitat disturbance or loss)
- CD Threat 2 – Water pollution from urban stormwater and treated effluent discharge
- CD Threat 3 – Water pollution from agricultural diffuse source runoff
- CD Threat 4 – Pollution of water, beach sand and other habitat areas with litter, solid waste, marine debris and microplastics
- CD Threat 5 – Coastal development encroaching onto natural coastal processes to exacerbate hazard impacts

Engagement and Governance and Compliance

- EGC Threat 1 – Lack of compliance with regulations (by users) or lack of compliance resources (by agencies)
- EGC Threat 2 – Insufficient community and visitor awareness of the values and threats to the coastal environment, and lack of engagement with managing this environment
- EGC Threat 3 – Insufficient or inappropriate governance and management of the coastal environment
- EGC Threat 4 – Insufficient involvement of Traditional Owners in the management of cultural heritage and use within the coastal environment

Figure 4-2 List of Management Threats in the Study Area

Many of the other identified threats have been derived from the state-wide TARA, with particular note given to Table 5-4 in the TARA, the ranked priority threats for the South Region, which includes the Eurobodalla Shire. **Table 4-2** shows the top five priority threats to environmental assets and to social, cultural and economic benefits for the South region as identified in the TARA and indicates how these have been captured in the threats developed specifically for the study area in this CMP.

The study area has one certified CZMP for Wharf Road (ESC, 2017). The threats identified for this study incorporate those identified as part of the Wharf Road CZMP. **Table 4-3** shows the threats identified in the Wharf Road CZMP and indicates how these have been incorporated into this CMP.

Council has also identified a number of threats, as documented on their "Options for Managing Eurobodalla's Coast" webpage (ESC, 2021). These threats, and how they have been incorporated into this CMP, are presented in **Table 4-4**.

Climate change and associated sea level rise, as well as population and tourism growth and coastal development pressure are all stressors that will exacerbate the impacts from the identified management issues into the future.

Table 4-2 Incorporation of TARA Highest Priority Threats for South Region in this CMP

TARA Ranked Priority Threats for the South Region (BMT WBM, 2017)	Captured in this CMP Scoping Study (refer Figure 4-2)
Threats to Environmental Assets	
Estuary entrance modifications	Coastal Hazard Threat 8 – Entrance Management
Urban stormwater discharge	Coastal Development Threat 2 – Stormwater and treated effluent discharge
Threats to Social, Cultural and Economic Benefits	
Water pollution on environmental values - urban stormwater discharge	Coastal Development Threat 2 – Stormwater and treated effluent discharge
Water pollution on environmental values - litter, solid waste, marine debris and microplastics	Coastal Development Threat 3 – litter solid waste, marine debris and microplastics
Inadequate social and economic information	Engagement and Governance Threat 2 – lack of engagement with managing the coast
Lack of compliance with regulations (by users) or lack of compliance effort (by agencies)	Engagement and Governance Threat 1 – Lack of compliance with regulations (by users) or lack of compliance resources (by agencies)

Table 4-3 Incorporation of Wharf Road CZMP Threats in this CMP

Threats from Wharf Road CZMP	Captured in this CMP Scoping Study (refer Figure 4-2)
Erosion	CH Threat 1 – Beach Erosion
Beach Recession	CH Threat 2 – Shoreline Recession
Ocean Inundation	CH Threat 4 – Coastal Inundation
Wave Runup	CH Threat 4 – Coastal Inundation

Table 4-4 Council Identified Threats to the Coast and Coastal Lifestyles

Threats Identified by Council	Captured in this CMP Scoping Study (refer Figure 4-2)
Lifestyle and coastal economy impacted through loss of access to natural beach landscapes.	RA Threat 3 - Poorly located, poorly maintained and/or inappropriate access and supporting facilities
Our community assets, key infrastructure and private properties can be damaged or lost through storms and other coastal hazards.	All CH Threats
Over time, protection works such as rock walls can prevent access to or result in the loss of a public beach.	RA Threat 3 - Poorly located, poorly maintained and/or inappropriate access and supporting facilities
Clearing of natural dune and beach vegetation can spoil natural landscapes and compromise the ability of dunes to hold together and protect houses during storms.	CD Threat 1 - Coastal development resulting in loss of plant and animal species (habitat disturbance or loss) CD Threat 5 - Coastal development encroaching onto natural coastal processes to exacerbate hazard impacts
Non-strategic development that does not consider coastal landscapes and hazards.	EGC Threat 3 - Insufficient or inappropriate governance and management of the coastal environment
Pollution of waterways through spills, littering, run-off and failure of infrastructure during storms.	CD Threat 2 - Coastal development resulting in loss of plant and animal species (habitat disturbance or loss) CD Threat 3 - Pollution of water, beach sand and other habitat areas with litter, solid waste, marine debris and microplastics CD Threat 4 - Coastal development encroaching onto natural coastal processes to exacerbate hazard impacts

5 Current Coastal Management Arrangements

This chapter describes the current coastal management arrangements and reviews their effectiveness.

This includes Council's existing coastal management framework (both the policies and organisational structure) and an overview of land tenure and associated responsibilities for that land.

This review also provides an audit of implementation of coastal management actions, any barriers to implementation and learnings to date.

5.1 Existing Land Tenure and Land Governance Arrangements

Eurobodalla Council has the primary governance oversight of the majority of terrestrial coastal lands with the CMP area. Land below mean high water mark is Crown Land (with the beach area itself being under the care and control of Council), whilst submerged areas are state-managed as Crown Land under the provisions of the Marine Estate Management Act, 2014 (managed by the Marine Estate Management Authority, MEMA).

There are numerous other organisations from the Commonwealth, State, Regional to Local level that are also involved in managing aspects of the coastline and waters of the study area.

Maps RG-05-01 illustrate the current land tenure arrangements and governance context for the study area. It can be seen from this figure that the study area is comprised of a mixture of land tenure and land management arrangements; private freehold land, Council public land (community and operational land) and Crown land reserve.

These Crown reserves are owned by DPIE – Crown Lands but generally are managed by Council. Recent changes to the *Crown Land Management Act 2016* mean that Council will be required to develop Plans of Management under the *Local Government Act 1993* for all land managed by Council.

Figure 5-1 provides a summary of the land tenure and governance arrangements with **Figure 5-2** providing the corresponding owners and stakeholders.

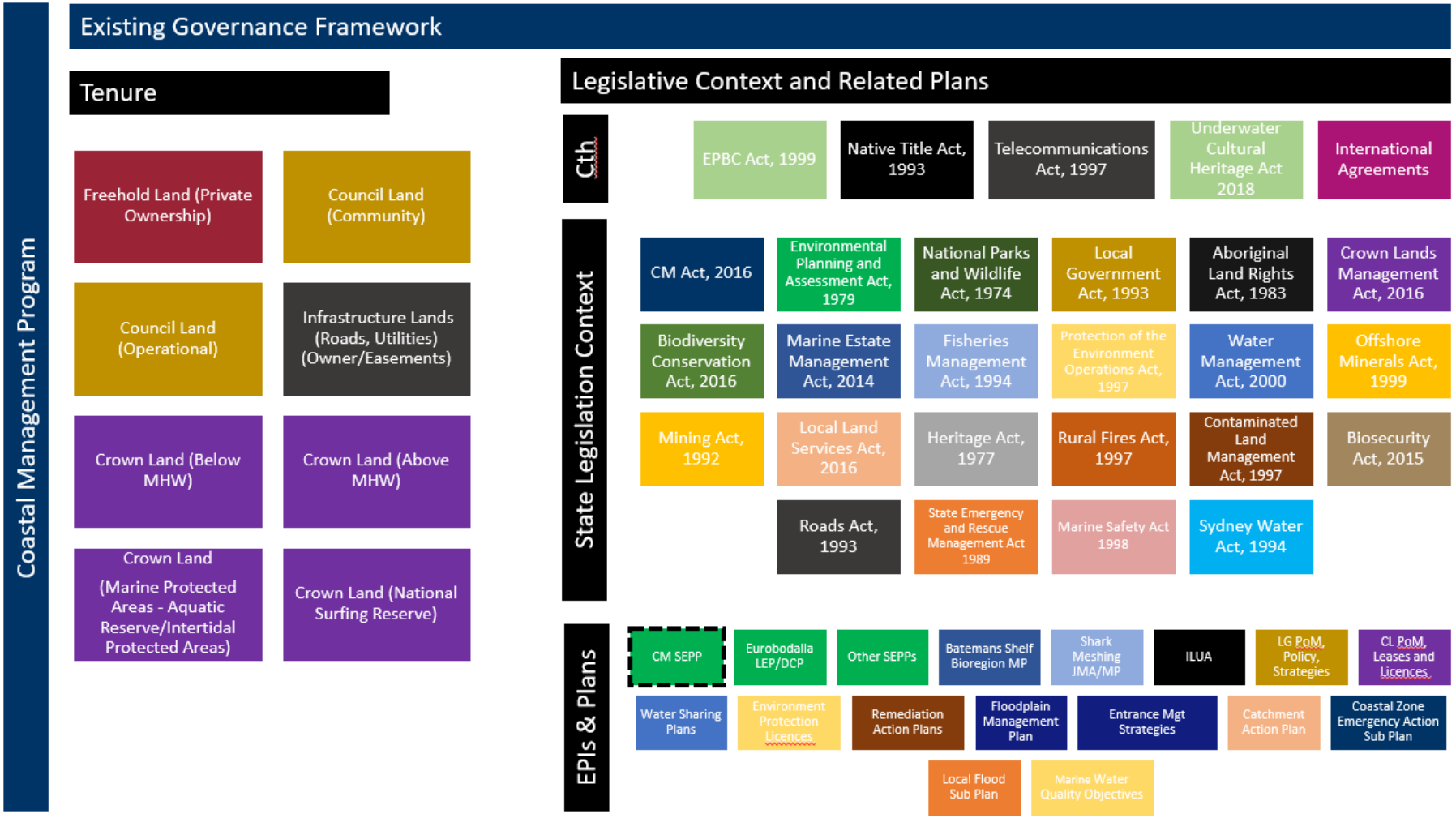


Figure 5-1 **Existing Governance Framework**

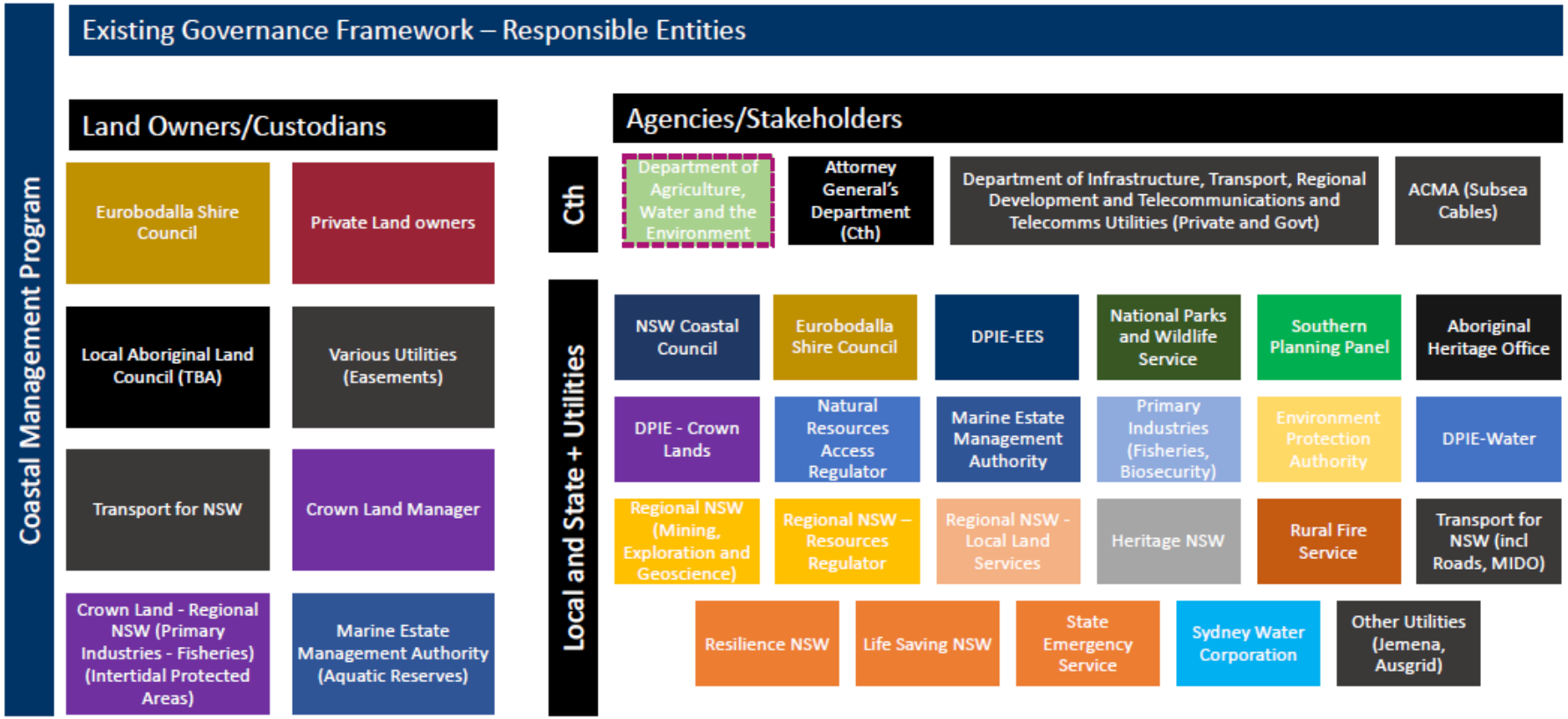


Figure 5-2 Existing Governance Framework – Responsible Entities

5.1.1 Native Title and Aboriginal Land Governance

Native title is governed by the Commonwealth *Native Title Act 1993*. The South Coast People have submitted a native title application for a large area covering over 16,000 km^2, spanning 16 LGAs, including Eurobodalla LGA. The claim has been registered and is currently active (National Native Title Tribunal file number NC2017/003), however no determinations of native title have been made for this application yet. The South Coast claim area includes the entire Eurobodalla LGA open coastline, including coastal waters 3 nautical miles east of the mean high-water mark.

The Wagonga LALC submitted a native title application for one lot/DP near Little Lake, however the application was determined in August 2020 with the determination outcome being that native title does not exist.

It should be noted that Native Title claims may be made in the future over areas within the CMP study area. As such, allowance needs to be made for potential future impacts to coastal management arrangements.

5.1.2 Non-Aboriginal Land Governance and Agencies

Council is responsible for preparing and maintaining the CMP with input from agencies, stakeholders and the community. Implementation of actions within the CMP will lie also with these groups based on their jurisdiction which may solely be based on land tenure or if they are a core service of the agency.

State and local government share strategic and statutory planning responsibilities for land in the study area. DPIE and Council administer the *Environmental Planning and Assessment Act 1979*, which is the key legislation for land use planning and development assessment in NSW.

The Intertidal Protected Areas (IPA) and Aquatic Reserves are managed by NSW Fisheries, who undertake the day to day management of these areas. Council will also need to work with MEMA in relation to the NSW Marine Estate. MEMA's role is to ensure that policies and programs (such as the *NSW Marine Estate Management Strategy (2018-2028)* (MEMA, 2018)) address priority issues for the marine estate as identified in the TARA, are well coordinated, efficient, evidence-based and result in positive outcomes.

Other state agencies such as the Natural Resources Access Regulator (NRAR), Rural Fire Service (RFS), Environment Protection Authority (EPA) and TfNSW also play a role in planning, management and compliance in the study area.

Crown land areas are managed under the *Crown Land Management Act 2016* by DPIE – Crown Lands, or where Council managed "community land", under the *Local Government Act 1993*.

In the Federal context, the key piece of legislation relevant to the study area is the *Environment Protection and Biodiversity Conservation Act 1999*, which protects nationally significant threatened species and communities. At the Federal Level, National Parks (under the Department of Agriculture, Water and Environment) are a key stakeholder, being responsible for significant land regions within the study area.

The CM Act provides the legislative framework for managing the coastal zone in a strategic and coordinated manner. The CM Act is administered by DPIE. Under the CM Act, CMPs are developed and certified to specify actions to be implemented by local councils (generally through councils IPR Framework, which is established in the *Local Government Act 1993*) and state agencies (through written agreement).

5.1.3 Adjacent Council Areas

Eurobodalla Shire is identified within two primary coastal sediment compartments and six secondary sediment compartments (Geoscience Australia 2015), listed below and shown **Map RG-05-02**.

- Beecroft Head to Wasp Head (south Durras) (NSW 08/23)
  - Lake Tabourie coast – Warden Head to Wasp Head (NSW8.06/102), (Durras Beach is at the far southern end of this secondary compartment)
- Wasp Head to Cape Howe (NSW 09/24)
  - Murramarang - Wasp Head to Three Islet Point (NSW 9.01/103)
  - Batemans Bay – Three Islet Point to South Head (Mosquito Bay) (NSW9.02/104)
  - Moruya River – South head (Mosquito Bay) to Bingie Bingie Point (NSW 9.03/105)
  - Eurobodalla coast – Bingie Bingie Point to Cape Dromedary (NSW 9.04/106)
  - Mount Gulaga (Dromedary) Coast – Cape Dromedary to Goalen Head (NSW9.05/107). Most of this compartment is in Bega Shire.

Eurobodalla Shire Council share primary coastal sediment compartments with Shoalhaven City Council to the north and Bega Valley Shire Council to the south.

The CMP should look into this as part of Stage 2 to 4 and consultation between the councils will be required for this purpose. Shoalhaven City Council and Bega Valley Shire Council may also share the responsibility for management of recreational use of Durras Beach and Wallaga Lake, respectively.

5.2 Existing Management Arrangements

5.2.1 Council Coastal Planning Controls

Council currently undertakes landuse planning within the coastal zone through a range of legislative and planning documents, including a range of relevant development controls set out in a Development Control Plan and the Interim Coastal Hazard Adaptation Code. The CMP will review the relevant planning approaches and development controls within these document and provide recommendations for updates.

5.2.1.1 Eurobodalla Local Environmental Plan 2012

The Eurobodalla LEP 2012 commenced 20 July 2012. The LEP sets the direction for land use and development in the study area by establishing suitable land uses across the local government area (as 'zones') and defining where development consent is required. It determines what can be built, where it can be built and what uses or activities can occur on land.

The Eurobodalla LEP 2012 is based on a standard format used by all Councils in NSW and can be viewed on the NSW legislation website (www.legislation.nsw.gov.au).

The Eurobodalla LEP 2012 contains a clause (6.5(4)) that addresses properties that are affected by flooding and coastal processes and states:

> *Before determining a development application for development on land to which this clause applies, the consent authority must consider the potential to relocate, modify or remove the development if the land is affected by coastal processes, coastal hazards and sea level rise.*

In this regard, the LEP Dictionary has the following definition:

- *coastal hazard has the same meaning as in the Coastal Management Act 2016, which is:*

(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 and inundation of foreshores caused by tidal waters and the action of waves, including the interaction of those waters with catchment floodwaters.

Coastal processes and sea level rise are undefined in both the Eurobodalla LEP 2012 and in the *Coastal Management Act 2016*.

The Eurobodalla Interim Coastal Hazard Adaptation Code (ESC, 2017) applies to lands within the coastal zone or areas identified by Council as potentially at risk from coastal hazards out to a maximum planning period ending at the 2100 coastal hazard projections identified in the *Eurobodalla Coastal Hazard Assessment* (WRL, 2017) or area mapped within the Code as 'Eurobodalla Investigation Areas' (noting that no maps were incorporated in Appendix A of the Code at the time of this review).

5.2.1.2 Local Strategic Planning Statement

The Eurobodalla Local Strategic Planning Statement 2020 – 2040 (ESC, 2020) is a strategic document, setting out a 20-year vision for land use planning in the Shire. It outlines how growth and change will be managed to ensure high levels of liveability, prosperity and environmental protection are achieved in Eurobodalla.

With respect to coastal processes and hazards and aspects of the coastal environment area, the Eurobodalla LSPS includes:

- *Planning Priority 3: Consolidate development within town and village centres.* The LSPS indicates the region is subject to coastal inundation and erosion, and inland flooding which are threats that are predicted to increase over time and impact many residents. It is essential that hazards are identified, and mitigation measures are put in place to reduce the risk of loss of life or property in the future
- *Planning Priority 4: Adapt to Natural Hazards.* The LSPS indicates there is an ongoing need to identify and adapt to coastal inundation and erosion, among other natural hazards. Natural hazard resilience needs to continue to be an essential part of settlement planning for Eurobodalla in the future. Specifically, Item 4.2 is to finalise and certify the Eurobodalla Coastal Management Program (this study)
- *Planning Priority 5: Conserve and celebrate bushland and waterways*. The LSPS recognises Eurobodalla's diverse natural surrounds and the importance of protecting and rejuvenating wildlife corridors, managing important habitat and establishing development controls that minimise impacts on endangered species of the area
- *Planning Priority 10*: *Promote nature-based tourism opportunities*. The LSPS recognises that Eurobodalla's natural environment is a significant attraction and point of difference, so attention is placed on identifying future opportunities in nature-based tourism.

5.2.1.3 *Eurobodalla Development Control Plans*

Eurobodalla Shire has adopted a number of DCPs to provide planning and building design guidelines for new development or alterations to existing development.

Council does not have an LGA wide code, but rather a series of codes for specific development types and/or regions, namely:

- Batemans Bay Regional Centre DCP;
- Bodalla Village DCP;
- Industrial Zones DCP;
- Mogo Village Commercial Centre DCP;
- Moruya Township DCP;
- Narooma Township DCP;
- Neighbourhood Centres DCP;
- Nelligen Village DCP;
- Residential Zones DCP;
- RU1, RU4, R5 Large Lot Residential and E4 Environmental Living Zones DCP; and,
- Tilba Villages and Conservation Area DCP.

None of the DCPs currently make an explicit reference to coastal hazards.

Recognition of some coastal values are implicit in controls relating to tree preservation, biodiversity and sustainability.

5.2.1.4 *Interim Coastal Hazard Adaption Code*

Initiates the process of providing long term management options for the LGA and provides guidance on how coastal hazards will be considered in the assessment of development applications in Eurobodalla Shire until such time as the Eurobodalla Coastal Management Program is completed (ESC, 2017).

The interim Code aims to:

- Facilitate economic and residential use of the coast and foreshore over the maximum period possible under conditions of sea level rise;
- Provide a precautionary risk-based approach to managing the impacts of coastal hazards;
- Provide strategic options for an adaptive response to coastal hazards;
- Identify Investigation Areas in accordance with recommendations contained within the NSW Coastal Planning Guideline: Adapting To Sea Level Rise;
- Promote appropriate development within Coastal Management Areas in accord with the NSW Coastal Management Act 2016 and the draft Coastal Management State Environmental Planning Policy;
- Apply coastal hazard planning guidelines for merit-based assessment of development applications; and,
- Provide an interim reference during the development of the Eurobodalla Coastal Management Program.

5.2.2 Coastal Emergency Management Arrangements

Council has prepared a long-term management strategy for managing emergencies which outlines the actions it intends to undertake in the event of an emergency occurring within the LGA. This plan is called the Eurobodalla Local Emergency Management Plan (ESC, 2019).

Under the plan Council may work with emergency service providers such as the State Emergency Service (SES) in the event of a declared emergency or an emergency caused by severe weather.

There is a sub-plan to the Eurobodalla Local Emergency Management Plan that covers operations for all levels of flooding and arrangements for the management of coastal erosion in the LGA. This sub-plan is the Eurobodalla Shire Flood Emergency Subplan (SES, 2013). This sub-plan specifies that the NSW SES Eurobodalla Shire Local Controller will participate in floodplain and coastal risk management initiatives organised by Eurobodalla Shire Council and identify and monitor people and/or communities at risk of flooding and coastal erosion. Therefore, the SES is a key stakeholder in development of this CMP.

A site-specific Emergency Action Sub-plan was prepared for the Wharf Road coastal erosion hotspot as part of the Wharf Road CZMP.

5.2.3 Interrelationship between Floodplain and Coastal Management

A number of large river systems as well as numerous smaller ICOLLS and creek systems are located within the Eurobodalla Shire LGA. The catchments of these systems that lie adjacent to the coastal zone are subject to flooding from both catchment as well as coastal driven storm events, resulting in some overlap between floodplain and coastal management.

The following flood studies, floodplain management plans and entrance opening strategies for the associated ICOLLs have been prepared for these catchments and should be considered as part of any coastal management actions within these floodplains:

- Moruya Floodplain Management Plan;
- Tomakin, Mossy Point and Mogo Flood Study;
- Wagonga Inlet, Kianga and Dalmeny Flood Study;
- Batemans Bay Urban Creeks Flood Study (in progress);
- Narooma Coastal Inlets Floodplain Risk Management Study and Plan (in progress); and,
- Entrance opening policies for the following Lakes: Durras, Surfside, Joes, Short Beach, Wimbie, Coila, Tuross, Kianga, Little Bullengella, and Nangudga.

5.3 Implementation of Coastal Management Actions

A variety of coastal management actions have been undertaken over time by Council, public authorities and private landowners in response to coastal management issues. A review of these actions is provided in the following sections.

5.3.1 Coastal Zone Management Plans

Council prepared a CZMP for Wharf Road North Batemans Bay (ESC, 2017), which was certified by the Minister for the Environment on 4 June 2018.

The back beach area at Wharf Road is low lying and subject to immediate coastal inundation and erosion hazards. The study was undertaken in response to the NSW Government identifying this part of Batemans Bay as a coastal erosion 'hotspot' (now termed as a location identified as having 'significant open coats hazards' by DPIE under their Coastal and Estuary Grants Program).

As a result of the CZMP, a draft Emergency Action Sub-plan for the Wharf Road Coastal Erosion Hotspot was adopted by Council on 24 July 2012, and Council has zoned the whole of the subject land 'E2 Environmental Conservation' under the *Eurobodalla Local Environmental Plan 2012* to avoid current and future risk by preventing development unsuited to a high hazard coastal area. The Plan identified additional management options, including:

- Voluntary purchase of affected properties;
- Investigation of options for removal or relocation of sewer mains;
- Access improvements; and,
- Weed and rubbish control.

The Wharf Road Coastal Erosion Hotspot is included in the current scope, so this CMP will replace the Wharf Road CZMP governing this area. Eurobodalla Shire Council – Batemans Bay is currently listed as a location identified as having 'significant open coats hazards' by DPIE under their Coastal and Estuary Grants Program (DPIE, 2020). The funding implications for this are that Councils with a certified CZMP or CMP for a 'significant open coats hazards' location can apply for funding at any time to implement actions that cannot wait until the next funding round.

5.3.2 Entrance Management

Most of Eurobodalla's coastal lakes are perched behind a barrier of sand between the lake and the ocean. These barriers can be breached naturally during heavy rainfall or heavy seas, however, prior to this occurring, water builds up behind the barriers, which can flood roads, stormwater systems and private properties.

Council recognises that intermittently closed or opened coastal lakes and lagoons (sometimes referred to with the acronym ICOLLS) are governed by natural process and should be maintained with respect to that natural process unless assets are at risk of being flooded.

'Entrance management' refers to the opening of lakes when water levels begin to cause inundation. Council aims to maintain sand barriers and coastal lakes in as close to a natural condition as possible. In doing so, managing lake entrances is a balance between maintaining natural process and preventing the inundation of assets (i.e., houses etc.).

Council has responsibility for opening the following coastal lakes:

- Durras Lake
- Surfside (creek entrance)
- Joes Creek
- Short Beach Creek
- Wimbie Creek
- Coila Lake
- Tuross River
- Kianga Lake
- Little Lake
- Nangudga Lake

5.3.3 Public Access Management

Council plays an active role in public access management, providing safe beach access ways and fencing at locations throughout the study area. In order to manage the needs of the community in maintaining existing pathways and prioritising the construction of new and reconstructed pathways, Council has prepared the Eurobodalla Pathways Strategy (ESC, 2017).

The strategy covers all pathways within the LGA, including beach access and coastal walking tracks.

Council has allocated $3.5 million over the next 10 years (from 2017) to develop high priority sections of the pathway network. A small proportion of this is related to access to the coastal zone.

5.3.4 Other Management Strategies

Other management strategies that have been undertaken or are being undertaken with the study area include:

- Compliance activities: regular ranger patrols (illegal camping, dogs, parties, etc.)
- Beach Signage: Council has undertaken a risk assessment of 47 beaches in 2012, and from this, installed 174 beach signs to inform users or local risks in and around the beaches. The program received a Commendation Award at the State-wide Mutual Risk Management Conference 2012-13.
- Coastal amenity infrastructure installation and maintenance program: Council maintains and constructs a range of coastal amenity infrastructures including boat ramps, access routes, seating, exercise equipment, carparks and guttering, trash bins and caravan opportunity throughout the LGA.
- In May 2016, Council collaborated with the Department of Primary Industries - Lands and Water to dredge the Clyde River entrance bar at Batemans Bay and use the sand for local beach nourishment.
- Council's success in containing and then eliminating the threat of bone seed (bitou) invasion within the Eurobodalla was recognised with a Weed Management accolade at the NSW Local Government Excellence in Environment Awards 2014.
- A range of community lead bush regeneration initiatives, including Landcare and Dunecare projects.

6 Roles and Responsibilities

This chapter identifies stakeholders with interests in the preparation and implementation of the CMP. It details how the scope of the CMP relates to the roles and responsibilities of adjoining councils and public authorities, when information and feedback is expected to be required from other councils and public authorities as well as issues to be addressed in the CMP where councils will seek a collaborative approach.

6.1 Existing Roles and Responsibilities

Information on roles and responsibilities is documented in other chapters of this scoping study as follows:

- **Section 5.2** provides details on the many organisations from the Federal, State, Regional to Local level that are involved in governing the coastline and waters of the study area. **Figure 5-1** provides a summary of the land tenure and governance arrangements with **Figure 5-2** providing the corresponding owners and stakeholders; and,
- **Section 5.1.3** provides details on the adjoining councils; Bega Valley and Shoalhaven Shire Councils, both of whom are important partners in coastal management due to longshore littoral drift of sand along the coastline, considering sediment compartment boundaries.

Photo: Melville Point Interpretive Signage (photo by Emma Maratea)

6.2 Proposed CMP Governance Structure

A CMP provides a unique opportunity for Council, state government agencies and their communities to achieve a strategic and coordinated approach to manage coastal risks and improve coastal habitats and environments, for both environmental and social (community) benefit within the Eurobodalla Shire.

Council will manage the CMP development, implementation and reporting process(es). This includes the preparation, development and review of, and the contents of the plans, strategies, programs and reports to which Part 2 of Chapter 13 of the *Local Government Act 1993* applies, and the preparation of planning proposals (if required) and development control plans under the *Environmental Planning and Assessment Act 1979*.

Stakeholders with interests in the preparation and implementation of this CMP are shown in the agencies/stakeholder panel of **Figure 5-2**.

Potential governance and management arrangements for the CMP are outline in **Table 6-1**.

Table 6-1 Potential CMP Governance and Management

Entity	Responsibility
Eurobodalla Shire Council	Lead agency for development, coordination and implementation of CMP
State Agencies/Land Managers DPIE– Environment, Energy and Science DPIE – Water DPIE – Planning DPI- Crown Lands DPI- Fisheries Local Aboriginal Land Councils (LALCs) Local Land Services National Parks and Wildlife Services NSW Environment Protection Authority Transport for NSW Maritime Infrastructure Delivery Office (MIDO) **Heritage NSW**	Sign off on CMP, collaboration and action(s) implementation (as defined)
Coastal & Environment Management Advisory Committee (CEMAC) Eurobodalla Shire Council Agencies (above who have direct land ownership and management responsibilities in the CMP study area) Regional Bodies (LLS, RDA, LALC, etc) RFS and SES Selected community and user group(s)	Non-statutory committee to assist facilitating local community and stakeholder involvement and oversight of the planning and implementation process(es). Advisory only, potentially a committee of council under S355 of the *Local Government Act 1993.*

6.3 Community and Stakeholder Engagement Strategy

Active engagement with the community and stakeholders is considered critical to the CMP process.

Engagement with local communities and stakeholders assists in ensuring that the developed CMP is representative and enable the planning process to remain flexible in order to capture changing values within the region.

Community and stakeholder support for the actions included in a CMP will also be beneficial during the implementation phase.

A Community and Stakeholder Engagement Strategy has been developed for this CMP Scoping Study and is provided in **Appendix A**. The strategy outlines:

- Which individuals and organisations should be involved in the review, preparation and implementation of the CMP
- How and when they will be offered engagement opportunities
- How their input will be incorporated into the planning process.

Photo by Eurobodalla Coast Tourism

7 Data Gaps and First Pass Risk Assessment

7.1 Data Gaps

Through the detailed literature review of existing studies and management documents for the study area, several knowledge gaps were identified and discussed with stakeholders during the first pass risk assessment process (**Section 7.2**). Identifying these knowledge gaps and where the risk warrants that these knowledge gaps be filled has assisted with developing the forward plan for additional studies to be undertaken in Stage 2 (**Section 9**).

7.1.1 Coastal Hazard Data Gaps

A number of technical and management studies have been completed, in the form of consultant and government technical and management reports, in the study area over recent years that provide a substantial knowledge base for the Coastal Management Program. It is noted however that the majority of available literature relates to Batemans Bay, with a scarcity of coastal science and engineering literature in the wider Eurobodalla local government area. A comprehensive literature review was completed as part of the Eurobodalla Coastal Hazard Assessment (WRL, 2017), and this review has been reproduced in **Appendix C**. In addition to that literature review, a summary of the WRL (2017) study and any more recent studies are also included in **Appendix C**.

All the available literature addressing coastal processes, coastal protection works and coastal management within the Eurobodalla LGA was consulted. This included the management of risks to public safety and built assets, as well as risks from climate change. A brief summary of key documents (where it is relevant to the study area and the scope of the Coastal Hazard Assessment) is presented in **Appendix C**. The quality and reliability of the data and information was also assessed and the historical context to contemporary issues was provided where possible (WRL, 2017).

Of particular note to Stage 2 of the CMP, the following studies quantify the coastal hazard exposure along the Eurobodalla Coast:

- Wharf Road Coastal Zone Management Plan (BMT WBM, 2009)
- Eurobodalla Shire Coastal Hazards Scoping Study (SMEC, 2010)
- Eurobodalla Coastal Hazard Assessment (WRL, 2017).

Between these studies, erosion hazard estimates are provided for 36 beaches and inundation/wave runup estimates provided for 37 beaches.

Coastal hazard estimates and associated mapping are therefore available for present day, 2050 and 2100 and are deemed adequate and appropriate for the preparation of the CMP. That is, planning timeframes of 2050 and 2100 are considered consistent with the requirements of coastal planning under the CM Act (2016). In addition, sea level policy and guidance set out within the South Coast Regional Sea Level Rise Policy and Planning Framework (Whitehead & Associates / Coastal Environment, 2014) are suitable for development of the CMP.

In general, the circumstances concerning coastal management across the study area have not changed for the majority of locations and hence the availability of coastal hazard information from the previous studies will allow for fast-tracking of Stage 2 of the CMP. However, following community feedback as part of the previous CMP process, supplementary information will be sought in Stage 2 to refine hazards lines at 3 locations: namely, Long Beach, Surfside Beach and Tomakin Cove. Specifically, geotechnical

information is being collected to quantify in influence of underlying rock stratum and relic coastal structures on coastal hazard exposure in these areas.

Further, the more contemporary study by WRL (2017) applies two methods for the estimation of erosion hazard across the study area: namely a deterministic and probabilistic method. While consistent in the underlying data that is used, the methods vary in the definition of the adopted likelihood for erosion hazard mapping. For example, the deterministic method is used to produce erosion hazard extents representative of the 100 years ARI storm demand at the end of adopted planning horizon (2100), whereas the probabilistic method is used to produce erosion hazard extents representative of the 1% exceedance probability over the planning horizon (2100). The two methods provide different outcomes. It is understood that this was requested and endorsed by Council (it is noted that Local Government is the decision maker, with State Government providing advice for Council consideration) at the time. However, as part of the reviews for this scoping study it recommended that the approach to erosion hazard lines is made consistent between the various sites, such that the relative risk between sites is directly comparable, and that deterministic erosion hazard lines be adopted at all beaches. The deterministic method has been selected as it describes a probability of occurrence that is suitably conservative and consistent with common practice for hazard assessments along the NSW coast. Mapping of erosion hazard using the deterministic method will be updated for 5 sites in Stage 2 of the CMP; being Long Beach, Surfside Beach, Malua Bay, Tomakin Cove and Broulee Beach.

7.2 First Pass Risk Assessment

The CM Act requires Council to follow a risk management process when preparing a CMP and identifying where management actions are required. This includes identifying and assessing risks to environmental, social and economic values and benefits and evaluating and selecting management actions to address those risks (OEH, 2018c).

The first pass risk assessment in Stage 1 is a qualitative risk assessment using available information to help inform the scope of the CMP. It is a relatively straightforward way to prioritise the threats to the coastal environment and risks from coastal hazards. The goal is to identify what values and assets might be at risk and then establish whether the risk is large enough to warrant a more detailed assessment / further assessed in subsequent stages of the CMP (OEH, 2018c).

The risk assessment specifically assessed the vulnerability (including sensitivity and tolerance) of environmental, economic and social/cultural values to coastal risks as well as benefits and opportunities. Risk is a function of the likelihood of a hazard or threat occurring and the consequences of the hazard or threat, with the consequences combining the concepts of magnitude, sensitivity and duration (OEH, 2018c).

7.2.1 Risk Assessment Methodology

The Coastal Management Manual indicates the assessment process should be systematic and demonstrate that both likelihood and consequence have been considered, which involves applying qualitative scales of likelihood and consequence. In order to undertake the first pass risk assessment, the consequence and likelihood scales recommended in the Coastal Management Manual were considered, sourced from *Australian Greenhouse Office Climate Change Impacts and Risk Management* (AGO, 2006). The risk matrix recommended in the *Coastal Management Manual* was also applied (note this differs from that presented in AGO (2006), which is indicated as the source). The consequence and

likelihood scales used are shown in **Table 7-1** and **Table 7-2** and the risk matrix used is shown in **Table 7-3**.

Notably one change was made to the AGO (2006) Consequence Scale table; this was to include cultural heritage in the success criteria by rewording 'Environment and sustainability' to 'Environment and cultural heritage' and including cultural heritage in each rating description to ensure impacts to cultural heritage were adequately considered in the risk assessment process.

In addition to an assessment of the risk associated with each threat, a confidence level was also assigned to each threat assessment based on the *National Emergency Risk Assessment Guidelines* (AIDR, 2020). In accordance with the guidelines, the outputs generated by a risk assessment are used to determine possible action. Before decisions are made however, an indication of the robustness of the risk assessment approach is required. To achieve this the level of confidence in the risk assessment process is used to identify and communicate uncertainty (e.g. lack of data informing the assessment). Assessing confidence also addresses decision makers' concerns for whether there is a need for more detailed risk assessment (AIDR, 2020). The confidence scales are shown in **Table 7-4**.

To determine a confidence level using the risk rating, a separate assessment was made for supporting evidence, expertise and participant agreement. Each assessment was then rated using the criteria in **Table 7-4** and the lowest rating of the three assessed confidence levels determined the overall confidence rating in the risk.

As part of the assessment process data gaps were identified and based on the risk and confidence ratings, Stage 2 studies have been recommended where the assessment highlighted that more robust information was required to give a more informed understanding of risk.

Table 7-1 Consequence Scale (Adapted from: AGO, 2006)

Rating	Success criteria				
	Public safety	Local economy and growth	Community and lifestyle	Environment and cultural heritage	Public administration
Catastrophic	Large numbers of serious injuries or loss of lives	Regional decline leading to widespread business failure, loss of employment and hardship	The region would be seen as very unattractive, moribund and unable to support its community	Major widespread loss of environmental amenity and/or cultural heritage and progressive irrecoverable environmental and/or cultural heritage damage	Public administration would fall into decay and cease to be effective
Major	Isolated instances of serious injuries or loss of lives	Regional stagnation such that businesses are unable to thrive, and employment does not keep pace with population growth	Severe and widespread decline in services and quality of life within the community	Severe loss of environmental amenity and/or cultural heritage and a danger of continuing environmental and/or cultural heritage damage	Public administration would struggle to remain effective and would be seen to be in danger of failing completely
Moderate	Small numbers of injuries	Significant general reduction in economic performance relative to current forecasts	General appreciable decline in services	Isolated but significant instances of environmental and/or cultural heritage damage that might be reversed with intensive efforts	Public administration would be under severe pressure on several fronts
Minor	Serious near misses or minor injuries	Individually significant but isolated areas of reduction in economic performance relative to current forecasts	Isolated but noticeable examples of decline in services	Minor instances of environmental and/or cultural heritage damage that could be reversed	Isolated instances of public administration being under severe pressure
Insignificant	Appearance of a threat but no actual harm	Minor shortfall relative to current forecasts	There would be minor areas in which the region was unable to maintain its current services	No environmental or cultural heritage damage	There would be minor instances of public administration being under more than usual stress, but it could be managed

Table 7-2 Likelihood Scale (Source: AGO, 2006)

Rating	Recurrent risks	Single events
Almost certain	Could occur several times per year	More likely than not - Probability greater than 50%
Likely	May arise about once per year	As likely as not - 50/50 chance
Possible	May arise once in ten years	Less likely than not but still appreciable - Probability less than 50% but still quite high
Unlikely	May arise once in ten years to 25 years	Unlikely but not negligible - Probability low but noticeably greater than zero
Rare	Unlikely during the next 25 years	Negligible - Probability very small, close to zero

Table 7-3 Risk Matrix (Source: OEH, 2018)

	Consequence				
Likelihood	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	Medium	High	High	Extreme	Extreme
Likely	Medium	Medium	High	High	Extreme
Possible	Low	Medium	High	High	High
Unlikely	Low	Low	Medium	Medium	High
Rare	Low	Low	Medium	Medium	High

Table 7-4 Confidence Scales (Source: AIDR, 2020)

Confidence Level	Descriptor	Supporting Evidence	Expertise	Participant Agreement
Highest	Assessed likelihood, consequence or risk is easily assessed to one level, with almost no uncertainty.	Recent historical event of similar magnitude to that being assessed in the community of interest. Quantitative modelling and analysis of highest quality and length of data relating directly to the affected community, used to derive results of direct relevance to the scenario being assessed.	Risk assessment team contains relevant and demonstrated technical expertise in the field being assessed, and experience in data and/or modelling of direct relevance to the scenario being assessed. Technical expertise is highly influential in the decisions of the risk assessment team.	Agreement among participants on the assessment of levels of likelihood, consequence or risk.
High	Assessed likelihood, consequence or risk has only one level, but with some uncertainty in the assessment	Recent historical event of similar magnitude to that being assessed in a directly comparable community of interest. Quantitative modelling and analysis uses sufficient quality and length of data to derive results of direct relevance to the event being assessed	Risk assessment team contains relevant technical expertise in the field being assessed, and experience with data and/or modelling relating to the event being assessed. Technical expertise is highly influential in the decisions of the risk assessment team	Disagreement on only minor aspects, which have little effect on the assessment of levels of likelihood or consequence.
Moderate	Assessed likelihood, consequence or risk could be one of two levels, with significant uncertainty	Historical event of similar magnitude to that being assessed in a comparable community of interest Quantitative modelling and analysis with reasonable extrapolation of data required to derive results of direct relevance to the event being assessed	Risk assessment team contains relevant technical expertise in the field being assessed, and experience in data and/or modelling of relevance to the event being assessed, and Technical expertise is used by the risk assessment team	Disagreement on significant issues, which would lead to different levels of likelihood or consequence depending on which argument was followed
Low	Assessed likelihood, consequence or risk could be one of three or more levels, with major uncertainty	Some comparable historical events through anecdotal information Quantitative modelling and analysis with extensive extrapolation of data required to derive results of relevance to the event being assessed	Risk assessment team contains technical expertise related to the field being assessed Technical expertise is taken into account by the risk assessment team	Disagreements on fundamental issues relating to the assessment of likelihood or consequence, which would lead to a range of rating levels
Lowest	Assessed likelihood, consequence or risk could be one of four or more levels, with fundamental uncertainty	No historical events or quantitative modelled results to support the levels	No relevant technical expertise is available to the team for analysis	Fundamental disagreement on levels of likelihood, consequence or risk, with little prospect of agreement

7.2.2 Coastal Hazards Risk Assessment Methodology

A key input to the first pass risk assessment was an understanding of the exposure of the entire Eurobodalla coastline against the coastal hazard threats relevant to the open coast. To achieve this, the coastline was separated into smaller coastal compartments, a total of 46 each with similar foreshore character, and the exposure of each coastal compartment was then estimated based on available coastal hazard information (such as coastal hazard mapping from within WRL, 2017 and SMEC, 2010). Where no existing data or study was available, a high level estimate of the erosion, recession and inundation exposure was developed. This screening level hazard exposure was interpreted with observations made by the study team during the site visits (16th – 18th March 2021) to provide a first pass assessment of the exposure and risk profile against the 10 coastal hazard threats (**Section 4.3.2**).

The exposure to each coastal hazard threat (open coast) was considered as follows:

- CH Threat 1 – Beach erosion
    - Erosion hazard lines defined in WRL (2017) or SMEC (2010) or through beach erosion hazard lines estimated from a storm demand of 120m^3/m of beach (southern areas up to and including Broulee) or 80m^3/m of beach (for areas north of Broulee). These estimated storm demands were considered suitably conservative values for the screening level assessment (where hazard studies were not available) and are based on the upper value for 100 year ARI storm demand at sites assessed within WRL (2017).
- CH Threat 2 – Shoreline recession
    - Shoreline recession estimates from WRL (2017) and SMEC (2010) or adopting a Bruun factor (average beach slope, 1 in X) of 20 (north of Broulee) or 40 (southern areas up to and including Broulee), consistent with beach profiles at analysed beaches.
- CH Threat 4 – Coastal inundation
    - Wave runup height estimates from WRL (2017) and SMEC (2010) or adopting a runup level of +5.5mAHD (at 2100). This was considered suitably conservative for the screening level assessment.
- CH Threat 5 – Tidal inundation
    - HHWSS tidal plane level (+0.92mAHD) with the inclusion of sea level rise (+0.71m) to 2100.
- CH Threat 6 – Erosion and inundation of foreshores caused by tidal waters and the action of waves, including the interaction of those waters with catchment floodwaters
    - Not considered as part of the open coast CMP
- CH Threat 7 – Coastal watercourse entrance instability
    - The identification of watercourse entrances and observations made by the study team during the site visits.
- CH Threat 8 – Coastal watercourse entrance modifications (interventions in natural opening regimes for ICOLLs)
    - All locations where intervention of entrances occur (**Section 5.3.2**).
- CH Threat 9 – Dune slope instability
    - Beach profiles extracted from available coastal LiDAR (OEH, 2016), NSW Beach Profile Database (DPIE 2021) and the identification of scarped dune profiles.
- CH Threat 10 – Coastal cliff instability
    - Identification of where coastal cliffs are in close proximity to coastal assets or property.

7.2.3 Outcomes of the Risk Assessment

The results of the first pass risk assessment are used in the subsequent sections of this CMP Scoping Study and to inform the Forward Plan (**Section 9**). As part of the assessment process, data gaps were identified and based on the risk and confidence ratings, Stage 2 studies have been recommended where the assessment highlighted that more robust information was required to give a more informed understanding of risk.

A first pass risk assessment was undertaken considering the following information for each management issue:

- Management issue description/detail/consequences, including key hotspots
- How the management issue was identified (i.e. data source)
- Values affected by the management issue
- Likelihood, consequence, risk ratings for all timeframes and confidence rating
- Current management arrangements
- Available information/data and studies relating to the issue
- Data gaps
- Recommended studies and actions for future stages of the CMP.

The level of risk associated with each threat for the 2100 timeframe is shown in Table 7-5 for those threats not related to coastal hazards.

Cultural heritage sites may be under threat at numerous known and unknown locations along the coast. This is not shown on the hazards map but is included in EGC Threat 4.

Photo: Narooma

Table 7-5 Non-Coastal Hazard Risks for 2100

ID	Threat	Future Risk (+100 years)
Recreational Activities Threats		
RA Threat 1	Conflict over resource access and use (e.g. beach users and dog walkers)	**Medium**
RA Threat 2	Habitat (physical) and wildlife disturbance (e.g. from overuse, overcrowding, foreshore development, commercial and recreational fishing methods, etc)	**High**
RA Threat 3	Poorly located, poorly maintained and/or inappropriate access and supporting facilities	**Medium**
RA Threat 4	Anti-social behaviour and unsafe practices	**Medium**
RA Threat 5	Passive recreational use (swimming, surfing, bush walking, etc)	**Medium**
RA Threat 6	Active recreational use (recreational boating, motorised watercraft, camping etc) - recreational activities needing associated infrastructure	**High**
RA Threat 7	Commercial and recreational fishing	**High**
Coastal Development Threats		
CD Threat 1	Coastal development resulting in loss of plant and animal species (habitat disturbance or loss)	**High**
CD Threat 2	Water pollution from urban stormwater and treated effluent discharge	**Medium**
CD Threat 3	Pollution of water, beach sand and other habitat areas with litter, solid waste, marine debris and microplastics	**Medium**
CD Threat 4	Coastal development encroaching onto natural coastal processes to exacerbate hazard impacts	**High**
Engagement and Governance Threat		
EGC Threat 1	Lack of compliance with regulations (by users) or lack of compliance resources (by agencies)	**High**
EGC Threat 2	Insufficient community and visitor awareness of the values and threats to the coastal environment, and lack of engagement with managing this environment	**High**
EGC Threat 3	Insufficient or inappropriate governance and management of the coastal environment	**High**
EGC Threat 4	Insufficient involvement of Traditional Owners in the management of cultural heritage and use within the coastal environment	**High**

The first pass risk assessment of coastal hazards provided guidance for each location as to whether:

- the risks to the coast are sufficiently low that no further assessment of risk or risk management is required at that location,
- additional data or analysis are required in Stage 2 of the CMP to better define the risk at that location, or
- no additional data or analysis are required in Stage 2, but there are known management issues relating to coastal hazards that should be addressed through management options in Stage 3 of the CMP.

The mapping of these outcomes is shown on **Figure 7-1** and **Map RG-09-01**.

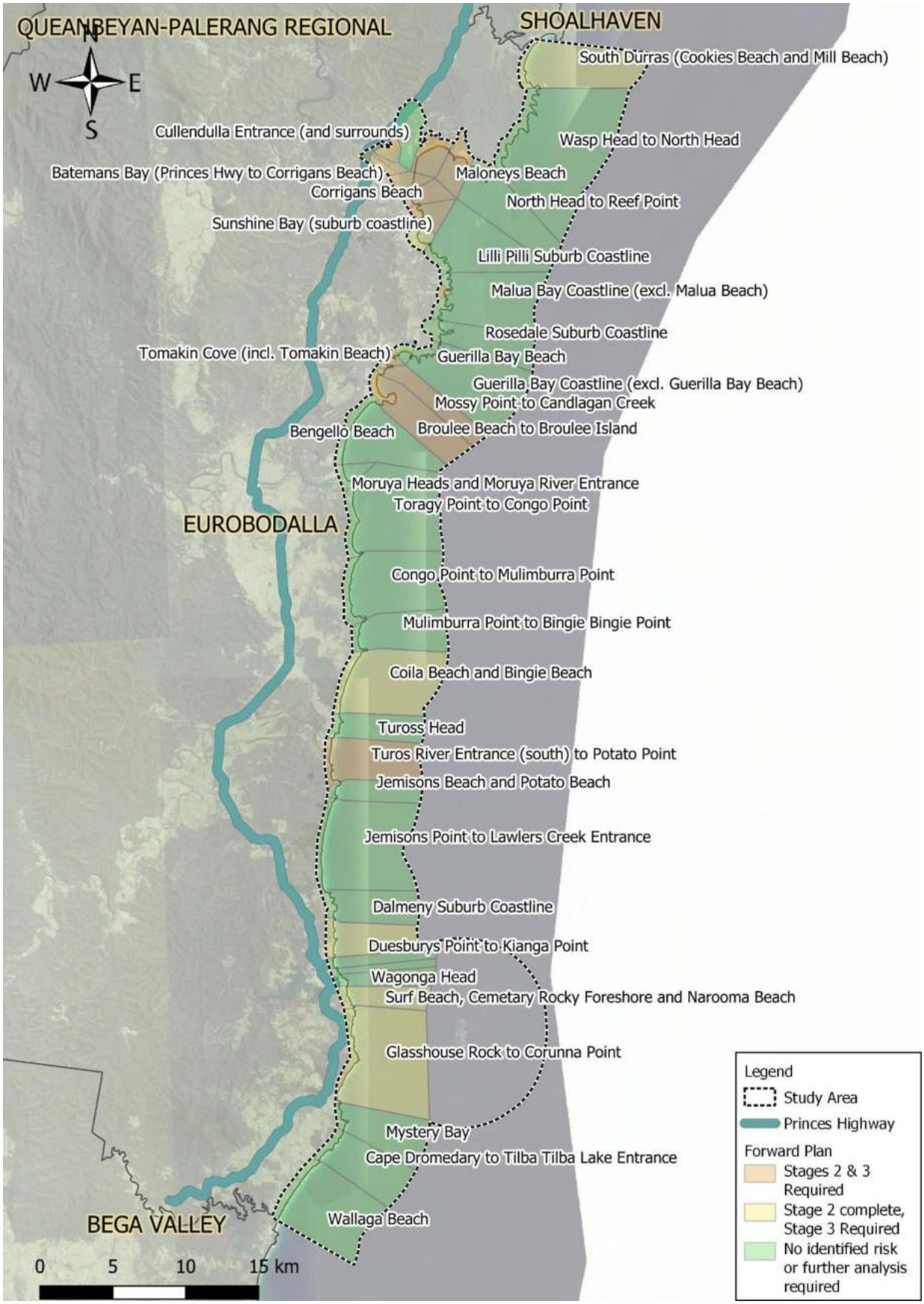


Figure 7-1 Mapping of First Pass Risk Assessment Outcomes

8 Preliminary Business Case

In accordance with the Coastal Management Manual, a detailed business plan must be included in a CMP to support implementation of the coastal management actions contained in the CMP. A preliminary business case can be used to gain support and commitment to undertake additional studies and activities that are required to prepare the CMP.

A preliminary business case has been prepared as part of this Scoping Study in accordance with NSW Treasury's *NSW Government Business Case Guidelines (TPP18-06)* and NSW Government's *Benefits Realisation Management Framework (2018)*, as well as with the requirements of the Manual. As the program proceeds, the use of this structure and framework will streamline future funding submissions and ensure applicability of the business case to a wide array of NSW funding scenarios, including those beyond the Coastal Management Framework. The CMP will be prepared to align to align with Council's IR&R Framework, including the CMP Business Plan, which is to be prepared under Stage 4 of the project.

The preliminary business case is provided in full in **Appendix D**. A summary of the key findings is provided in the following sections.

8.1 Components Required to Develop a CMP

The business case identifies, at a broad scale, the current CMP elements, the current budget of coastal management activities in the study area, through Council, other Government initiatives and other private groups.

The forward plan provided in the Scoping Study also provide details on proposed activities to prepare the CMP for the five beaches included in the study area (refer **Section 9**).

Council has undertaken numerous studies and assessments in coastal management. While not developed specifically for the CMP these studies will be utilised in the CMP to Fast Track components of Stage 2 and allow both time and costs saving in the CMP development. Extensive review of these existing studies and assessments has been undertaken as part of a literature review, which was undertaken to identify key 'knowledge gaps' of future studies that may be required. This literature review and identification of knowledge gaps and potential required studies is discussed in depth in **Section 7**.

The Coastal Management Manual set out the preparation of a CMP across a five stage process. The CMP Scoping Study completes Stage 1. A summary of what is involved in subsequent Stages 2 to 5, as outlined in the Coastal Management Manual (OEH, 2018b), are provided in **Section 9.1**.

This business case seeks the release of funding to support ongoing CMP development as outlined within the forward plan. As the CMP develops, the business case will be advanced to seek implementation funding as relevant.

There are variabilities in the projected costs for each element as there are potentials for cost sharing options with other government bodies, such as adjacent councils for example.

A number of key studies are required to be undertaken to finalise the CMP, with some variability in their costings and possibilities for cost sharing amongst other agencies depending on the study extent. These are identified in the Forward Plan (**Section 9**).

8.2 Benefits

A certified CMP would permit a number of significant benefits to be realised, including:

- Improved Funding security for coastal management in Eurobodalla
- Improved Social legitimacy
- Holistic coastal planning
- Collaborative management opportunities.

8.2.1 Funding Security

Through provision of a certified CMP, Council has a defined and accessible pathway through which funding may be sought to support and supplement the implementation of identified recommended actions identified within the CMP.

Moreover, as ultimate funding for CMP initiatives is predicated on the demonstration of economic viability (i.e. cost benefit analysis), the CMP process also provide and effective mechanism to ensure that funding is directed towards the highest performing value for money options.

Photo: Eurobodalla Coast by Emma Maratea

8.2.2 Social Legitimacy

A certified CMP will provide certainty in planning, investment and decision making by both Council and the community, providing net social and legal support in Council's Coastal Management. It is less likely that community members will be inclined to challenge proposed actions in the NSW Land and Environment Court, where the proposed actions have previously been approved under the CM Act. This will serve to help expedite the roll out of mitigation measures and break the current cycle of planning and failed implementation.

From a legislative perspective, Council is likely to benefit as Section 733 of the Local Government Act 1993, provides statutory exemption from liability for Councils in respect of advice, actions or omissions in good faith relating to the likelihood of land being affected by a coastal hazard. Actions covered include the making of a CMP and acting substantially in accordance with the principles and mandatory requirements set out in the Manual is also relevant to the indemnities afford by s.733. Consequently, pursuing a CMP, in accordance with the Manual may reduce the exposure to liability for decisions made relating to coastal risk.

Moreover, social acceptance and enhancement of Council reputation, is likely to facilitate stakeholder engagement with community members and interest groups within the study area. It is also likely to engender confidence with the community, stakeholders and government bodies that coastal management is being developed through a regulatory compliant framework with funding available that is designed to incorporate community, cultural, societal, economic and environmental elements in the management process.

8.2.3 Holistic Coastal Planning

The Manual recognises that the coastal issues and risks of inaction are dependent upon a range of uncertainties regarding the future growth or amelioration of coastal hazards as well as the future growth and change to onshore sensitive receivers (e.g. communities, land use, social values).

It is important that coastal managers have a proper and holistic understanding the risks and opportunities within the coastal zone and the consequences of specific courses of action. Accurate and detailed information about risk and consequence is necessary to assist decision makers generate effective management strategies which identify and prioritise future actions and investment. A CMP provides a mechanism that can encapsulate the full array of issues of the environment, the local economy, the community and the cultural elements of area, as well as recognising the uncertainties therein. A coastal management processes that is able to fully identify and incorporate the full suite of issues is more likely to generate an optimal outcome in light of uncertainty than an ad hoc approach. This is particularly, so given the previous physical hazard focus of CZMPs.

8.2.4 Collaborative Management Opportunities

Development of a CMP will ensure that Council's coastal management is aligned with the state-wide approach to coastal management and community expectations. As such, it will also be aligned with the monitoring, evaluation and improvement of concurrently implemented CMPs and facilitate access to knowledge sharing and lessons learnt on other CMPs developed by other agencies.

The NSW Coastal Management Framework provides flexibility around the scope, structure and governance arrangements of a CMP, providing a unique opportunity for Council, state government agencies and their communities to achieve a strategic and coordinated approach to manage coastal

risks and improve coastal habitats and environments, for both environmental and social benefit within the Eurobodalla Shire. Implementation will allow access to a clearly defined management and governance framework supported by regulatory bodies and subsequent funding opportunities. Further to this, the CMP integrated process allows access to collaboration with adjacent bodies in terms of undertaking studies and in implementing interventions that may have a larger than study area impact.

In addition to the knowledge sharing opportunity this provides, this may also generate cost sharing opportunities on studies and interventions and access to knowledge sharing network developed as part of the CMP process.

On a more local scale, the preparation of the CMP represents a strategic opportunity to improve engagement with the various land owners, coastal managers and stakeholders, gaining broad community support for the program and their commitment to contribute towards the necessary studies and implementation of management actions as agreed within the final CMP.

8.3 Risks

8.3.1 Risks of Not Preparing a CMP

The four main risks of not preparing a CMP are:

- **Funding**: Council will be prevented for applying for and thus obtaining funds from the NSW Coastal and Estuary Program without an approved CMP.
- **Implementation**: Council will be at risk of indirectly adopting an ad hoc approach to coastal management, which due to limitations of available funding will necessarily be piecemeal, limited and reactionary:
    - Sections of coast, unable to be addressed will continue to be exposed to forecast hazards and avoidable damage and loss of property, infrastructure and potentially loss of life and injury, as well as associated environmental, social and economic values.
    - There is potential that ad hoc actions in one location may adversely affect assets and values in other locations.
    - Currently, following storm events, the lack of a certified CMP limits the ability of Council to implement well considered emergency response measures.
- **Legitimacy**: There will be continued lack of social legitimacy for coastal management action, which may result in court actions, slowing down potential implementation of recommendations, lowering available funds to support implementation and increasing Council's liability.
- **Scope**: Current guidance regarding coastal management adopts a broader and more holistic suite of considerations in its identification and prioritisation of the coastal issues and management actions compared to the earlier CZMP approach.

Related to this are a range of secondary risks and costs, including:

- Inaction may expose Council to increased liabilities for any adverse outcomes through avoidable damage and loss of property, infrastructure and potentially loss of life and injury, as well as associated environmental, social and economic values
- Increased pressure on coastal areas through development occurring that would not be permitted under a comprehensive management plan
- Increased misalignment between Council activities and broader regional actions and NSW policy.

- A higher potential of non-compliance with regulatory bodies for grant funding or other compliance aspects, including possible delays in review due to avoiding the streamlined process for CMPs
- Uncertainty for community members and developers regarding investment within the region. There is a community sentiment that it is trapped within a perpetual planning cycle
- Inefficiencies and repeat expenditure of Council and State Government funds in response to coastal damages and risks
- Inability to readily incorporate a collaborative planning approach that recognised a wider scale approach to coastal management, as promoted by the State and neighbouring Councils.

Given the significant issues faced by Council in the implementation of its CZMP to date, it is considered likely that a do-nothing scenario will lead to any substantive change in this outcome and that Council will continue to struggle to make material improvements in its coastal management. Ultimately, this will result in the realisation of identified hazards and the loss of environmental, social and economic values. Given the dependency of the local economy upon its tourism and environmental values, the long-term costs of such a course of action, may be significant to the region as a whole.

8.3.2 Risks of Preparing a CMP

While the CMP will address the problem statement and support the realisation of the identified benefits, it is acknowledged that its introduction can lead to a number of risks which require management, monitoring and evaluation over its implementation life and the service life of its resultant actions. Key risks include:

- Expectations of the local community and stakeholders – The community and stakeholder engagement and consultation to support preparation of the CMP is likely to create (or exacerbate) expectations in the community for implementation of actions for coastal management. An inherent risk lays thereafter if the CMP process, then fails to deliver the actions, or if these actions do not achieve the vision and objectives of the CMP.
- Council responsibilities – As the CMP owner of the CMP process, once gazetted, Council has responsibility for its implementation (Division 4 section 22 of the Coastal Management Act):
    - A local council is to give effect to its coastal management program and, in doing so, is to have regard to the objects of this Act.
    - In particular, without limiting subsection (1), a local council is to give effect to its coastal management program in:
        - the preparation, development and review of, and the contents of, the plans, strategies, programs and reports to which Part 2 of Chapter 13 of the Local Government Act 1993 applies, and
        - the preparation of planning proposals and development control plans under the Environmental Planning and Assessment Act 1979.

  A failure to implement management actions is not permitted under the CM Act.
- Conflict with other resource commitments and demands of Council and agencies – Preparing a CMP may result in conflict within Council and contributing agencies, in terms of competing need for scarce resources (including but not limited to funding and staff). However, the CMP preparation process should be thorough, so any potential conflicts are identified, and controls are implemented to mitigate associated risks.

- Competition with other Councils – While there is significant state funding available, the funding is finite and there may be both real and perceived competition between councils for State Government support. This may also affect community opinions regarding perceived inequality in value pending amount of funding invested/made available.

8.4 Value for Money

Given the acknowledged importance of the coastal area to the Eurobodalla region and the wider state of NSW as a tourist destination and desired place to live there is significant incentive to ensure the responsible management of its coastal environment. While the costs of undertaking the CMP process are substantial, there is clear value in proceeding with the CMP process in comparison to the current, highly constrained management options accessible to Council, which puts both current and future environmental, social and economic values of this unique area at risk. Quantification of the magnitude of this relative net present value will be undertaken as the CMP development continues.

9 Forward Plan

This chapter provides a summary of the subsequent stages of the CMP process and a summary of recommended studies, investigations and assessments proposed, which forms the forward plan. The forward plan is the key outcome of this Stage 1 Scoping Study. The timeframe for subsequent stages is:

- Stage 2: May 2021 to September 2021
- Stage 3: September 2021 to February 2022
- Stage 4: February 2022 to July 2022

9.1 Subsequent Stages of the CMP Process

As stated in the Coastal Management Manual and shown in **Figure 1-2**, preparation of a CMP follows a five stage process. This CMP Scoping Study completes Stage 1. A summary of what is involved in subsequent Stages 2 to 5, as outlined in the Coastal Management Manual (OEH, 2018a), are provided in **Table 9-1**.

Table 9-1 Requirements for Subsequent Stages 2 to 5 of the CMP Process

Stage	Description in CM Manual (OEH, 2018a)
Stage 2: Determine risks, vulnerabilities and opportunities 	Stage 2 involves undertaking detailed studies that help councils to identify, analyse and evaluate risks, vulnerabilities and opportunities. This includes: • Engaging with the community and stakeholders • Refining the understanding of key management issues • Filling knowledge gaps by undertaking additional technical studies • Identifying threats to coastal values and areas exposed to coastal hazards • Analysing and evaluating current and future risks (detailed risk assessment) • Identifying scenarios for environmental, social and economic change and related opportunities for coastal communities • If a planning proposal is required to amend maps of coastal management areas, commencing the Gateway process • Identifying timing and priorities for responses, thresholds and lead times.
Stage 3: Identify and evaluate options 	Stage 3 involves the identification and evaluation of management options. This includes: • Identifying and collating information on management options • Evaluating management actions, considering their feasibility, viability and acceptability to stakeholders • Selecting preferred management actions and determining priorities • Engaging public authorities about implications for their assets or responsibilities • Evaluating mapping options and implications if a planning proposal is being prepared • Identifying pathways and timing of management actions • Preparing a business plan for implementation.

Stage	Description in CM Manual (OEH, 2018a)
Stage 4: Prepare, exhibit, finalise, certify and adopt the CMP 	Stage 4 includes: Preparing a draft CMP Exhibiting the draft CMP and any related planning proposal Reviewing and adopting the draft CMP Submitting the draft CMP to the Minister administering the Act, for certification Publishing the certified CMP in the Gazette Making the CMP available to the community. Prior to exhibition, councils may seek advice from DPIE on the draft CMP.
Stage 5: Implement, monitor, evaluate and report 	Stage 5 involves: Implementing actions in the published CMP through the Integrated Planning and Reporting (IP&R) framework and land-use planning system Implementing actions in partnership with adjoining councils and public authorities where relevant Implementing an effective monitoring, evaluation and reporting (MER) program Monitoring indicators, trigger points and thresholds Reporting to stakeholders and the community on progress and outcomes through the IP&R framework Reviewing and updating the CMP at least every 10 years. The evaluation of program outcomes will contribute to council's review of its Community Strategic Plan.

9.2 Engagement with Key Stakeholders

It is critical to the success of the CMP development process that relevant state agencies have early involvement and understanding of the CMP Scoping Study recommendations to ensure they endorse their future role and/or responsibility in later stages of CMP development and actions outlined in the Forward Plan.

Agency stakeholders listed in the engagement strategy (**Appendix A**) have been contacted as part of this Scoping Study.

9.3 Recommended Studies for the Forward Plan

The recommended studies, investigations and assessments for Stages 2 to 4 of the CMP are listed in **Table 9-2**, as developed through the detailed data and information review, the review of current management arrangements and the first-pass risk assessment.

Table 9-2 provides indicative costs for the studies, a combined cost for undertaking the CMP stages and a timeline for completion of the studies.

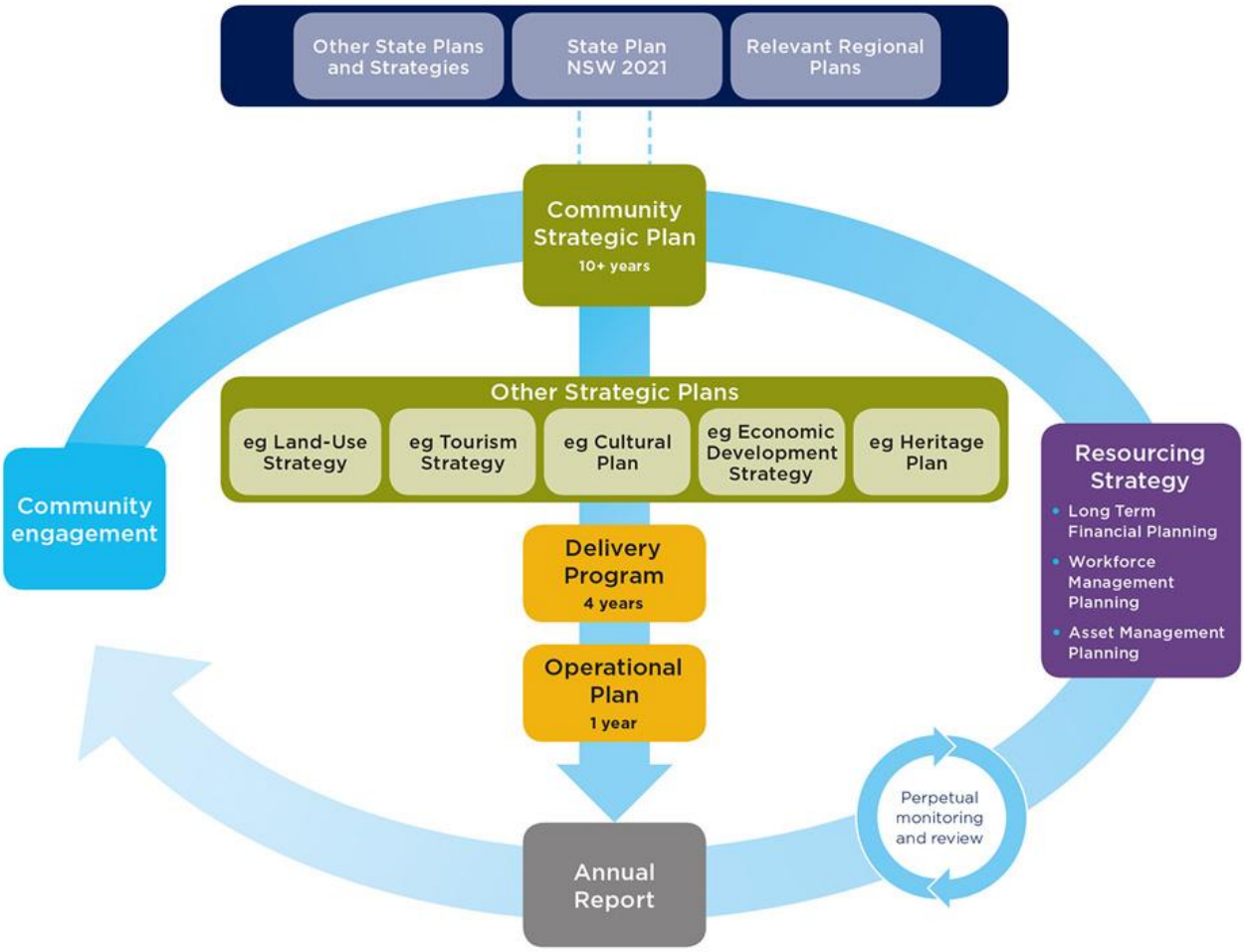


Figure 9-1 Integrated planning and reporting framework (Source: https://www.olg.nsw.gov.au/councils/integrated-planning-and-reporting/framework/)

In the IP&R Framework the Delivery Program is where the community's strategic goals are systematically translated into actions. It is a statement of commitment to the community from each newly elected Council. The Delivery Program is a fixed four-year program as shown in **Figure 9-1**.

The Operational Plan is based on an annual financial year cycle. Local Government elections have been scheduled for December 2021, following which will be an opportunity to revise the Community Strategic Plan and associated Delivery and Operational Plans.

Table 9-2 CMP Forward Plan

Recommended Studies / Components	Cost Estimate	Estimated Completion	Lead Agency	Support Agency
Stage 2: Risks, Vulnerabilities and Opportunities				
Coastal Erosion Assessments	$ 15,000	July 2021	Council	DPIE
Coastal and Coastal Connected Waterways Inundation Assessment	$ 15,000	July 2021	Council	DPIE
Geotechnical Assessments	$ 28,000	July 2021	Council	DPIE
Community and Stakeholder Engagement Strategy (CSES): CEMAC briefing, community workshops, website updates, meetings.	$ 18,000	August 2021	Council	DPIE, NPWS, DPI, LLS
Estimate Stage 2 Subtotal	**$ 76,000**			
Stage 3: Identify and Evaluate Options				
Option identification and modelling	$ 37,000	October 2021	Council	DPIE
Risk assessment, MCA and financial analysis	$ 26,000	November 2021	Council	DPIE
Concept and decision pathway diagrams and beach mapping	$ 18,000	November 2021	Council	DPIE
Land use planning recommendations and planning proposal consideration	$ 10,000	October 2021	Council	DPIE
Community and Stakeholder Engagement Strategy (CSES): CEMAC briefing, website updates, meetings, public input to options.	$ 9,000	December 2021	Council	DPIE, NPWS, DPI, LLS
Broader engagement of stakeholders and community.	$6,000	December 2021	Council	DPIE, LALCs
Activities involving engagement of Aboriginal cultural knowledge holders.	$6,000	December 2021	Council	DPIE, LALCs
Stage 3 reporting	$ 9,000	December 2021	Council	DPIE
Estimate Stage 3 Subtotal	**$ 121,000**			
Stage 4: Identify and Evaluate Options				
Prepare CMP (draft) document, including: Executive summary; Introduction; A snapshot of issues; Actions to be implemented by the local council; Actions to be undertaken by public authorities; A business plan; A coastal zone emergency action subplan; Mapping; Reference list; and Supporting documentation.	$ 15,000	March 2022	Council	DPIE
Finalising the CMP (with Community and Stakeholder public exhibition feedback).	$ 7,500	June 2022	Council	DPIE
Community and Stakeholder Engagement Strategy (CSES): CEMAC / Councillor briefing, website updates, meetings, public information sessions, public exhibition submissions.	$ 23,000	April 2022	Council	DPIE, NPWS, DPI, LLS
Activities involving engagement of Aboriginal cultural knowledge holders.	TBC	TBC	Council	DPIE, LALCs
Estimate Stage 4 Subtotal	**$ 45,500**			

10 References

BMT WBM. (2017). *New South Wales Marine Estate Threat and Risk Assessment Report: Final.* Nelson Bay: NSW Marine Estate Management Authority.

BOCSAR. (2021, April 13). *NSW Crime Tool*. Retrieved from NSW Bureau of Crime Statistics and Research: http://crimetool.bocsar.nsw.gov.au/bocsar/

Breen, D., Avery, R., & Otwat, N. (2005). *Broadscale biodiversity assessment of marine protected areas in the Batemans Shelf and Twofold Shelf marine bioregions.* NSW Marine Parks Authority.

CoastAdapt. (2021, 03 17). *Sea-level rise and future climate information for coastal councils*. Retrieved from https://coastadapt.com.au/sea-level-rise-information-all-australian-coastal-councils#NSW_EUROBODALLA

Department of Agriculture, Water and Environment. (2021). *Underwaer Heritage*. Retrieved from Heritage: https://www.environment.gov.au/heritage/underwater-heritage/underwater-cultural-heritage-act#:~:text=On%2024%20August%202018%20the,1976%20(Historic%20Shipwrecks%20Act)

Department of the Environment, Water Heritage and the Arts. (2008). *Assessment of Australia's Terrestrial Biodiversity 2008.* Canberra: National Land and Water Resources Audit.

Donaldson, S., & Barry, G. (2008). *Eurobodalla Aboriginal Heritage Study.* Eurobodalla Shire Council.

DoP. (2007). *South Coast Regional Strategy 2006 – 2031.* New South Wales: Department of Environment and Conservation.

DPE. (2017). *South East and Tablelands Regional Plan 2036.* NSW Government Department of Planning and Environment.

DPI. (2018). *Department Of Primary Industries.* Retrieved from User Guides: https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0009/656289/BMP-User-Guide-June-2018.pdf

DPI. (2020). *Aquaculture Production Report 2018-2019.* NSW Department of Primary Industries.

DPI. (2021). *Dolphin and whale watching*. Retrieved from Marine Parks: Batemans Bay Marine Park: https://www.dpi.nsw.gov.au/fishing/marine-protected-areas/marine-parks/batemans-marine-park/dolphin-and-whale-watching

DPI. (2021, March 23). *Threatened and protected species*. Retrieved from Depertment of Primary Industries: Batemans Bay Marine Park: https://www.dpi.nsw.gov.au/fishing/marine-protected-areas/marine-parks/batemans-marine-park/life-under-the-sea/threatened-and-protected-species

DPIE. (2015). *Endangered ecological communities (EECs) of the Shoalhaven, Eurobodalla and Bega Valley local government areas. VIS ID 3901*. Retrieved from The Seed Initiative: https://datasets.seed.nsw.gov.au/dataset/endangered-ecological-communities-eecs-of-the-shoalhaven-eurobodalla-and-bega-valley-local-g5e1fd

DPIE. (2020). *Coastal and Estuary Grants Program – Guidelines for applicants 2020-21.* State of NSW and Department of Planning, Industry and Environment.

DPIE. (2020). *State of the Beaches Report 2019-2020.* State of NSW.

ESC. (2017). *Coastal Zone Management Plan Wharf Road North Batemans Bay.* Eurobodalla Shire Council.

ESC. (2017). *Estuary health and water quality monitoring*. Retrieved from Coastal Management: Estuaries: https://www.esc.nsw.gov.au/environment/coastal-management/estuaries/estuary-health-and-water-quality-monitoring

ESC. (2017). *Interim Coastal Hazard Adaption Code.* Eurobodalla Shire Council.

ESC. (2017). *One Community – Eurobodalla Community Strategic Plan 2017.* Eurobodalla Shire Council.

ESC. (2019). *Economic Development Strategy 2019-28.* Batemans Bay: Eurobodalla Shire Council.

ESC. (2019). *Economic Development Strategy 2019-28.* Eurobodalla Shire Council.

ESC. (2019). *Eurobodalla Local Emergency Management Plan.* Eurobodalla Shire Council.

ESC. (2020). *Aboriginal Action Plan 2020 – 2024.* Eurobodalla Shire Council.

ESC. (2020). *Annual Report 2019-20.* Batemans Bay: Eurobodalla Shire Council.

ESC. (2020). *Eurobodalla Local Strategic Planning Statement 2020 – 2040.* Eurobodalla Shire Council.

ESC. (2021, March 15). *Eurobodalla Beachwatch Program*. Retrieved from Residents: Water Quality: https://www.esc.nsw.gov.au/residents/water/water-quality/eurobodalla-beachwatch-program

ESC. (2021). *Options for managing Eurobodalla's coast*. Retrieved from Environment: Coastal Management Projects: https://www.esc.nsw.gov.au/environment/coastal-management/coastal-management-projects/Open-Coast-Coastal-Management-Program/managing-eurobodallas-coast

Feary, & Donaldson. (2011). *Connecting With Country in the Eurobodalla, South Coast, NSW.*

Garret Barry Planning Services. (2015). *Discussion Paper 6 - Managing Biodiversity in Rural Areas.* Eurobodalla Shire Council.

Garret Barry Planning Services. (2015). *Discussion Paper 7: Local Food.* Eurobodalla Shire Council.

IPCC. (2019). Summary for Policymakers. *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate*.

Marine Parks Authority. (2010). *Batemans Marine Park Operational Plan.* New South Wales: Department of Environment, Climate Change and Water.

MEMA. (2018). *NSW Marine Estate Management Strategy 2018 – 2028.* NSW Government, Marine Estate Management Authority.

Miles, J. (2006). *Recognition and Management of Endangered Ecological Communities in the South East Corner of NSW.* Southern Rivers CMA.

Narooma Oyster Festival. (2021). *Join us in Narooma for the 2021 Oyster Festival!* Retrieved from Narooma Oyster Festival: https://www.naroomaoysterfestival.com/

NPWS. (2003). *The Bioregions of NSW: their biodiversity, conservation and history.* Hurstville: National Parks and Wildlife Services.

NSW Government. (2015, January 23). *Promoting the 'Unspoilt' South Coast*. Retrieved from Destination NSW: Media Releases: https://www.destinationnsw.com.au/news-and-media/media-releases/promoting-unspoilt-south-coast

NSW National Parks and Wildlife Service. (2001). *Morton National Park, Budawang National Park Plan of Management.* NSW National Parks and Wildlife Service.

NSW National Parks and Wildlife Services. (1998). *Murramarang Aboriginal Area Plan of Management.* NSW National Parks and Wildlife Services.

NSW National Parks and Wildlife Services. (2000). *Eurobodalla National Park Plan of Managemet.* NSW National Parks and Wildlife Services.

NSW National Parks and Wildlife Services. (2002). *Murramarang National Park, Brush Island Nature Reserve Plan of Management.* NSW National Parks and Wildlife Services.

NSW National Parks and Wildlife Services. (2019). *Far South Coast Escarpment Parks Plan of Management.* NSW National Parks and Wildlife Services.

OEH. (2018a). *Coastal Management Glossary.* State of NSW/Office of Environment and Heritage.

OEH. (2018b). *Our future on the coast – NSW Coastal Management Manual Part A: Introduction and mandatory requirements for a coastal management program.* State of NSW/Office of Environment and Heritage.

OEH. (2018c). *Our future on the coast – NSW Coastal Management Manual Part B: Stage 1 – Identify the scope of a coastal management program.* State of NSW/Office of Environment and Heritage.

Salients. (2020). *Moruya River, Mummuga Lake and Wagonga inlet Estuarine Coastal Management Program.* Eurobodalla Shire Council.

SES. (2013). *Eurobodalla Shire Flood Emergency Subplan.* SES Local Emergency Management Committe.

South Coast Beagle. (2021). *Surfing*. Retrieved from South Coast Travel Guide: https://www.southcoasttravelguide.com.au/surfing

South East LLS. (2014). *South East Catchment Action Plan 2013 – 2023.* South East Catchment Management Authority.

South East LLS. (2016). *South East Local Strategic Plan 2016 – 2021.* State of NSW through Local Land Services.

South East LLS. (2017). *South East Regional Strategic Weed Management Plan 2017 – 2022.* State of NSW through Local Land Services.

Whitehead & Associates. (2014). *South Coast Regional Sea Level Rise Policy and Planning Framework.*

Wray, M. (2018). *Eurobodalla Destination Action Plan 2018 to 2021.* Eurobodalla Shire Council.

Appendix A

Community Engagement Strategy

Appendix B

Data Review Summary

Appendix C

Coastal Hazard Studies
Literatures Review
(Reproduced from WRL, 2017)

A comprehensive literature review was completed as part of the Eurobodalla Coastal Hazard Assessment (WRL, 2017). The majority of the following section is reproduced from WRL (2017).

The Persistence of Rip Current Patterns on Sandy Beaches (Eliot, 1973)

This conference paper outlined the results of 20 current measurement campaigns undertaken at South Durras Beach over 37 days in November and December 1972. Measurements were taken at 50 m intervals covering the full 2.25 km length of the beach. Analysis of the current measurements was used to infer nearshore water circulation patterns. The number of rips along South Durras Beach varied with incident wave energy, incident wave direction and other parameters affecting the longshore current velocity. The range of the number of rips observed along South Durras Beach as a function of incident wave height and direction is shown in Table A-1. The data indicated that there was an inverse relationship between the prevailing energy conditions on South Durras Beach and the number of rip currents which occurred along it. The average rip spacing under high energy conditions (wave height > 1.5 m) was 905 m and 200 m under low energy conditions (wave height > 1.5 m). It was noted that there were places where rips tend to occur frequently and that these places appeared to be regularly spaced. It was also noted that the more permanent rip locations were those established during high energy conditions. The drop in the number of rip currents from low to high energy conditions was accompanied by a widening of the surf zone. During low energy conditions, the width of the South Durras Beach surf zone varied from 75 to 125 m. For high energy conditions, the surf zone width was approximately 200 m.

Table A-1: Number of Rips along South Durras Beach (Source: Eliot, 1973)

Wave Direction	**Number of Rips**	
	Wave Height < 1.5 m	**Wave Height > 1.5 m**
N to ENE	7-9	2-3
ENE to ESE	6-9	2-1
ESE to S	7-11	2-3

The forms which occurred along the low water line on South Durras Beach were sinuate in shape. Their wavelengths (the distances between projections) varied from 75 to 425 m. Ninety per cent of them had wavelengths between 75 and 250 m. The projections were located landward of sandbars and shoals and the depressions landward of pools, troughs and feeder channels. There appeared to be no direct relationship between the nearshore water circulation system and the forms that developed along the shoreline. That is, the rip currents did not show any consistent locations with respect to projections or depressions along the shoreline.

Seasonal Beach Change, Central and South Coast, NSW (Thom, McLean, Langford-Smith and Eliot, 1973)

This conference paper related beach surveys at South Durras Beach and Bengello Beach with observed weather systems during 1972. The surveys at South Durras Beach were those described in detail by Eliot (1973). The surveys at Bengello Beach included four profiles from the foredune to the offshore bar measured at fortnightly intervals. The envelope of profile change relative to Mean Low Low Water (MLLW) ranged from 2 m in elevation to 56 m horizontally. The mean change in volume between

successive fortnightly surveys was 25 m3/m (with range of 7 to 85 m3/m). During 1972, Bengello Beach generally built upwards and seawards although phases of short-term erosion were noted. The envelope of profile change at South Durras Beach was quite similar to that at Bengello Beach with an overall accretionary trend during 1972. However, recovery after an erosion phase was more rapid at South Durras Beach when compared to Bengello Beach.

Beach Changes at Moruya, 1972-1974 (McLean and Thom, 1975)

This conference paper related beach surveys undertaken at Bengello Beach with observed weather systems from January 1972 to October 1974. Bengello Beach was described as being a relatively undisturbed, crescent-shaped beach facing slightly south of east and exposed to moderate to high energy waves emanating from directions between NE and S. Headlands at the extremities of the beach cause refraction of ocean swell from the north and south and act as barriers to littoral drift from adjacent beaches. The active beach is backed by a series of parallel relict beach ridges (or foredunes) 5 to 8 m high which have accumulated since the Postglacial Marine Transgression. Sediments at Bengello Beach were described as predominantly well sorted, fine to medium grained (d50 range of 0.15 to 0.35 mm) clean quartz sands; the proportion of shell being less than 10% on the sub-aerial portion of the beach, although it increases seawards of this zone. Waldrons Swamp is located landward of the active beach. It drains Waldrons Creek towards the northern end of Bengello Beach.

The analysis for 1972 was presented in WRL's review of Thom et al (1973) and is not reproduced for brevity. From January to June in 1973, Bengello Beach continued to accrete. However, in mid-June 1973, the beach was severely depleted by a storm. The authors identified that the storm in June 1973 marked an abrupt change from an accretionary period to an erosional regime. For the remainder of 1973 and into 1974, the general tendency was one of gradual depletion. In February, March and April 1974, storms further eroded Bengello Beach which was left relatively undernourished. Bengello Beach was then further changed dramatically during late May and June 1974. Over three weeks of successive storms, with two major storms from 24-27 May and 9-15 June, the mean change in volume was 130 m3/m above -0.94 m AHD. From July to October 1974, Bengello Beach was observed to begin recovery. The envelope of profile change relative to Mean Sea Level (MSL) ranged from over 3 m in elevation to 60 m horizontally from January 1972 to October 1974. Finally, the authors asserted that frequent monitoring of one beach which is considered "representative" of the region will shed more light on temporal variations than infrequent monitoring of many beaches. As such, extrapolation of behaviour at Bengello Beach to other beaches in the region was considered to be reliable.

Observations of Resonant Surf and Current Spectra on a Reflective Beach and Relationships to Cusps (Wright, Thom, Cowell, Bradshaw and Chappell, 1977)

This journal paper outlined observations of inshore wave and current behaviour at McKenzies Beach on 9 December 1976. It was described as being a pocket beach with a steep linear beachface with slopes of 1V:7H to 1V:10H. It was noted that a gravel step is consistently present at the subaqueous base of the beach face, and beach cusps are invariably present. This experiment provided evidence that beach cups are related to low-mode edge waves which oscillate parallel to as well as perpendicular to the beach (strong inshore resonance).

Batemans Bay Waterway Planning Study (Laurie, Montgomerie and Pettit, 1978)

This report by Laurie, Montgomerie and Pettit examined hydraulic and engineering aspects of Batemans Bay to inform its use and management. It attempted to delineate between sensitive and inherently stable areas. The report provided a preliminary plan for conservation and future development with respect to ecology and urban planning. It was asserted that care for the Clyde River and Cullendulla Creek requires skilful management for effects on the inner bay due to erodible catchment slopes. The Clyde River was described as a well-mixed estuary system with a wide and deep mouth and extensive headwaters draining a basin with an area in excess of 1,600 km2. The principal characteristics of the area were deemed to be:

- exposure to easterly storms;
- navigation restrictions imposed by the Clyde River bar and extensive sand shoals in the inner bay;
- relative frequency of high river discharges; and
- topographical limitations on public access to the water.

The report defined the inner bay as the region between the highway bridge and a line between Square Head and Observation Head. This is equivalent to the current study area with the exclusion of Maloneys, Long and Caseys Beaches. The inner bay was found to be a complex area with the greatest degree of fluvial and marine interaction. Sediment in this area was found to be largely fluvial in origin but bi-directionally forced by the tides, river flows and wave action. This influx of riverine sands is from the Clyde River, smaller creeks and rapid weathering of local headlands. Sand in the inner bay is finer than in the outer bay, with the coarsest sand accumulating on the Clyde River bar and at the northern end of Corrigans Beach. Following construction of the training wall in the early 1900s, the river mouth bar moved further east, and accretion occurred behind the wall and at the northern end of Corrigans Beach. Erosion of the inner bar northern shoreline was observed during this time. The Clyde River bar is mobile but generally located within a few hundred metres east and north of the end of the training wall. As early as 1864, bathymetric charts show it in this same position even prior to dredging and construction of the training wall. Commercial shipping services ceased in 1955. In 1964, dredging was stopped since, although desirable, it was not economically practical. Infilling of the boat harbour on the south side of the inner bay was deemed to be primarily due to wind and wave transport through the entrance and to a lesser extent wave overtopping and sediments from Hanging Rock creek. Virtually the whole north side of the inner bay was considered to be in a state of instability or fragile stability and not suited to development of waterfront structures other than for several hundred metres downstream of the highway bridge. The most severe conditions for erosion were deemed to be when flooding and associated channel scour occurred just prior to a large wave event. The south side of the inner bay was generally considered stable. The report noted that accretion at the northern end of Corrigans Beach had seemed to have temporarily ceased but that it may occur again in the future and recommended ongoing monitoring in this area. The report also cautioned against development in the Cullendulla Creek catchment, which is a shallow estuary in its own right with a small input of freshwater. This area is a depositional plain with unique geomorphic qualities. It has “chenier-like” plains of sand-shell ridges separated by saltmarsh and mangrove flats. The report recommended that it should be protected for its geomorphic uniqueness, rich oysters, flora and Aboriginal middens. It was noted that between 1864 and 1899, the location of the Cullendulla Creek mouth moved westward from its current position by 200 m during a period of accretion but had returned to its present position by 1922.

In the outer bay (seaward of a line between Square Head and Observation Head), there was little evidence of long term variations in bathymetry between 1893 and 1960. The beaches on the southern side (including Caseys Beach) were generally described as pocket beaches between rocky headlands with minor depositional plains from creeks. The southern beaches were noted to be generally protected from southerly, south-easterly and westerly storms with highest wave impacts during summer. Shell (and hence sand) production in shallow waters offshore of the southern beaches was considered to be effective in maintaining beach sediment budgets. It was recommended that dredging not be undertaken in this area. Caseys Beach was described as an independent sediment unit with little longshore movement of sand beyond the platforms and headlands at both ends of the beach. On the northern side of the outer bay, Maloneys and Long Beaches were considered not be influenced by river mouth processes; with erosion and accretion only occurring due to wave variability. It was recommended that building and construction at Maloneys, Long and Surfside Beaches should be avoided and, where practicable, the width of the foreshore reservation be extended to at least 100 m.

A significant storm in June 1975 was described with overtopping and damage to structures and vessels. It was considered that seiching may have occurred in the inner bay. High flows in the Clyde River were noted to mainly pass under the northern half of the highway bridge before heading towards the south side of the inner bay and along the training wall. This sudden channel width expansion also caused high velocity eddy currents downstream of the highway bridge.

The report considered a series of proposals to improve boat moorings including:

- a breakwater at the southern end of Caseys Beach;
- a marina at Corrigans Beach;
- a breakwater wall just downstream of the highway bridge on the northern bank; and
- dredging and improvement works behind the training wall (to raise the crest).

Surf-Beach Dynamics in Time and Space – An Australian Case Study, and Elements of a Predictive Model (Chappell and Eliot, 1979)

This journal paper outlined the results of 20 beach survey campaigns undertaken at South Durras Beach over 37 days in November and December 1972. These were undertaken in parallel with the current measurements outlined in Eliot (1973). Profiles were taken at 50 m intervals covering the full 2.25 km length of the beach. South Durras Beach is described as being a medium to high energy surf beach. The beach fronts a Holocene barrier structure which test drilling has shown to have a 25 m thickness above bedrock. The beach sediment is dominated by medium sand compromised largely of shell carbonate and quartz. The bathymetry offshore of South Durras Beach is inherited from Pleistocene subaerial erosion subdued by Holocene sediment cover, is moderately complex and refraction thus significantly affects the longshore distribution of wave energy. It was noted that the inshore morphology and circulation patterns are very changeable, and the beach is not homogenous along its length. Statistical analysis of the inshore morphology behaviour through varying energy conditions and modelling of the general inshore/nearshore profile under different wave energies was also presented.

Experimental Control of Beach Face Dynamics by Water-Table Pumping (Chappell, Eliot, Bradshaw and Lonsdale, 1979)

This journal paper outlined the results of the first known field experiments of beach groundwater manipulation undertaken in Australia at South Durras Beach. Beach groundwater manipulation, or beach dewatering, is an alternative to more traditional coastal stabilisation methods. Beach dewatering consists of the artificial lowering of the groundwater table with its proponents suggesting that this results in enhancing infiltration losses during wave uprush/backwash cycles while promoting sediment deposition at the beach face. Two beach dewatering experiments were undertaken on a 150 m long segment of South Durras Beach 7 October 1973 and 22 January 1975. An array of wells plus a large pump were used to regulate the intertidal beach water table while inshore and nearshore morphologies, water circulation and sedimentary processes were monitored adjacent to and away from the well array. The first experiment involved four pumped wells at 2 m centres while the second involved 24 wells at 1.5 m centres. The experiments indicated that beach dewatering has potential as an effective means of beach stabilisation.

Surf Zone Resonance and Coupled Morphology (Chappell and Wright, 1978)

This conference paper discussed the results of field experiments involving direct measurements of inshore current spectra, inshore circulation patterns and depositional morphology at McKenzies Beach and Bengello Beach. For brevity, WRL has not reviewed this paper as its content is discussed in greater detail in Wright et al (1979) and Wright (1982).

Morphodynamics of Reflective and Dissipative Beach and Inshore Systems: Southeastern Australia (Wright, Chappell, Thom, Bradshaw and Cowell, 1979)

This journal paper compared the results of field experiments involving direct measurements of surf and inshore current spectra, inshore circulation patterns and depositional morphology at McKenzies Beach, Broulee Beach and Bengello Beach. With the exception of McKenzies Beach which is composed of a bimodal population of sand and gravel, the beaches are primarily composed of medium sand.

McKenzies Beach was described as being a relatively high energy, reflective beach. Runup (relative to breaker amplitude) was noted as being high. Two experiments examining the spectral characteristics of and cross-spectral relationships between water surface and horizontal flow oscillations at different locations in the inshore system were conducted on 9 December 1976 (see Wright et al, 1977) and 26 May 1977. Wave data measured at McKenzies Beach showed pronounced narrow spectral peaks centred at swell frequencies. The peaks were noted to be conspicuously narrower and sharper than is the case for Broulee Beach and Bengello Beach, owing to sheltering.

Broulee Beach was described as being a partially protected dissipative beach. It is sheltered from the dominant south-easterly swell and from the south-easterly storm waves and exhibits a narrow range of temporal variability (compared to Bengello Beach), typically having a low tide terrace beach typography year round. An experiment conducted at the northern end of Broulee Beach on 31 July 1976 was discussed.

Bengello Beach was described as being a relatively high energy, dissipative beach. It is long and weakly embayed with the full spectrum of beach typographies evident along it. Wave exposure is greatest in the middle of the beach, slightly reduced at the northern end and most protected at the southern end. Two experiments conducted at the northern end of Bengello Beach (30 July 1976 and 27 May 1977) and

three experiments conducted at the middle of the Bengello Beach (8 December 1976, 24 May 1977 and 25 May 1977) were discussed.

Runup (relative to breaker amplitude) at Broulee Beach and Bengello Beach was noted as being lower than at McKenzies Beach. Wave spectra from the surf zones at Broulee Beach and Bengello Beach showed significant energy at a much wider range of frequencies than at McKenzies Beach.

Field Observations of Long Period, Surf-Zone Standing Waves in Relation to Contrasting Beach Morphologies (Wright, 1982)

This journal paper extended the work presented by Wright et al (1979) at McKenzies Beach and Bengello Beach. In addition to the field experiments on 9 December 1976 and 26 May 1977 at McKenzies Beach, results from supplementary experiments on 10 and 11 December 1977 were outlined. In addition to the experiments at the northern end of Bengello Beach (30 July 1976 and 27 May 1977), results from a more extensive experiment on 12-14 December 1977 were presented. Analysis of the measurements of surf and inshore current spectra, inshore circulation patterns and depositional morphology and their inter-relationships were set out.

Transgressive and Regressive Stratigraphies of Coastal Sand Barriers in Southeast Australia (Thom, 1983)

This journal paper discussed the stratigraphic characteristics of the coastal sand barrier at Bengello Beach. The author asserted that the series of parallel relict beach ridges, which back the active beach, were deposited during the Postglacial Marine Transgression. Radiocarbon dating results from sediment cores forming a cross-section through the middle of Bengello Beach were presented.

Batemans Bay Drainage Study (Willing and Partners, 1984)

This report by Willing and Partners concerns the construction of a shopping complex upstream of the Soldiers Club in the CBD. The catchment was considered to be a single valley with an area of 50 ha which discharges into the Clyde River with varying degrees of tidal inundation. During extremely high water levels, water was noted to back up in existing drainage works. Rainfall and runoff analysis and retardation effects were undertaken with the RAFTS (Runoff Analysis and Flow Training Simulation) numerical model. 10 and 100 year ARI rainfall events were considered. The design of the shopping complex was based on a river water level of 1.5 m AHD and required the infilling of an existing swamp which acted as a natural retarding basin. The report discussed the requirements of a new retarding basin to offset this impact and other necessary drainage requirements.

Coastal Storms in NSW in August and November 1986 (Higgs and Nittim, 1988)

This report by WRL documented wave runup at beaches in Batemans Bay during storms on 4- 9 August and 17-23 November 1986. A variety of oceanographic and meteorological data was collected with wave buoys (offshore of Batemans Bay), tide gauges (Snapper Island and Princess Jetty) and an anemometer (Moruya Heads).

The August storm had a peak HS of 5.6 m and typical TP of 10-13.5 s. Local winds were from the SSW-SSE. The maximum water level recorded at the Snapper Island tide gauge was 0.86 m.

The November storm had a peak HS of 6.0 m and typical TP of 10-13.5 s. Local winds were from the S-SW. The maximum water level recorded at the Snapper Island tide gauge was 1.02 m.

The location and elevation of maximum runup were pegged and surveyed after both storm events and are shown in Table A-2.

Table A-2: Runup Levels During 1986 Storms

Site	**Maximum Runup Elevation** (m AHD) 4-9 August	**Maximum Runup Elevation** (m AHD) 17-23 November
Maloneys Beach	1.9-2.2	2.2-3.7
Long Beach	2.7	2.1-3.7
Cullendulla Beach	-	1.4-1.8
Surfside Beach	-	2.3-2.8
Wharf Road	2.0	1.5-1.7
Central Business District	-	1.4
Boat Harbour West	-	1.5
Boat Harbour East	-	1.4
Corrigans Beach	2.2-2.8	2.2-2.3
Caseys Beach	-	2.5-3.2
Malua Bay	5.5	-

Batemans Bay Inundation Study (Willing and Partners, 1988)

This report by Willing and Partners followed the 1984 Drainage Study (Willing and Partners, 1984). It reviewed the 100 year ARI oceanic still water level at the CBD (2.60 m AHD) and recalculated flood levels with 1, 5, 20, 50 and 100 year ARI rainfall for additional flooding impacts. It was noted that if the 100 year ARI rainfall was coincident with the 100 year ARI oceanic still water level, the CBD tail water level would rise by 0.16 m. As such, the effect of additional rainfall under such an oceanic flooding event was considered minimal.

Batemans Bay Oceanic Inundation Study (NSW PWD, 1989)

This report by the NSW Public Works Department was commissioned to determine the likely water levels during extreme storm events in Batemans Bay. The bay was described as funnel shaped; reducing from 5 km width near the Tollgate Islands to approximately 500 m at the Princes Highway bridge. Most of the beaches, dunes and hind dunes are typically 2 m AHD. Oceanic flooding had historically occurred at Surfside Beach, Wharf Road, the CBD, the boat harbour (east and west), Corrigans Beach and Caseys Beach. At the time of writing, the mid-range sea level rise estimate was described as 1.0 m by 2100 but this was not taken into account in the calculated design water levels. The area was considered to be tectonically stable, and the impact of tsunamis was not considered.

A brief outline of historic oceanic inundation and river flooding was presented. To the south-east of Wharf Road, a survey in 1898 showed that a high sand spit existed 1.5 m above the high water mark. However, in 1959 this sand spit (and the associated subdivisions) was washed away during a flood event coinciding with spring tides. On 22 May 1960, a severe earthquake in Chile triggered a tsunami that caused oscillations of approximately 0.84 m at 45 minute intervals below the highway bridge. In August 1963, flooding occurred mainly due to rainfall combined with a high tide. In the storms during May and June in 1974, the peak still water level at Wharf Road was observed as 1.5 m AHD, with runup exceeding 3.4 m AHD at Surfside Beach. In June 1975, 90 m of Beach Road at Caseys Beach was damaged due to wave overtopping. In June and July 1984, wave overtopping, and sand deposition occurred along Beach

Road and the CBD foreshore (peak HS of 5.6 m). In August 1986, waves overtopped the culvert at McLeod Street on the northern shoreline of the inner bay. In November 1986, wave runup was within approximately 0.2 m of the seawall crest of the CBD. The highest still water level observed in Batemans Bay is approximately 1.85 m AHD at the Princes Highway bridge (date unknown).

This study focused on storm events with significant offshore wave heights greater than 5 m. A bathymetry survey of Batemans Bay was commissioned as part of the project. Water levels were derived at 17 locations around the bay through a series of modelling exercises. Storm surge (determined by Monte Carlo analysis) was found to be common to all parts of Batemans Bay, but other components of elevated water levels (such as wave setup and river flooding) may vary. While joint probability analysis was undertaken for the ocean water levels, the probability of their occurrence with river flooding was not included in the simulations. However, it was noted that some dependency exists between the occurrence of river floods and elevated ocean water levels. A hydraulic flood model was constructed to determine the contribution of flooding to elevated water levels between Surfside Beach and the boat harbour. Wave setup was found to be greatest at Maloneys and Long Beaches. Northerly winds were found to be unlikely to generate high elevated water levels as they generate an offshore current due to the Coriolis force. A 0.3 m uncertainty factor was applied to each of the design water levels. Wave runup was then calculated for each of the 17 locations based on the 20 and 100 year ARI wave events (determined from 5 years of wave data at Jervis Bay, 1982-1986). Except at the western end of Long Beach, wave runup exceeded the nominal crest level at each location for the 100 year ARI event. Importantly, at Cullendulla Beach, Wharf Road, the CBD, the boat harbour and the southern end of Corrigans Beach, the 100 year ARI design still water level is above the nominal crest elevation. At these locations, the crest would be inundated even without wave runup. The crest levels would need to be raised by 1 to 4 m to prevent inundation and wave overtopping.

Finally, due to the protection offered by Square Head, the modelling indicated that a wave setup (and consequent pressure head) differential exists between Surfside and Cullendulla Beaches. It speculated that this difference in head drives a current which continues to supply sand to the shoal on the western side of Square Head.

Joes Creek Flood Study (Willing and Partners, 1989a)

This report by Willing and Partners reviewed present and future flooding conditions for Joes Creek as a result of the proposed George Bass Drive extension. Joes Creek catchment has an area of 536 ha, discharges under Beach Road and terminates at Corrigans Beach. The RAFTS numerical model was used to simulate the 5, 20, 50 and 100 year ARI rainfall events. Modelling was undertaken with three different tail water conditions: 0.94 m AHD (High High Water Solstices Springs tidal level which occurs approximately 3 times per year), 2.25 m AHD and

2.55 m AHD. The latter two tail water conditions included wave setup and were derived from the Batemans Bay Oceanic Inundation Study (NSW PWD, 1989). Peak flood levels were determined for a number of outlet configurations before and after the road alignment for George Bass Drive.

Short Beach Creek Flood Study (Willing and Partners, 1989b)

Short Beach Creek catchment has an area of 350 ha and an outlet at the southern end of Caseys Beach. A tributary to Short Beach Creek flows past a caravan park (Caseys Beach Holiday Park) and joins the creek approximately 200 m upstream of the outlet at the beach. After recent flooding, this report by

Willing and Partners was initiated to investigate the sufficiency of five pipe culverts under Sunshine Bay Road and also consider the future effects of the proposed George Bass Drive extension. The RAFTS numerical model was again used to simulate the 5, 20, 50 and 100 year ARI rainfall events. Modelling was again undertaken with three different tail water conditions: 0.94 m AHD, 2.43 m AHD and 2.70 m AHD. It was noted that the bridge over Short Beach Creek acts as a control point for upstream water levels. Modelling also considered the build-up of sand blocking the outlet with sand bar elevations between 1.40 and 3.20 m AHD considered. The bar was expected to scour out during minor floods and hence the risk of Beach Road acting as an overland spillway is minimal. It was noted that tail water conditions lower than 0.94 m AHD did not affect upstream water levels as critical depth is achieved immediately downstream of the bridge. A range of short and long term flood mitigation options were set out for reducing post-development flows to pre-development values.

Batemans Bay Oceanographic and Meteorological Data (MHL, 1990)

This report by Manly Hydraulics Laboratory describes a range of data collected at Batemans Bay between 1986 and 1989 for the Batemans Bay Oceanic Inundation Study (1989). The data collection project involved commissioning a network of data recorders to measure offshore and inshore waves, offshore and inshore tides, wave runup and wind data. Waves were recorded at the newly installed offshore buoy and inshore on a Zwarts pole near Snapper Island. Tides were measured near the Tollgate Islands, Snapper Island and at Princess Jetty (CBD). Poles were used to measure wave runup at Long and Surfside Beaches. It was found that the tides recorded at Princess Jetty correlated well to Snapper Island except during floods and within periods with strong onshore winds where higher tidal anomalies were recorded at the CBD. Generally, the tide at Snapper Island leads Princess Jetty by approximately 22 minutes with a slight reduction in amplitude due to energy loss over the sand shoals. The most intense storm during the data collection period occurred on 23-24 May 1988 during a neap tidal cycle. The tidal anomaly was 0.23 m offshore and 0.15 m inshore. The deep water HS was 3.9 m and

2.1 m at Snapper Island. However, the maximum wave runup level recorded at Surfside Beach during this storm was only 1.0 m AHD.

Behaviour of Beach Profiles During Accretion and Erosion Dominated Periods (Thom and Hall, 1991)

This journal paper discussed beach surveys undertaken at Bengello Beach from January 1972 to December 1987. Analysis from January 1972 to October 1974 was presented in WRL's reviews of Thom et al (1973) and McLean and Thom (1975) and is not reproduced for brevity. It was noted that beach surveys had been undertaken fortnightly up until January 1976, after which time they were undertaken monthly. An erosion dominant period including the May/June storms of 1974 extended to June 1978 (when the beach reached its most eroded state since measurements commenced) after which Bengello Beach returned to an accretion dominated period up until the latest available surveys (December 1987). The maximum accretionary rate was 0.419 m3/m/day, but 0.120 m3/m/day was typical. It was noted that the subaerial beach volume had remained approximately constant from 1981 to 1987. The maximum change in beach volume above -0.94 m AHD varied between 279 and 298 m3/m between 1972 and 1987.

The authors asserted that the pre-1974 beach may not have been indicative of a long-term equilibrium beach. It was suggested that the mean beach volume in 1981 was approximately equivalent to the mean beach volume in 1973. A small amount of additional accretion from 1981 to 1987 was attributed to sediment contributions from offshore of Bengello Beach. The authors noted that additions to the

compartment's total sand store from external sources (e.g. the Moruya River or alongshore) were considered insignificant but that further work was required to conclusively determine this. The Moruya River, which terminates at the southern end of Bengello Beach, experienced large-scale flooding in 1975 and 1976.

Reed Swamp – Long Beach Flood Study (Willing and Partners, 1991)

Reed Swamp is located behind Sandy Place at Long Beach. It has a catchment area of 136 ha and a wetland which occupies 33 ha of which 5.4 ha is a permanent lagoon. This report by Willing and Partners revised the flood levels presented in previous studies. The existing culverts under Sandy Place were found to be inadequate to discharge a design flood event within the existing drainage channels. The study estimated the 5, 20 and 100 year flood levels and investigated upgrade options for the culverts including protection and augmentation. In June 1991, high flows (estimated to be greater than a 20 year ARI rainfall event) bypassed the culvert and flowed through adjacent properties to Long Beach. It was noted that the outflow from Reed Swamp is primarily governed by downstream tail water levels.

Land at Cullendulla Creek, Surfside (Patterson, Britton and Partners, 1992)

This report by Patterson, Britton and Partners reviewed oceanic inundation, beach stability and stormwater drainage at Cullendulla Beach. It is an engineering assessment concerning a proposed caravan park development in the lee of the beach. Specifically it reviewed the results of a Local Environmental Study (LES) commissioned by ESC (Kinhill Engineers, 1990).

The LES found that flood flows from Cullendulla Creek were not sufficient to generate water surface gradients and increase tailwater levels under oceanic inundation. The coastal engineering report commented that wave setup at Cullendulla Creek was expected to be lower than on the adjacent beach. The report also discussed at length the 0.7 m difference in design inundation levels between Surfside and Cullendulla Beaches (PWD, 1989) and the potential for overland flow between the two. It was asserted that the Cullendulla Creek estuary essentially behaves as a flood storage basin. The potential for an increase in storage level is determined by the discharge capacity of the Cullendulla Creek outlet relative to overland flow from Surfside Beach. It was concluded that since the Cullendulla Creek outlet is very efficient, the rise in water level from any overland flow would be less than a few millimetres.

With regard to beach stability, the report commented that the inner part of Batemans Bay is essentially a closed sediment system. It asserted that the exchange of sediments between the inner bay and the outer bay is not significant except for very fine to fine sand transported into the outer bay during flood events. Historically, the inner bay may actually have been a mud basin separated from the ocean by a barrier. Approximately 3,000 years before present, this barrier failed, and the inner bay was connected to the ocean. The report considered sediments from Cullendulla Creek to be a minor if not insignificant source of sediment for the Square Head shoal seaward of the eastern end of the beach. The main contributors to sediment at Cullendulla Beach were deemed to be the Clyde River and shells produced offshore. The report hypothesised that Cullendulla Creek receives less sediment than the adjoining Surfside Beach, with little littoral exchange between the two. During storms, it was postulated that a mega-rip would tend to form against the Square Head shoal. Westerly winds were deemed to be very effective at generating littoral drift between the western end of Cullendulla Beach and the Square Head shoal. The report asserted that the historical connection of Hawkes Nest to the western end of Cullendulla Beach was not the cause of ongoing recession as progradation had previously occurred between 1864 and 1930 under this arrangement. From 1930 to 1990, Cullendulla Beach receded by 40-

60 m (typical) and up to 100 m its eastern end. The report noted that the 1990 shoreline position was still located seaward of the 1864 shoreline. A review of photogrammetric data between 1942 and 1990 indicated typical recession of 1-1.2 m per year. Recession for the western and central parts of the beach (0.4-0.5 m per year) was lower than at the eastern end (1.0-2.0 m per year). Also, recent recession in the western and central parts of the beach was lower than the long term average, whereas the rate at the eastern end was consistent over the analysis period. It was asserted that erosion in the western and central parts of the beach were dominated by storm (swell) waves. Erosion in the eastern part was contended to be from local south-westerly and westerly wind waves. The annual total sediment loss from Cullendulla Beach was estimated to be 3,000 m3 per year (1,000 m3 per year above 0 m AHD). The report concluded that in the absence of a major flood or a series of smaller floods, Cullendulla Beach would continue to recede due to swell and wind wave attack. A beach management concept design involving a groyne field and nourishment was also set out. The preferred fill source for beach nourishment was sand extracted from the Square Head shoal.

Finally, the report undertook a preliminary review of stormwater drainage for the proposed development and noted that the detailed design should maximise natural infiltration and recommended that drainage be directed towards Cullendulla Creek and/or the wetland. It was noted that water quality control ponds would be required prior to drainage into the wetland.

Coastal Engineers Report, Timbara Crescent (Patterson, Britton and Partners, 1994)

This letter report by Patterson, Britton and Partners addresses the coastal hazards relevant to a private property at Timbara Crescent on the northern shoreline of the inner bay. A 50 year planning period was adopted and as no photogrammetry existed, the storm demand for the site was conservatively estimated to be 20 m3/m. A conservative profile when the beach was slightly eroded (December 1986) was used as the average profile for determination of the hazard lines. It was noted that the present day sediment processes were both event driven (flood and coastal storms) and responsive to relatively sustained periods of accumulation or loss (over several decades). No long term recession was observed at the site. The 50 year design water level was adopted as 2.3 m AHD (from the Batemans Bay Oceanic Inundation Study, less the 0.3 m uncertainty allowance). Under these conditions, the relevant property would be inundated by water to a depth of up to 1.3 m with maximum breaking wave heights of 1.0 m. The best estimate of sea level rise for 2045 at the time of writing was 0.24 m and the Bruun rule was applied to estimate recession at the site. However, it was noted that the ongoing supply of sand from the Clyde River and offshore shell production may nullify shoreline recession due to sea level rise. The letter report recommended that development on the property should consider raised floor levels, structural members designed for wave loadings, the addition of a wall between the adjacent property to the east to prevent wave reflection impacts and preparation of a flood evacuation plan.

Coastal Processes of Cullendulla Creek (Short, 1995a)

This report is the first of two by Short concerning a revised tourism development proposal at Cullendulla Beach. It was commissioned by the NSW state government. This report discusses the coastal processes operating in the area and the impact of the proposed development on the natural processes. Cullendulla Creek is described as a barrier estuary containing a tidal creek, flats and delta together with a chenier beach ridge sequence and the modern beach. It was noted that oceanic inundation of the entire site will occur approximately every 20 years with an oceanic water level of 1.8 m AHD. Cullendulla Beach has a relatively steep reflective high tide beach (3°) fronted by a wide, low gradient low tide

beach/terrace (1°). Maxima for recession were noted to occur at both the western and eastern ends of the beach (where there is shoreline instability from the creek entrance) with a minimum in the lee of the western side of the ebb tide delta. The author reviewed previous work in the area but asserted that there is insufficient information on coastal processes operating in the inner bay and at Cullendulla Beach to conclusively attribute the exact cause of recession and its future rate and duration. However, it is likely to be related to both wave and tidal current impacts on sediments in the inner bay. Recession was considered likely to continue for the next few years to decades. The report asserted that cycles of recession and progradation at Cullendulla Beach were in the order of hundreds of years. The author also contended that a mega-rip would not tend to form against the Square Head shoal. Instead, if a mega-rip does occur, it was more likely to occur at the western end of Cullendulla Beach. The report concluded that the proposed development and its protective works were not in accord with the goals of the NSW Coastal Policy.

Geomorphology of Cullendulla Creek (Short, 1995b)

This report is the second of two by Short concerning a revised tourism development at Cullendulla Beach. This report discusses the impact of the proposed development on the geomorphology of the system, in particular the outer beach ridges. Cullendulla Creek is the only known chenier site in NSW and one of only two known and documented sites in southern Australia. Cheniers are defined as low, shore linear, swash deposited sand and shell that overlie and are separated by inter-tidal and sub-tidal mud. They represent episodic wave deposition in a muddy tidal flat environment. Such sites are rare in NSW due to the lack of pre-existing fine sediments and high wave energy which removes any fine sediments from the shoreline. The entire system represents a unique coastal system and preserves an excellent record of sea level rise, estuary infilling and shoreline progradation over the past 10,000 years. The author asserts that the cheniers and beach ridges clearly and dramatically illustrate past positions of the shoreline. The report describes the nature of fluvial and marine sediments and the infilling sequence of the creek in six phases. The present geomorphology was categorised into the following major terrain units: outer beach ridge and cheniers, inner beach ridge and cheniers, tidal creeks, a tidal delta and shore platforms. The area also contains numerous Aboriginal occupation sites. The report contended that Cullendulla Beach has the best developed ebb tide delta in NSW. The entire system was asserted to be of additional importance due to its occurrence in a relatively small area (180 ha) with good access from a major town (Batemans Bay) and highway. The report concluded that the proposed development would completely cover and “destroy” the outer beach ridges and thereby severely downgrade the scientific and natural integrity of the entire system. It was also asserted that there was no practicable way that the development could be modified to mitigate its impacts.

Batemans Bay Vulnerability Study (NSW DLWC, 1996)

The Federal Government was interested in documenting examples of typical climate change vulnerability in each state of Australia. Batemans Bay was selected as the representative site for NSW. The project was jointly funded by ESC, the NSW Government and the Commonwealth Government. The study by the NSW Department of Land and Water Conservation adopted a 50 year planning horizon and a mid-range sea level rise projection of 0.24 m in 2045. Impact assessments were then prepared for beaches, buildings and habitats. The impacts of climate change quantitatively considered included sea level rise, sea surface temperature, rainfall and runoff, storm wave heights and suspended sediment

yield from the catchment. Storminess and shoreline re-alignment were also considered qualitatively. Photogrammetry was used to estimate storm demand and long term recession.

The report noted that a low carbonate content of sand in the inner bay appeared to suggest accretion due to fluvial infilling. Maloneys and Long Beaches were characterised by onshore/offshore sand transport only. In contrast, Cullendulla, Surfside and Corrigans Beaches responded to a combination of onshore/offshore and longshore sediment transport. Aeolian losses were not considered to be a major issue as most beaches had well developed dune vegetation. Human intervention in the coastal zone included the rock training wall, dune reconstruction at the northern end of Corrigans Beach in 1988, dredging and terminal revetments at Long, Corrigans and Caseys Beaches. As a result of the intervention at Corrigans Beach, photogrammetry was analysed separately and normalised prior to 1988 and post 1988. The report noted that five major storms occurred in the photogrammetry between 1972 and 1977 at Cullendulla and Corrigans Beaches. However, photogrammetry was only available between 1972 and 1990 at Maloneys, Long, and Surfside Beaches. It was noted that a flood in February 1992 brought a large amount of debris and sediment onto Corrigans Beach.

In comparison to the Batemans Bay Oceanic Inundation Study, a lower uncertainty level of 0.2m was adopted in the design still water levels. In comparison with the previous study, design water levels on the northern side of Batemans Bay increased by approximately 0.1 m and there was also a small decrease (< 0.1 m) on the southern side. This change was only due to variations between the bathymetric surveys used to develop meshes for the numerical models. The boundary conditions derived for the revised model were also based on wave data from Batemans Bay rather than from Jervis Bay and Botany Bay. On the basis that either bathymetry condition was possible, the study applied the higher design water level of the two studies at each site.

For the 50 year planning period, the study adopted increased design rainfall projections. As such, a hydraulic flood model was constructed to model the increased flood levels from this runoff under climate change. The report commented that suspended sediment load in Batemans Bay is proportional to discharge and rainfall erosivity and speculated that there would likely be a small increase in sediment supply to the bay under climate change. It was also speculated that any damage to seagrass beds in Batemans Bay would lead to increased wave heights at the shoreline. Climate change may cause damage to the seagrass beds by salinity change, sediment smothering following floods, higher waves and sea temperature change. Limited data was available at the time of writing regarding future changes in wind patterns under climate change, although speculative commentary was provided.

Hazard lines at each site were determined from storm demand and recession due to sea level rise using the Bruun rule. Ongoing long term recession was noted at Maloneys, Long and Cullendulla Beaches and included in the respective hazard lines. Surfside Beach also included an additional parameter, an erosion escarpment, in determination of its hazard line to account for mid-term shoreline fluctuations. The applicability of the Bruun Rule at Maloneys, Long and Surfside Beaches was questioned due to the presence of rock reef nearshore.

Site specific management options considering environmental planning, development controls and protection works were set out for each site around Batemans Bay. Cullendulla Beach was characterised by its lack of an incipient dune and vegetation due to ongoing long term recession. Cullendulla Creek was described as a barrier estuary containing a tidal creek, tidal flats and an ebb tide delta. Long term recession at Cullendulla Beach will likely lead to the loss of a vehicle track, a Telstra cable and a rising

main. The dune at Surfside Beach was considered stable except at the northern end which was recently eroded (at the time of writing) with a 1 m high scarp. The beach there appeared to be stable as a result of waves moving flood deposited sand onshore. The report indicated that the revetment around the CBD was necessary primarily for protection against flood flows rather than for protection against the structural impacts of waves. The northern end of Corrigans Beach was accreting due to flood deposition and longshore sediment transport (northward) being trapped against the training wall. A sewage pumping station at the southern end of Caseys Beach was also considered to be at risk from coastal hazards.

Finally, the report reproduced the findings of Short (1995b), who noted that to fully understand the processes operating in the inner bay and at Cullendulla Creek, accurate information regarding the following processes is required:

- transport of Clyde River sediment into, within and through the inner bay, particularly associated with major floods;
- transport of marine sands from the outer bay to inner bay;
- the impact of major storm wave events on sediment transport within the inner bay and the impact of the waves and associated setup and runup on bay shores;
- the sequential modification of the depth and morphology of the bay associated with such events
- the impact of modification of adjacent coastal processes and sedimentation;
- the impact of the southern training wall on processes and sedimentation within the inner bay; and
- the interaction of all these processes within the inner bay over years and decades.

Batemans Bay Wave Penetration and Run-Up Study (Lawson and Treloar, 1996)

This study by Lawson and Treloar was commissioned as a sub-component of the Batemans Bay Vulnerability Study. It was intended to recalculate the wave propagation, wave runup and design still water levels (including setup) at 17 selected sites (as with previous Inundation Study) with updated bathymetric data. The report examined changes in bathymetry between 1987 and 1995. The training wall was extended in 1987 leading to accretion at the northern end of Corrigans Beach. The bathymetry adjacent to Acheron Ledge (separating Maloneys and Long Beaches) had also changed between 1987 and 1995 and affected propagation to the northern shoreline. The study adopted the same tide and storm surge levels as in the previous study. A reverse ray frequency-direction spectral wave refraction method was used to developed nearshore wave coefficients (RAYTRK). It was not possible to propagate waves seaward of Cullendulla Beach, Wharf Road and the CBD at mean sea level. The study found that Caseys and Corrigans Beaches were more sheltered from the southerly sector than determined previously and Maloneys, Long and Surfside Beaches were similarly more exposed. Design still water levels included an uncertainty allowance of 0.2 m. Overall design still water level changes were in the order of 0.1 m. The 100 year ARI design still water level (without sea level rise) varied between 2.2 and 3.0 m AHD around the selected sites of Batemans Bay.

Drainage Report Wharf Road-Surfside (ESC, 1997)

This report by ESC reviewed the existing drainage in the Wharf Road catchment and considered mitigation options for minor flooding. Rainfall and runoff modelling was undertaken with the XP RAFTS model which was setup with six separate sub-catchments. The hydraulic grade line method was used for hydraulic modelling with a tail water level of 0.6 m AHD (approximately mean high water). The study

considered the effects of localised flooding in isolation of oceanic inundation levels. However, the effects of oceanic inundation on the site based on still water levels presented in the Batemans Bay Vulnerability Study were qualitatively discussed.

The Impact of a Major Storm Event on Entrance Conditions of Four NSW South Coast Estuaries (McLean and Hinwood, 1999)

This conference paper discussed the effects of a major storm event on 8-13 May 1997 on four estuaries, one of which was the Tomaga River. The Tomaga River was described as being a permanently open, elongated coastal river with no associated lake. Under typical conditions the authors indicated that it has an area of 1.6 km2 and a catchment of 98 km2. At each estuary, the influx of sand through storm induced washover deposits provided a noticeable change (restriction) to pre-existing entrance conditions. Analysis of the water level inside the Tomaga River indicated that immediately following the storm, the mean water level increased by 0.033 m. Weak changes to the tidal constituents within Tomaga River as result of the storm were detected (reduced tidal amplitude and increased phase lag). The modified regime persisted for less than a week following the major storm event. The authors concluded that a dominant negative feedback mechanism in the Tomaga River encouraged the rapid recovery of pre-storm flows and amplitudes. This negative feedback mechanism was the increased still water level which promoted higher efflux velocities and bed shear stresses. At the same time, a positive feedback mechanism existed in the reduced tidal amplitude. The balance between these two mechanisms at Tomaga River was biased towards the negative feedback allowing relatively rapid "recovery" from a major storm event.

Batemans Bay Primary School Relocation Surfside Stormwater Drainage Study (ESC, 2000)

This report by ESC considered stormwater drainage for the proposed Batemans Bay primary school relocation site at Surfside. It superseded an earlier drainage study undertaken in 1986. The catchment is immediately upstream of the culverts under Wharf Road. Rainfall and runoff modelling was undertaken with the XP RAFTS model for the 1, 20 and 100 year ARI events. The one-dimensional HEC-RAS surface profile model was used to estimate water surface levels. Four different tail water conditions were considered: 0.6, 1.1, 1.5 and 2.3 m AHD. Calculations were undertaken with unblocked and blocked culverts. The report concluded that the effect of the primary school relocation on stormwater would be minimal and that the benefits exceeded a slight rise (0.1 m) in flood levels at Wharf Road in a 20 year ARI event.

Batemans Bay/Clyde River Estuary Processes Study (WBM Oceanics, 2000)

This study by WBM Oceanics addressed the water quality and sedimentation aspects of the estuary and associated catchment.

A two-dimensional (2D) RMA hydrodynamic model was developed for the area downstream of Nelligen. Flows from smaller tributaries were defined using the AQUACM-XP model. The RMA advection-dispersion module was also used. The model was calibrated and validated to available data on water levels and flows in the estuary for a range of measurement sites. Tidal water level data from Eden was determined to be most representative of the tide across the entrance to Batemans Bay. The report notes that the ocean tide attenuates slightly (approximately 10%) between the entrance and the highway bridge. It was also noted that the annual median rainfall over the Clyde River coastal plain varies between 900 and 1,150 mm. The highest daily rainfall (24 hours to 9 AM) on record at Batemans

Bay was 363 mm on 9 April 1945. Preliminary (un-calibrated) water quality modelling was also undertaken using a module in the MIKE11 model. Predictive assessments for sewer spill scenarios and land use changes with water quality impacts were simulated.

Batemans Bay was described as having an open funnel shape with its centre-line orientation directed towards the south-east. Direct ocean wave access to the inner bay area is available from a range of ocean wave directions between the east 90° and approximately the south-south-east (150°). Waves from further north and south than this are subject to substantial refraction, diffraction and associated attenuation in propagating to the inner bay. It was noted that the shape of Batemans Bay may exacerbate wind-induced setup in certain conditions. Wave attenuation by bed friction across Batemans Bay causes a tendency for setup to occur further offshore with a slightly lower resultant setup at the shore. Where much wave refraction occurs in offshore areas, the same wave setup tendencies may also result. As part of the study, 2D preliminary (un-calibrated) wave propagation modelling was undertaken to derive refraction, diffraction and shoaling characteristics for several representative wave cases. The modelling of wave induced currents was used to infer indicative sand transport patterns. Wave related radiation stresses within the inner bay were found to induce significant current circulations including a consistent clockwise current circulation in the deeper regions (especially significant for accretion at the northern end of Corrigans Beach) and westward current flow across the ramp margin shoals past the Wharf Road area to the main river channel.

The study provides an excellent overview of sediment transport processes within Batemans Bay including Holocene sediment supply, river delta morphology, shoreline evolution and historical bathymetric changes. With respect to sedimentation aspects of the estuary, the annual average flood fluvial sand supply at the highway bridge was calculated to be approximately 22,000 m^3 per year. A substantial proportion of this volume is transported by the most infrequent flood events. The seabed across the inner bay was described as being highly mobile over a wide area out to and beyond Square Head and Snapper Island. Since 1898, approximately 800,000 m3 of sand has accumulated on Corrigans Beach. The extent of accretion on Corrigans Beach is largely determined by the length of the training wall. The study noted that tidal currents act with wave action to move sand on the river bar, the ramp margin shoals and the Wharf Road area. The study described the Wharf Road area as having two fundamental configuration categories for the shoreline and shoals. The first is a nearshore current dominated configuration with a shoreline shape which runs approximately east-west. The second is a wave dominated shoreline evolution forming a well-established sand spit alignment approximately parallel to wave crests in the area.

In general, it was asserted that sand movement is westwards at Wharf Road. Only infrequent floods were deemed to have capacity for substantial reworking of the Wharf Road shoals seaward to the Surfside Beach nearshore area.

Finally, the study documented several important changes introduced to the Batemans Bay area. In response to progressive erosion of the northern end of Surfside Beach commencing around 1991, 12,000 m^3 of sand was placed on the beach in 1996. The sand for this beach nourishment exercise was sourced from the hind-dune area of Corrigans Beach. This was in turn replaced by sand removed from the marina basin during maintenance dredging. The report also noted that the highway bridge was constructed between 1951 and 1956, replacing the ferry crossing which had operated since the 1800s.

Moruya Odyssey: Beach Change at Moruya, 1972-2000 (Shen, 2001)

This conference paper discussed beach surveys undertaken at Bengello Beach from January 1972 to December 2000. Analysis from January 1972 to December 1987 was presented in WRL's reviews of Thom et al (1973), McLean and Thom (1975) and Thom and Hall (1991) and is not reproduced for brevity. It was noted that beach surveys had been undertaken fortnightly between January 1972 and January 1976, monthly between February 1976 and January 1989 and approximately every six weeks between February 1989 and December 2000. An accretion dominant period extended from June 1978 to January 1993 after which Bengello Beach entered a period of gradual erosion up until the latest available surveys (December 2000). The author noted that Bengello Beach had not yet experienced a full low-frequency cycle of erosion and accretion since monitoring commenced in 1972.

Batemans Bay Waterway Infrastructure Strategy (Webb, McKeown and Associates, 2002)

This report by Webb, McKeown and Associates formed part of the Estuary Processes Study and its outcomes would be included in the Estuary Management Plan for Batemans Bay. It considered the long term planning for, and provision and management of public waterway infrastructure. Specifically it assessed the current condition of public wharves and jetties, boat launching/retrieval facilities, car parking and other land based facilities, fish cleaning tables and boat access for persons with a disability. A 25 year planning timeframe was adopted with the greatest population growth in the area expected at Long Beach. The boat ramp at Maloneys Beach was considered to be dangerous as it often had a drop-off at the seaward end of the ramp due to erosion. Permanent waterway facilities at Cullendulla Beach, Surfside Beach and Wharf Road would be subject to shoaling and erosion which require extensive maintenance. Beach accretion around such facilities was noted to be just as significant for maintenance as erosion. Facilities constructed at Maloneys Beach, Long Beach, Surfside Beach, the northern end of Corrigans Beach and Caseys Beach would also be vulnerable to storm damage from wave action. Unofficial boat launching at the southern end of Corrigans Beach was noted to have caused damage to the dune back beach area. The report proposed that a boat harbour could be created at the eastern end of Long Beach with the construction of a breakwater.

McLeods Beach [Surfside Beach (West)] Emergency Response Plan - Draft (WBM Oceanics, 2003)

Following more than a decade of accretionary trends on the northern shoreline of the inner bay, severe erosion of the foreshore in December 2001 led to initiation of an Emergency Response Plan for Surfside Beach (West), also known as McLeods Beach. The storm had a peak HS of 4.0 m coinciding with a spring tide and storm surge of approximately 0.4 m. This report by WBM Oceanics prepared management options for irregular and severe erosion at the site.

It was noted that sand transport is dominated by tidal currents on a day-to-day basis and wave induced currents when swell propagates into the bay. Erosion of the foreshore is dependent on the location and volume of sand in the shoals offshore of the beach, the volume of sand on the beach and the location of the Surfside Creek outlet (which is intermittently closed). The sediment at Surfside Beach (West) is dominated by flood and non-flood cycles. During major floods, scour processes deposit sand offshore of Wharf Road and offshore of Surfside Beach (East). Flooding may cause erosion or accretion at Surfside Beach (West). During periods of high waves (without flooding), strong westward longshore transport from Surfside Beach (East) occurs along the Wharf Road foreshore. This wave action generally causes accretion at Surfside Beach (West). The natural recovery of Surfside Beach was noted to be dependent on major floods to provide new sand deposits offshore. The report concluded that there are

no theories or models which can reproduce or represent the processes over the timeframe of natural changes for the northern shoreline of Batemans Bay. Paradoxically, if a significant flood or large wave event does not take place for several years, persistent beach erosion may be apparent in some areas of the inner bay.

The study commented that a seawall (preferably composed of sand-filled geotextile containers) positioned landward of the historical eroded foreshore alignment should have a minimal probability of adversely affecting coastal processes. Sand nourishment was considered as an emergency response option combined with monthly monitoring. An alert was to be noted when the beach scarp came within 5 m of private property boundaries and nourishment was to commence if the scarp reached the boundaries. The construction of a groyne field was also appraised. The preferred solution set out in the report was immediate construction of a seawall composed of 2 tonne sand-filled geotextile containers. It was also recommended that sand build-up at the Surfside Creek outlet be monitored and relocated to adjacent beaches when necessary.

Batemans Bay and Clyde River Estuary Management Study (WBM Oceanics, 2004a)

This report by WBM Oceanics considered the current uses and values of the estuary and provided strategies for addressing issues and conflicts. Significantly, it found that the Clyde River is one of the few coastal rivers in NSW known to deliver significant sand to the coastal zone. The chenier sand plain forming part of the Cullendulla Wetlands was considered to be of national scientific significance. The report noted that this sand plain provides one of the few remaining intact sites which demonstrate shoreline evolution. It cautioned that development in the Surfside Creek catchment would increase discharge volumes (and hence sediments) if not carefully managed. This would increase the frequency at which the Surfside Creek outlet is blocked. One of the management strategies proposed was to undertake a cost-benefit analysis of dredging the Clyde River bar. It also recommended that additional technical studies regarding the bar be commissioned in parallel with ongoing monitoring of its elevation.

Batemans Bay and Clyde River Estuary Waterway User Management Plan (WBM Oceanics, 2004b)

This study by WBM Oceanics was commissioned as a sub-component of the Estuary Management Plan which was forthcoming at the time of writing. The plan was designed to protect recreational and environmental values of the waterway and ensure boating practices which maximised user safety and enjoyment. The report concluded that the boat ramp at Maloneys Beach (composed of board and chain) was no longer usable. It speculated that the impact of boat wash on bank erosion was minimal.

Background Information Document for Joes, Wimbie, Short Beach and Surfside Creeks (WBM Oceanics, 2004c)

This report is the first of three by WBM Oceanics concerning four creeks in the Batemans Bay area. It provides relevant technical information to inform subsequent reports. It was noted that breaching of entrance barriers at the four creeks is periodically undertaken by ESC to alleviate odour problems, as flood prevention strategy or to mitigate water quality issues. The creeks in the study are all small Intermittently Closed and Open Lakes and Lagoons (ICOLLs). Each creek has a relatively high catchment runoff to estuary volume ratio.

While not examined in this report, it was noted that within Eurobodalla Shire there are approximately 30 ICOLLs, of between 200 metres and 1 km in length and less than 20 to 40 m in width, which have lagoons located behind the beach berm.

Surfside Creek has a catchment area of 2.1 km2. The creek extends 400 m from the opening where it joins the southern extent of a freshwater wetland. This wetland is protected from tidal flushing by a bund wall. The entrance to this creek requires relatively frequent opening by ESC. Scour of the beach is dependent on the beach condition and the volume of water in the creek when it is opened. The elevation of the berm seaward of the outlet causing complete blockage is estimated to be 1.62 m AHD.

Creek Management Policies for Joes, Wimbie, Short Beach and Surfside Creeks (WBM Oceanics, 2004d)

This report is the second of three by WBM Oceanics concerning four creeks in the Batemans Bay area. It presents the adopted creek management policies. The adopted policy for Surfside Creek is to excavate sand blocking the culvert when the upstream water level reaches 1.5 m AHD.

Review of Environmental Factors for Joes, Wimbie, Short Beach and Surfside Creeks Creek Management Policies (WBM Oceanics, 2004e)

This report is the third of three by WBM Oceanics concerning four creeks in Eurobodalla Shire. It documents the magnitude and nature of potential environmental impacts associated with entrance management policies. It is considered that artificial opening of the creeks is merely an early facilitation of a natural process to temporarily re-establish a tidal connection between the creeks the ocean. The study discusses the natural berm elevation variability without human intervention. It concluded that the creek management policies are unlikely to have significant environmental impacts upon the respective ecosystems in the short term.

Comprehensive Coastal Assessment #06: New South Wales Coastal Lands Risk Assessment – Draft Issue 3 (Patterson, Britton and Partners, 2005)

This report by Patterson, Britton and Partners developed a whole-of-coast comparative risk assessment, identifying those parts of the NSW coastal zone that are at risk from a range of coastal hazards for one probability scenario (1% AEP) in 2005 and in the future (2015). The project was funded by the NSW Department of Infrastructure, Planning and Natural Resources. The results were intended to alert local councils and state agencies to areas requiring more detailed scrutiny when planning future land use. "Broad-brush" methodologies were developed and used for all localities regardless of whether or not detailed coastal processes investigations had previously been completed. That is, the output from this report at any on locality includes greater uncertainties than a coastal hazard study focused only on that locality. A total of 99 discrete coastal "localities" were broadly assessed in Eurobodalla Shire including 46 open beaches, 10 pocket beaches and 43 cliffs/bluffs. Note that areas within tidal rivers/estuaries and the inner part of Batemans Bay; Central Business District, Boat Harbour West and Boat Harbour East, were not included. The coastal hazards considered included erosion, recession, cliff instability and overwash potential (dynamic inundation). The primary coastal vegetation line was used as a baseline for mapping coastal hazard lines as it was considered to be representative of an erosion escarpment during past erosion events. This line was defined as the distinct sand/vegetation interface (i.e. the edge of significant vegetation rather than sparse dunal vegetation) and was manually digitised for the NSW coastline using aerial photographs. Unfortunately, the coastal hazard figures for each of the localities within Eurobodalla Shire were not available for review by WRL (report text available only). The key assumptions in the "broad- brush" assessment is presented below:

- Present Day Setbacks from the Primary Coastal Vegetation Line (storm bite distance)
    - Pocket Beach: 10 m
    - Open, Exposed Beach, Dune Elevation > 8 m AHD: 15 m
    - Open, Exposed Beach, Dune Elevation 6-8 m AHD: 20 m
    - Open, Exposed Beach, Dune Elevation < 6 m AHD: 25 m
    - Open, Sheltered Beach, Dune Elevation > 8 m AHD: 10 m
    - Open, Sheltered Beach, Dune Elevation 6-8 m AHD: 15 m
    - Open, Sheltered Beach, Dune Elevation < 6 m AHD: 20 m
- Underlying recession rate: 0.3 m/year
- Recession due to sea level rise
    - Bruun Factor: 50
    - Sea Level Rise (Relative to 1990 MSL): 0.50 m (2105)
- Present Day Wave Runup level: 6 m AHD

Batemans Bay Wharf Road Development - Soft Option Coastal Engineering Assessment (Webb, McKeown and Associates, 2005a)

This report by Webb, McKeown and Associates concerns a residential development at Wharf Road on the northern shoreline of Batemans Bay. Three structures up to 4.5 storeys high were proposed, with a total of 33 residential units. The development application required a coastal engineer to demonstrate that the site would be secure from flooding and coastal processes and not impact upon flooding and coastal processes. The proponent wished to install a buried seawall with a wave return wall along the 100 % historical line (the most eroded beach alignment on record). However, ESC requested that a "soft option" without a seawall be considered by the proponent.

The report considered that 1964 was the most eroded beach state between 1898 and 1999 and this was adopted as the 100 % historical line. For erosion beyond this line to occur, the report speculated that a very large flood would have to occur when the main channel and margin shoals were highly shoaled. Such conditions would direct flood flows into the Wharf Road area, particularly if combined with a low tide. Peak flood velocities would be in the order of 2 to 4 m/s. While the report acknowledged that the effect of climate change on sediment movement along Wharf Road is not clear, it was speculated that the probability of future erosion extending beyond the 100 % historical line was small. Despite this assertion, the report applied the Bruun rule to estimate recession beyond the 100 % historical line due to sea level rise (0.2 m) in 2050. No additional storm demand was allowed for in these calculations. The report concluded that the development could proceed if structural members were designed for wave loading and inundation, and beach nourishment was planned to follow any major erosion events.

Addendum to Batemans Bay Wharf Road Development Soft Option - Coastal Engineering Assessment (Webb, McKeown and Associates, 2005b)

Further to the previous study, this report by Webb, McKeown and Associates considered additional requests from ESC regarding the development at Wharf Road. It was noted that the present vegetation line (2005) was actually located up to 15 m landward of the 100 % historical line (1964). The report also considered impacts on the proposed development from recent coastal protection in its vicinity. Upstream of the development, the foreshore revetment in front of the caravan park had been extended by 5 m in early 2005. Immediately downstream of the development a temporary rock wall had also been constructed in May 2005.

From Foreshore to Foredune: Foredune Development Over the Last 30 Years at Moruya Beach, New South Wales, Australia (McLean and Shen, 2006)

This journal paper discussed beach surveys undertaken at Bengello Beach from January 1972 to June 2004. Analysis from January 1972 to December 2000 was presented in WRL's reviews of Thom et al (1973), McLean and Thom (1975), Thom and Hall (1991) and Shen (2001) and is not reproduced for brevity. A period of gradual erosion extended from 1993 to 1999 after which Bengello Beach entered a period of gradual accretion up until mid-2001. From this time up until the latest available surveys (June 2004), Bengello Beach has been relatively stable. At this time, the beach was considered to be in a well-nourished state. The maximum change in beach volume above 0 m AHD (averaged across the four profiles) was an increase of 210 m3/m between 1975 and 1994. The authors also noted that during the 7 weeks from 6 May to 21 June 1974, 95 m3/m of sand above 0 m AHD (averaged across the four profiles) was eroded (2 m3/m/day).

Flood Risk Assessment (URS, 2006)

This report by URS presents findings and recommendations on Floodplain Risk Management within ESC. It is a strategic document for the development of more specific floodplain risk management studies and plans within the local government area. The report recommended that after a flood has occurred, flood damage and other data should be collected as quickly as possible. Potential flood prone properties were noted at Maloneys Beach (5), Long Beach (65), Surfside Beach and Wharf Road (180), the CBD and boat harbour (200), Corrigans and Caseys Beaches (100), Malua Bay (20), Rosedale Beach (15), Guerilla Bay (2), Tomakin Cove and Beach

(60) and Broulee Beach (10).

Batemans Bay Coastline Hazard Management Plan (Webb, McKeown and Associates, 2006)

This report by Webb, McKeown and Associates reviewed the findings of the Batemans Bay Vulnerability Study and further reports since this time (including the Clyde River/Batemans Bay Estuary Processes Study) to determine hazard management options for the region. The study area was the same as that for the present Coastal Hazard Zone Management Plan. The study did not consider rocky foreshores as they were not deemed to be significantly affected by coastal hazards. The present value of likely damage due to inundation was estimated using an Average Annual Damage approach. This estimated the damage for each event multiplied by its probability of occurrence.

Revetment stability was also assessed in the study. Small seawalls at Long Beach and Corrigans Beach were not considered to have the ability to withstand a major storm. After damage sustained in a severe storm in the early 1990s, the seawall at Caseys Beach was topped up with 0.6 to 0.9 m size granite.

The report reviewed water level records during three recent severe storms in the area. On 9-11 May 1997, a maximum water level of 1.08 m AHD was measured at Princess Jetty tide gauge with a maximum anomaly of 0.32 m. On 22-25 June 1998, a maximum water level of

1.25 m AHD was measured with a maximum anomaly of 0.51 m. On 6-10 August 1998, a maximum water level of 1.07 m AHD was measured with a maximum anomaly of 0.35 m.

The study adopted sea level rise projections of 0.2 m in 2050 and 0.5 m in 2100. Since flooding and storm surge are not entirely mutually dependent, the study combined a 20 year ARI flood with 100 year ARI storm surge in determination of 100 year ARI oceanic still water levels in the inner bay. At most, flooding contributed 0.1 m to these design water levels. Unlike the Batemans Bay Oceanic Inundation

and Vulnerability Studies, no uncertainty allowance was included in these levels. A hydrodynamic model was set-up for the CBD only to examine the combined effects of local runoff and oceanic inundation. Storm demands were calculated in a different manner to those in the Batemans Bay Vulnerability Study (DLWC, 1996), but not consistently based on an eroded volume above 0 m AHD. The storm demand for Cullendulla Beach was estimated in an unconventional manner and assumed to be equivalent to the volume of sand removed by ongoing recession over 5 years. The Bruun rule was applied to determine recession due to sea level rise, but these estimates were considered to be conservative.

The following recommended coastal hazard management options were presented for each part of Batemans Bay:

- Maloneys Beach: No major recommendations.
- Long Beach: Continue and strengthen existing development controls. Cullendulla Beach: Relocate assets when required in the medium term.
- Surfside Beach: Continue minimum floor level policy but large scale land filling is not feasible. Wharf Road: Continue existing development controls but large scale land filling is not feasible. CBD: Continue and strengthen existing development controls.
- Boat Harbour West: Continue existing minimum floor level policy.
- Boat Harbour East: Consider construction of a levee around the caravan park. Corrigans Beach: Continue minimum floor level policy with planned retreat.
- Caseys Beach: Sustain ongoing maintenance and possible upgrade of the seawall.

Southern Rivers Catchment Action Plan (SRCMA, 2006)

This plan by the Southern Rivers Catchment Management Authority broadly addresses six subregions from Stanwell Park to the Victorian Border of which Eurobodalla is one. It identifies the desired condition of natural resources and sets out priority targets towards achieving this condition over 10 years. Adaptive management is considered an important principle to deal with fire, flood, drought, storms and climate change. The main threats to the quality of ecosystems were deemed to come from historic and current impacts. Ecologically sustainable development principles and climate change impacts were taken into account in development of the Catchment Action Plan. Specifically, it targets the identification, auditing and rehabilitation of erosion “hotspots”.

South Coast Regional Strategy 2006-31 (NSW Department of Planning, 2007)

This strategy by the NSW Department of Planning represents an agreed NSW government position on the future of the south coast to complement and inform other state government planning documents. Batemans Bay is identified as a major regional centre in the document, while Moruya and Narooma are identified as major towns. Its purpose is to ensure the adequate and appropriately located supply of land to sustainably accommodate housing and employment needs over 25 years. Various adaptation strategies for climate change were presented. Future urban development will not be located in high risk areas from natural hazards (flooding, inundation, erosion and recession). The strategy deems that Local Environmental Plans should provide adequate setbacks in high risk areas. The document specifically identified Long Beach and Malua Bay as an area potentially suitable for future urban growth. However, future development in northern Batemans Bay was preferred in the first instance due to its proximity to the CBD.

Projected Changes in Climatological Forcing for Coastal Erosion in NSW (McInnes et al, 2007)

This report is the first of two by CSIRO concerning climate changes projections in the Batemans Bay area. This study demonstrates the expected range of variability of climate parameters that influence coastal erosion in Batemans Bay. Two high resolution regional climate models were forced with the same greenhouse gas emission scenarios with markedly different responses. Depending on the model considered, a climate variable may both increase or decrease such that the range of possible changes spans zero. This was an artefact of the differences in the formulation of the models and their treatment of physical processes. Both models were forced with the IPCC A2 scenario which is considered to be a sufficiently conservative future scenario to base risk averse planning decisions on.

Wave growth and propagation were not included in the regional climate models but were inferred from the wind outputs with application of desktop wave hindcast techniques. These techniques treated waves with a fetch less than 200 km as locally generated and waves with a fetch between 200 and 500 km as swell.

Conclusions were drawn from comparison of the two models based on whether a trend (i.e. an increase or decrease) was consistent for each variable between both models over the projected period. Sea level rise was expected to be 0-4 cm greater than the global mean at Batemans Bay in 2030 and 4-12 cm greater in 2070. Projected changes to wind speed, direction and frequency were inconclusive. Correspondingly, the projected changes to mean wave climate (height, direction and period) were considered small to negligible. Changes to extreme wave climate and storm surge behaviour were also inconclusive.

Climate Change Projections for the Wooli Wooli Estuary and Batemans Bay (Macadam et al, 2007)

This report is the second of two by CSIRO concerning climate changes projections in the Batemans Bay area. This study complements the previous report but examines additional variables with two different global mean temperature increases (low and high) for the same two regional climate models. The annual average maximum temperature at Batemans Bay was found to increase by 0.5 to 1.1° in 2030 and 1.1 to 4.6° in 2070. The annual average minimum temperature was found to also increase by 0.4 to 1.0° in 2030 and 1.0 to 4.3° in 2070. The annual average solar radiation was found to increase by 0.1 to 0.3% in 2030 and 0.2 to 0.8% in 2070. Projected changes to annual average rainfall, extreme rainfall and extreme drought were inconclusive.

Wharf Road Coastal Hazard Assessment and Hazard Management Plan (BMT WBM, 2009)

This report by BMT WBM was commissioned to consider the extent of coastline hazards effecting beachfront properties in the eastern end of Wharf Road. The area was subdivided in 1883 and is currently zoned for residential and tourism development. 80 per cent of the original subdivision is now below the high water mark. At the time of writing, coastal hazards were managed with minimum floor levels and additional development control. As a result of the construction of the training wall, the report asserted that 80 per cent of the sand supplied by the Clyde River into the inner bay had accreted on Corrigans Beach. It was speculated that this has reduced the supply of fluvial sediment to Cullendulla Beach, Surfside Beach and Wharf Road. It was noted that the northern end of Corrigans Beach had nearly accreted to the end of the training wall and its capacity as a sediment sink would correspondingly reduce. Extreme water levels were derived from the Princess Jetty tide gauge (including wave set-up and flood effects). A groyne constructed on private land without approval from ESC had maintained the

updrift (eastern) shoreline position but exacerbated downdrift (western) shoreline erosion between 2005 and 2007.

In contrast to two previous studies of the area, the 100 % historical line (the most eroded beach alignment on record) was identified as having occurred in 1977. The extent of maximum erosion had previously been nominated to have occurred in 1964 or 2005. A smooth equilibrium planform was also fitted through this 1977 foreshore alignment. The Bruun rule was also applied to estimate the recession due to sea level rise beyond the 1977 vegetation line.

The suitability of a range of management options including environmental planning, development control conditions, "soft" protective works, "hard" protective works and "hybrid" protective works were considered. It was determined that any structural protection works, or mitigation options would only be able to use a small amount of backfill due to its impacts on stormwater drainage. The report concluded that a second groyne or extension of the seawall fronting the caravan park would be required to offset the downdrift erosion caused by the unapproved groyne. However, it was considered unlikely that such "hard" protective works would satisfy ecologically sustainable development principles and so the recommended management option was rezoning of the Wharf Road area with possible voluntary resumption.

Eurobodalla Interim Sea Level Rise Adaptation Policy (ESC, 2010)

This policy by ESC initiates the process of providing long term management options for the ESC coastline under sea level rise projections and gives guidance on how development applications will be assessed until the Coastal Zone Management Plan is completed. Coastal risk areas are defined as those deemed to be at risk in a coastal hazard or floodplain study or within 100 m of the 1% still water level (1.435 m AHD) and/or at an elevation less than or equal to 5 m AHD. A 100 year planning period was used for residential land and a 50 year period for commercial or public facilities. The policy adopted the now withdrawn NSW sea level rise benchmarks of 0.4 m rise by 2050 and 0.9 m rise by 2100 relative to 1990 levels. The degree of risk was discretised as follows: immediate risk (at risk to the current 1% AEP event), high risk (at risk to 1% AEP event by 2050), medium risk (at risk to 1% AEP event from 2050 to 2100) and low risk (at risk to 1% AEP event after 2100). ESC promotes a policy of planned retreat for sites with immediate, high and medium risk (i.e. those sites at risk to 1% AEP event before 2100). New developments in the coastal zone must not create community risk, manage coastal hazard risk, not require protection works, not create community cost and be able to be removed or relocated at no cost to the community. As such, the policy noted that compliance with engineered property protection works is difficult to achieve. It was noted that planning control exclusions may be modified for coastal erosion protection in the CBD, the boat harbour (east and west) and the northern end of Corrigans Beach.

Concept Plan for the Batemans Bay Coastal Headlands Walking Trail (Gondwana Consulting, 2010)

This report by Gondwana Consulting presented a concept plan to guide the planning and development of a three phase formal walking trail linking the coastal headlands and beaches of the southern shoreline of Batemans Bay (Observation Head to Pretty Point). Parts of the trail are in the Coastal Hazard Assessment study area and include Caseys Beach, Sunshine Bay and Malua Bay. Acid sulphate soils were noted to occur along and landward of Sunshine Bay (west of Beach Road) and landward of Malua Bay (and along Reedy Creek).

In the first phase, the works proposed at each of the coastline sub-sections within the Coastal Hazard Assessment study area are minimal (i.e. addition of signage, drainage treatments and upgrade of existing walking track surfaces). The exception to this is at Caseys Beach, where a new footpath is to be built on the western side of Beach Road to allow travel between the northern end of Caseys Beach and Short Beach Creek before crossing back to the eastern side of the Beach Road. This footpath is to be constructed to avoid wave impacts on walkers under high tides and/or storm conditions.

During the second phase, the following significant works are proposed:

- picnic furniture is to be installed at the southern end of Caseys Beach;
- picnic furniture is to be installed at Sunshine Bay; and
- a footbridge is to be built over Reedy Creek at the northern end of Malua Bay.

In the third phase, it is proposed that Beach Road may be converted to a one-way road system at Caseys Beach and a foreshore reserve be established for the trail.

Eurobodalla Shire Coastal Hazards Scoping Study (SMEC, 2010)

This report by SMEC reviewed all existing coastal hazard studies for the whole of the ESC local government area and provided recommendation for future studies. The review specifically focused on the findings of previous reports with regard to current climate change projections. Specifically, it was commented that the Batemans Bay Vulnerability Study (DLWC, 1996) should have considered the 2100 planning period. It was noted that the storm demand values derived in that study appeared to be generally too low. The review found that there is a lack of coastal hazard information for the shire outside of Batemans Bay. It recommended that given the length of coastline and vast network of estuaries, beaches and lagoons within the shire, there is a need to target comprehensive coastal hazard investigations to priority areas. This report identified the priority areas for targeted assessments, as well as critical data acquisition requirements for the development of a Coastal Management Program for the entire coastline.

This scoping study analysed photogrammetry to estimate storm demand and long term recession at Maloneys Beach, Long Beach, Cullendulla Beach, Surfside Beach and Barlings Beach based on the storms of May-June 1974 and May 1978. Estimates for storm demand at other beaches were also presented based on approximate wave climate exposure. A small amount of recession was noted at Maloneys Beach and Barlings Beach, but it was speculated that this may be the result of sea level rise and not a sediment transport imbalance, and hence the long term recession at this beach was considered to be nil. Long term recession at Cullendulla Beach was not analysed. It was assumed that the median sand grain size for the beaches was 0.25 mm.

It was noted that the Bruun rule is a two-dimensional model which does not take into account three-dimensional effects. However, due to the lack of a more satisfactory model at the time of writing, it had been assumed that the Bruun rule could be applied uniformly along the beaches. However, the beaches within estuaries such as Cullendulla Beach, Wharf Road and the CBD would not undergo sea level rise recession that could be accurately calculated using the Bruun rule. It was asserted that this was because their offshore profiles are dominated by the dynamics of the tidal delta and three-dimensional sediment transport processes. Bruun factors were calculated from bathymetric and topographic data for Maloneys, Long and Surfside Beaches. A Bruun factor of 50 was specifically adopted for Barlings Beach as bathymetric data was unavailable. Bruun factors for the remaining beaches were approximated with

more limited data. As the study concerned the whole of the local government area, the extreme water level estimates were generic in nature. However, the 1,000 year ARI water level was used for maximum wave runup calculations. Hazard lines were plotted for Maloneys, Long, Surfside, Barlings and Moruya Heads Beaches.

Run-up and overtopping areas were plotted for the following coastline sub-sections:

- Durras Beach (south);
- Maloneys Beach;
- Long Beach;
- Surfside Beach;
- Wharf Road and the CBD;
- Corrigans Beach;
- Caseys Beach and Sunshine Bay;
- Denhams, Surf and Wimbie Beaches;
- Mosquito Bay and Garden Bay;
- Malua Beach;
- Rosedale Beach;
- Guerrilla Bay;
- Barlings Beach;
- Tomakin Cove and Beach;
- Broulee Beach;
- Bengello Beach;
- Moruya Heads Beach;
- Congo Beach;
- Tuross Beach;
- Potato Point;
- Yabbara, Dalmeny and Kianga Beaches;
- Bar Beach;
- Narooma Beach; and
- Mystery Bay.

A risk assessment indicated that extreme (immediate) risk was present for the eastern end of Long Beach (inundation and erosion), Surfside Beach (West) (inundation), the CBD (inundation), Caseys Beach (erosion) and the southern end of Tomakin Beach (inundation). It was also noted that the Durras Creek, Maloneys Creek, Surfside Creek and Short Beach Creek outlets are constricted, which may cause issues under significant flows.

Finally, the report concluded that at the time of writing, future studies would require an updated bathymetric survey of Batemans Bay, ongoing LIDAR collection and ongoing photogrammetry collection. It was noted that gaps existed in the historical photogrammetry record which could not be retrospectively filled. The report also recommended that a wave climate study of Batemans Bay be undertaken to update the previous analysis conducted for the Vulnerability Study in 1996.

Beach Change at Bengello Beach, Eurobodalla Shire, New South Wales: 1972-2010 (McLean, Shen and Thom, 2010)

This conference paper discussed beach surveys undertaken at Bengello Beach from January 1972 to October 2010. Analysis from January 1972 to June 2004 was presented in WRL's reviews of Thom et al (1973), McLean and Thom (1975), Thom and Hall (1991), Shen (2001) and McLean and Shen (2006) and is not reproduced for brevity. A period of relative beach stability (consistent mean volume) in a well-nourished state continued from mid-2001 up until October 2010, albeit with high variations in sand volume. Important erosional events occurred in July 2001, October 2004, July 2005, June-July 2007, October 2009 and May-June 2010. The most significant of these events was in June-July 2007 when the mean sea level intercept moved 20-30 m landward leaving a 1.5 to 2 m high vertical scarp. The post-storm state of Bengello Beach was approximately equivalent to when surveys commenced in January 1972. However, within a year of the June-July 2007 event, the beach had recovered to its pre-storm state and continued accreting to reach its most accreted state since surveys commenced.

The Cause of Breaks in Holocene Beach Ridge Progradation at Bengello Beach (Rae, 2011)

This postdoctoral thesis evaluated whether any, if not all, of the breaks in beach ridge progradation at Bengello Beach throughout the Late Holocene, from approximately 7,000 years before present (BP) to the present, may have been caused by possible sea level, sediment supply and/or wave climate changes.

Bengello Beach was described as a transgressive-regressive barrier infilling part of a drowned river valley. Between 10,000 to 8,500 years BP, a low relief barrier existed 30-40 m below the present sea level. A rapid marine transgression between 8,000 to 6,000 years BP caused Bengello Beach valley to flood. Open-ocean sand gradually blocked off the drowned valley causing estuarine mud to accumulate. The low-gradient coastal embayment and an excess of sediment caused episodic beach ridge progradation to occur, mostly between 6,000 to 2,500 years BP, thereby blocking several small drainage basins to create Waldrons Swamp. This resulted in the formation of 40-50 parallel beach ridges, each of which represent a former shoreline position. The source of this infilling sediment was concluded to be the offshore shelf deposit as the bounding headlands exclude littoral inputs of sediments and sediment input from the Moruya River was not considered significant. It was asserted that analysis of these beach ridges may be used as an indicator of the future response of Bengello Beach to changes in sea level and wave climate.

Hand augering of the beach ridges indicated that median sand grain size increased with depth. The Bruun Rule (Bruun Factor approximately 72) was used to estimate recession distances at Bengello Beach at three periods during the Holocene when the sea level rose. An analysis of aerial photographs of Bengello Beach indicated that there have been no significant changes in the orientation of the ridges along the centre of the embayment. However, to the south, the ridges curved to a common point along the airport indicating that this was the edge of the Bengello Beach barrier prior to draining (sea level fall) around 2,000 years BP. It was noted that Moruya airport was constructed in 1942.

It was concluded that the causes of the breaks in the beach ridges were attributed to a combination of wave climate and sea level changes and not sediment supply. Wave energy changes effecting the beach ridges were considered to include periods of increased wave heights and periods but without wave direction changes. The use of ground penetrating radar also indicated that a previous erosion event, approximately 1,900 years BP, had resulted in a 5 m scarp at the beach face. Since modern monitoring began in 1972, observed beach scarps have not exceeded 2 m in height.

Review of Environmental Factors for Clyde River Entrance Bar Maintenance Dredging and Beach Nourishment, Batemans Bay (NSW Department of Primary Industries, 2011)

This report by the NSW Department of Primary Industries documents the magnitude and nature of potential environmental impacts associated with dredging of the Clyde River bar and nourishment of Corrigans Beach. At the time of writing, shallowing of the entrance bar had limited the ability of recreational and commercial boats to safely cross the bar. NSW Crown Lands proposed to undertake dredging of the bar to maintain public safety and amenity followed by placement of sand on Corrigans Beach to minimise wave overtopping during storm conditions. 10,000 m3 of sand is to be dredged from the bar to the east of the end of the training wall. The dredged sand is to be placed at two different sites. 7,500 m3 sand is to be placed seaward of Batemans Bay resort at Corrigans Beach. This is to form a 320 m long dune with a maximum elevation of 3.7 m AHD. Placement of this sand at other beaches such as Long, Surfside and Caseys Beaches was considered and rejected. The remaining sand is to be placed at a second site seaward of the Hanging Rock playing fields. This sand will be stored at this location for future nourishment use as required elsewhere in Batemans Bay.

The report noted that on the opposite side of the bay, there was little movement of sediment around Square Head into Cullendulla Beach. It was noted that the 1989 extension of the training wall (by 150 m) was intended to prevent leakage of sand from Corrigans Beach past the training wall tip, along the channel and into the boat harbour ramp area. Ongoing beach accretion will eventually lead to repetition of this process.

The dredged depth was not to exceed approximately -2.8 m AHD to minimise the rate of infilling. It was speculated that dredging to a greater depth (say -3.3 m AHD) would result in faster infilling of the dredged area.

Eurobodalla Local Environmental Plan (ESC, 2012)

This plan by ESC aims to restrict development of land subject to flooding, coastal hazards, bush fire and land slip. It embraces ecologically sustainable development principles and aims to minimise any off and on site impacts on biodiversity, water resources and natural landforms. There are 22 different land zonings stipulated in the Local Environment Plan. Zone E2 is entitled Environmental Conservation and one of its objectives is to identify those areas at risk from coastline hazards, including sea level rise. Section 5.5 specifically discussed development within the coastal zone. New development must not be significantly affected by coastal hazards, have a significant impact on coastal hazards or increase the risk of coastal hazards in relation to any other land. Section 5.7 identifies that any development carried out below the high water mark requires consent. Section 6.5 discusses the development of land subject to flooding. The flood planning level was identified as being the 100 year ARI flood level with an additional 0.5 m freeboard. If such land is also affected by coastal hazards, the authority must consider the potential to relocate, modify or remove the development.

Geotech Slope Instability Risk Assessment (ACT Geotechnical Engineers, 2012).

The slope instability risk assessment was based on the landslide risk management concepts and guidelines of “Practice Note Guidelines for Landslide Risk Management 2007" issued by the Australian Geomechanics Journal Vol 42 March 2007, as required by the NSW Department of Infrastructure, Planning and Natural Resources. By these criteria it was established that the level of slope instability risk for Corrigan’s Beach, Casey’s Beach and Long Beach Headlands ranges from “Very Low” to “Very High”,

reflecting the nature of coastal topographic environment. Recommendations were made to reduce the risk level to normally acceptable levels.

South Coast Regional Sea Level Rise Policy and Planning Framework (Whitehead & Associates / Coastal Environment, 2014)

This study was jointly commissioned by Eurobodalla Shire Council and Shoalhaven City Council, with financial and technical assistance provided by the Office of Environment and Heritage and was completed in 2014 by Whitehead and Associates Environmental Consultants in consultation with Coastal Environment.

Key aims of the study were to:

(i) Develop regionally relevant sea-level rise projections for the Shoalhaven and Eurobodalla coasts; and

(ii) Develop a "Risk Assessment and Policy Response Framework" to address sea level rise for use by the Partner Councils in strategic planning, development control and consent activities.

The study considered a wide range of scientific reports and papers and came to the conclusion that the modelled projections from the IPCC's AR5 report are "widely accepted by competent scientific opinion" as required by the CZMP guidelines (OEH, 2013c) and form a suitable basis for deriving local projections of relevance to the study area. Further to this RCP8.5 was deemed a suitable basis for a sea-level rise projection with "High" values being recommended.

The following Coastal Hazard Planning Areas were recommended to Council for adoption:

- Current Hazard: Areas that are presently or will become imminently threatened by the 'design' hazards (e.g. design coastal storm, design flood) over the next 15 years.
- Medium Term Projected Hazard: Areas that are projected to be impacted within the next 15 to 35 years. In this area, plan sensibly, monitor changes and respond to any unexpected changes;
- Strategic Projected Hazard Planning: Areas containing development that are projected to be impacted within the next 35 to 100 years. In this area, forward planning is called for along with monitoring to inform future actions;
- Possible Maximum Strategic Hazard: Areas of existing or proposed critical infrastructure that are projected to be impacted over the next 100 years if a very high sea-level rise scenario (greater than RCP8.5) occurs.

The report highlights the need for a consistent, fair, open and well communicated approach to sea level rise and planning, with different responses being required for development depending on its nature and exposure.

Caseys Beach Seawall Upgrade, Review of Environmental Factors (NSW Public Works, 2016)

The Review of Environmental Factors (REF) was prepared by NSW Public Works, Department of Finance, Services and Innovation on behalf of Eurobodalla Shire Council, and presents the assessment of potential environmental impacts associated with the proposed upgrade of the Caseys Beach Seawall. Constructed in 1974, to mitigate against shoreline erosion and to protect Beach Road, residential properties (which face the beach in the north) and a sewage pumping station (SPS), the seawall is separated into two parts by Short Beach Creek. Approximately 60% of the southern part of the seawall,

which protects an existing SPS, required upgrading as a result of damage incurred during storms in June 2012.

The REF concluded that by adopting the safeguards identified, predominantly associated with short term construction works, there would be no significant adverse environmental impacts associated with the proposed works. The seawall upgrade was completed in 2017.

Erosion of Batemans Bay's Northern Beaches (Sethi, 2017)

This report provides an in-depth review of prior studies, reports and data of Batemans Bay and the Clyde River entrance. Specifically, it describes the public works around the Clyde River, such as the construction of the Clyde River Training Wall in 1905, extension of the training wall in 1988 and various dredging regimes, and sediment movement in the nearby area. The report also included a survey of local anecdotal evidence, which indicated that the half wall/training wall" was upgraded in the early 1960s. The report refers to scour along the Clyde River training wall, the erosion of the Northern Sand Spit and Shoal, erosion of Surfside Beach, and the accretion of Corrigans Beach. It posits that the construction of the river training wall, dredging along the river and placement of dredged sand on Corrigans Beach is responsible for the erosion of the Northern Sand Spit and Shoal; relies on observations to link various public works with sediment transport mechanisms that resulted in the loss of the Northern Sand Spit and Shoal and associated increased vulnerability to property along Surfside Beach. There is no process-based analysis performed to substantiate or verify this claim, however the report suggests a thorough study is completed to determine the underlying cause of erosion of the Northern Sand Spit and Shoal.

Eurobodalla Coastal Hazard Assessment (WRL, 2017)

The Water Research Laboratory (WRL) of the School of Civil and Environmental Engineering at UNSW Sydney was engaged by Umwelt, to prepare a Coastal Hazard Assessment for the highest priority beaches identified in the Stage 1 scoping study. This report forms Stage 2 of the CMP for ESC.

The Stage 2 study area extends southward from Durras Beach (south) to Broulee Beach and includes a selection of only 17 beaches. WRL examined sandy beaches and seawalls for which ESC has at least some management responsibility within the study area for extreme events between 2017 and 2100. That is, the examination of beaches managed by ESC which are fronted by rock platforms/reefs and backed by cliffed regions was outside of the scope of this study. The examination of beaches managed by other authorities such as the NSW National Parks and Wildlife Service (NPWS) and seawalls managed by NSW Crown Lands were also outside of the scope of this study.

The study was originally commissioned in 2011 to examine beaches within Batemans Bay only. In 2012, the scope of the study was extended to the wider local government area. In 2013, the study was put on hold while a sea level rise policy and planning framework were prepared, additional photogrammetric, topographic and bathymetric datasets were collected, and the NSW Government undertook coastal reforms. The study was re-commissioned with a modified scope and alternative methodologies in December 2016.

The principal aim of the study was to develop:

- Conceptual sediment transport models and erosion/recession hazard maps (10 beaches)
- Tidal (excluding wave effects) and coastal inundation hazard maps (17 beaches).

The study analysed photogrammetry to estimate storm demand and long term recession along with detailed numerical modelling of wave and storm demand and application of the Bruun Rule for future shoreline recession. To establish the characteristic erosion and recession values at the 100year ARI level

which would be used in subsequent mapping, WRL independently polled three (3) senior coastal engineers and scientists experienced on the Eurobodalla coast. This structured communication technique, called the Delphi method, relies on the decisions of a panel of experts to achieve a consensus of the most probable future by iteration.

Initially deterministic mapping of the 100years ARI erosion hazard was produced at the 10 beach locations. At beaches identified as having a high risk of damage or loss to property or coastal assets, a probabilistic erosion hazard method was then completed. The probabilistic approach takes each independent input variable (i.e. sea level rise and shoreline recession, and storm demand) and allows it to randomly vary over a range of values pre-defined through probability distribution functions. This range covers both uncertainty and error in a heuristic manner. The process of repeatedly combining these randomly sampled values is known as Monte-Carlo simulation which was completed to define 1% Encounter Probability erosion extents over planning periods to 2050, 2065 and 2100. It is noted that the effective return period of an event of an 1% encounter probability event over a ~100year planning period is around 10,000year ARI and is considered a conservative selection for the mapping of erosion hazard.

Coastal inundation hazard was defined for tidal inundation as well as extreme events for the 1, 20 and 100 years ARI. The assessment included wave run-up potential and an estimate of the inland propagation distance of wave runup once the foreshore/dune crest was overtopping. Inundation hazard mapping was complete based on the total still water level at the shoreline, including wave setup but excluding the wave runup component.

Geotech Slope Instability Risk Assessment (ACT Geotechnical Engineers, 2012).

The slope instability risk assessment was based on the landslide risk management concepts and guidelines of “Practice Note Guidelines for Landslide Risk Management 2007" issued by the Australian Geomechanics Journal Vol 42 March 2007, as required by the NSW Department of Infrastructure, Planning and Natural Resources. By these criteria it was established that the level of slope instability risk for Corrigan’s Beach, Casey’s Beach and Long Beach Headlands ranges from “Very Low” to “Very High”, reflecting the nature of coastal topographic environment. Recommendations were made to reduce the risk level to normally acceptable levels.

Eurobodalla Shire Council Coastal Management Program – Stage 1, Scoping Study (Draft) (Umwelt, 2018)

Umwelt was engaged to perform a Stage 1 Scoping Study for the Eurobodalla Shire Council in 2018, to meet the requirements of the Coastal Management Act 2016 and the NSW Coastal Manual as part of the Coastal Management Program. Despite not moving past the ‘draft’ stage, it provides a detailed review of prior reports and available data and was the basis for the present scoping study. It used a preliminary risk assessment to determine the locations most at risk of coastal process-related damage, discussed key parties to be involved in the CMP, identified priority issues and options, and determined data gaps. Umwelt evaluated coastal processes and hazards, ecological, social, cultural and economic values of the coast, the local communities use and enjoyment of the coast, coastal issues, threats, risks and opportunities, and the effectiveness of council’s management of the coast.

They proposed that the CMP be prepared with a detailed hazard/vulnerability study for selected beaches in Stage 2. 18 priority beaches were selected, based on high expected risk exposure to coastal

erosion and recession, and the Batemans Bay shoreline that had multiple vulnerability factors, including beach erosion, coastal recession and tidal and coastal inundation. They suggested no other detailed study was required, with sufficient information and community engagement already performed to complete the CMP.

This detailed report was a foundation of the present study and provided key insights into the particular intricacies of the coastal zone issues within the ESC.

Batemans Bay Independent Coastal Impact Assessment Stages 1 and 2 - Development and Assessment of Engineering Foreshore Protection Options (GHD, 2019 & 2020).

Following the approval for construction of the Batemans Bay Bridge replacement project, community members raised concerns that issues relating to erosion of the northern shoreline of Batemans Bay were not adequately addressed in the Environmental Assessment. Therefore, in October 2018 Roads and Maritime Services engaged GHD to undertake an Independent Coastal Impact Assessment.

The Independent Assessment was designed to be a two-stage approach when the project was commenced in 2018, taking into consideration status of design works associated with the bridge replacement and the available window in which to make design change. This process included the involvement of an appointed Project Reference Group (PRG) comprised of community members who held concerns over the bridge works. The PRG maintained their concern and expressed dissatisfaction over the course of several meetings with the project team, and the members issued a signed notice that they rejected the findings of the final report.

The first stage (Stage 1) was to identify potential hydrodynamic impacts of the replacement bridge and to provide recommendations relating to any necessary design modifications or other mitigation measures. Further, recommendations regarding the scope of work for a second stage of investigations (Stage 2), intended to examine the broader coastal processes within Batemans Bay and to identify causes of historical erosion and evaluate potential solutions.

The findings of the first stage were as follows:

- Impacts to hydrodynamics and sediment transport of Clyde River caused by the replacement bridge are predicted to be less severe than those associated with the existing bridge in terms of severity and extent during the design events investigated.
- The impact zone on hydrodynamic and sediment transport resulted from the replacement bridge did not extend beyond Pinnacle Point under the design flooding event examined.

Stage 2 was subsequently amended to assess the erosion issues along the northern shoreline of Batemans Bay, with the study mainly focused on exploring engineering protection options to protect Wharf Road foreshore and Surfside Beach, with a broader consideration of potential impacts of the proposed works on Batemans Bay as a whole.

Foreshore protection options included:

- Option 1 – Revetment and beach nourishment
- Option 2 – Groyne field and beach nourishment
- Option 3 – Low-crest offshore breakwater and beach nourishment

A multi criteria analysis was completed and identified Option 1 (Revetment and beach nourishment) to be the preferred engineering option.

Batemans Bay Urban Creeks Flood Study (Rhelm, 2020)

Rhelm prepared a draft flood study for the catchments around 7 Urban Creeks in Batemans Bay, which is currently on public exhibition for community feedback prior to being finalised. The 7 creeks included:

- Maloneys Beach (Maloneys Lagoon)
- Long Beach (Long Beach Lagoon)
- Surfside (Surfside Creek)
- The Water Gardens (Batemans Bay)
- Catalina (Hanging Rock Creek)
- Batehaven (Joes Creek)
- Sunshine Bay/Caseys Beach (Short Beach Creek)

This study meets the requirements of the *NSW Governments Flood Prone Land Policy*, outlined in the NSW Floodplain Development Manual 2005. This report identifies flood behaviour, including flooding depth, velocity and extent across the floodplain, using historical events to calibrate models to estimate flood risk from a range of rainfall and storm events. As this report also included flooding from tide and coastal inundation, it is a recent technical report that can be applied in assessing coastal hazard risk around Batemans Bay.

Appendix D

Preliminary Business Case

Rhelm Pty Ltd

ABN 55 616 964 517

ACN 616 964 517

Head Office

Level 1, 50 Yeo Street

Neutral Bay NSW 2089

contact@rhelm.com.au

+61 2 9098 6998

www.rhelm.com.au

N
W E
S

Mogood
SHOALHAVEN
Cockwhy
Pretty Beach
QUEANBEYAN-PALERANG REGIONAL
Pebbly Beach
Depot Beach
Nelligen
Surfside
Long Beach
Batemans Bay
Maloneys Beach
Batehaven
Sunshine Bay
Surf Beach
Malua Bay
Rosedale
Tomakin
Guerilla Bay
Broulee
Moruya
Mynora
EUROBODALLA
Congo
Tuross Head
Potato Point
Dalmeny
North Narooma
Narooma
Mystery Bay
BEGA VALLEY
Wallaga Lake
Bermagui

Rhelm
engineering | environmental | economics | engagement

Scale : 1:30,000@A3
Date : 23 March 2021
Revision : A
Created by : LRE
Coordinate System : MGA94/56

0 5 10 15 20 25 km

Legend

- Study Area
- LGA Regions
- Eurobodalla NPWS Reserves

SEPP Zones

- Littoral Rainforest
- Littoral Rainforest Proximity Area
- Coastal Wetland
- Coastal Wetland Proximity Area
- batemans bay marine park region

RG-01-01
Study Area

SHOALHAVEN

EUROBODALLA

BEGA VALLEY

EUROBODALLA

Scale : 1:30,000@A3
Date : 23 March 2021
Revision : A
Created by : LRE
Coordinate System : MGA94/56

Rhelm

0 0.4 0.8 1.2 1.6 2 km

- Study Area
- Bangalay Sand Forest
- Coastal Saltmarsh
- Freshwater wetlands on coastal floodplains
- Littoral Rainforest
- Lowland Grassy Woodland
- River-flat Eucalypt Forest on Coastal Floodplains
- Swamp oak floodplain forest
- Swamp sclerophyll forest on coastal floodplains
- Themeda Grassland on seacliffs and coastal headlands

RG-03-02
EEC Locations

South Durras to Lilli Pilli Suburb Coastline

SHOALHAVEN

EUROBODALLA

BEGA VALLEY

EUROBODALLA

Scale : 1:30,000@A3
Date : 23 March 2021
Revision : A
Created by : LRE
Coordinate System : MGA94/56

Rhelm

0 0.4 0.8 1.2 1.6 2 km

- Study Area
- Bangalay Sand Forest
- Coastal Saltmarsh
- Freshwater wetlands on coastal floodplains
- Littoral Rainforest
- Lowland Grassy Woodland
- River-flat Eucalypt Forest on Coastal Floodplains
- Swamp oak floodplain forest
- Swamp sclerophyll forest on coastal floodplains
- Themeda Grassland on seacliffs and coastal headlands

RG-03-02
EEC Locations

Malua Bay to Congo Point

SHOALHAVEN

EUROBODALLA

BEGA VALLEY

EUROBODALLA

Scale : 1:30,000@A3
Date : 23 March 2021
Revision : A
Created by : LRE
Coordinate System : MGA94/56

Rhelm

0 0.4 0.8 1.2 1.6 2 km

- Study Area
- Bangalay Sand Forest
- Coastal Saltmarsh
- Freshwater wetlands on coastal floodplains
- Littoral Rainforest
- Lowland Grassy Woodland
- River-flat Eucalypt Forest on Coastal Floodplains
- Swamp oak floodplain forest
- Swamp sclerophyll forest on coastal floodplains
- Themeda Grassland on seacliffs and coastal headlands

RG-03-02
EEC Locations

Congo Point to Jemisons Beach

SHOALHAVEN

EUROBODALLA

BEGA VALLEY

EUROBODALLA

Scale : 1:30,000@A3
Date : 23 March 2021
Revision : A
Created by : LRE
Coordinate System : MGA94/56

Rhelm

0 0.4 0.8 1.2 1.6 2 km

- Study Area
- Bangalay Sand Forest
- Coastal Saltmarsh
- Freshwater wetlands on coastal floodplains
- Littoral Rainforest
- Lowland Grassy Woodland
- River-flat Eucalypt Forest on Coastal Floodplains
- Swamp oak floodplain forest
- Swamp sclerophyll forest on coastal floodplains
- Themeda Grassland on seacliffs and coastal headlands

RG-03-02
EEC Locations

Jemisons Beach to Glasshouse Rock

EUROBODALLA

BEGA VALLEY

SHOALHAVEN

EUROBODALLA

BEGA VALLEY

Scale : 1:30,000@A3
Date : 23 March 2021
Revision : A
Created by : LRE
Coordinate System : MGA94/56

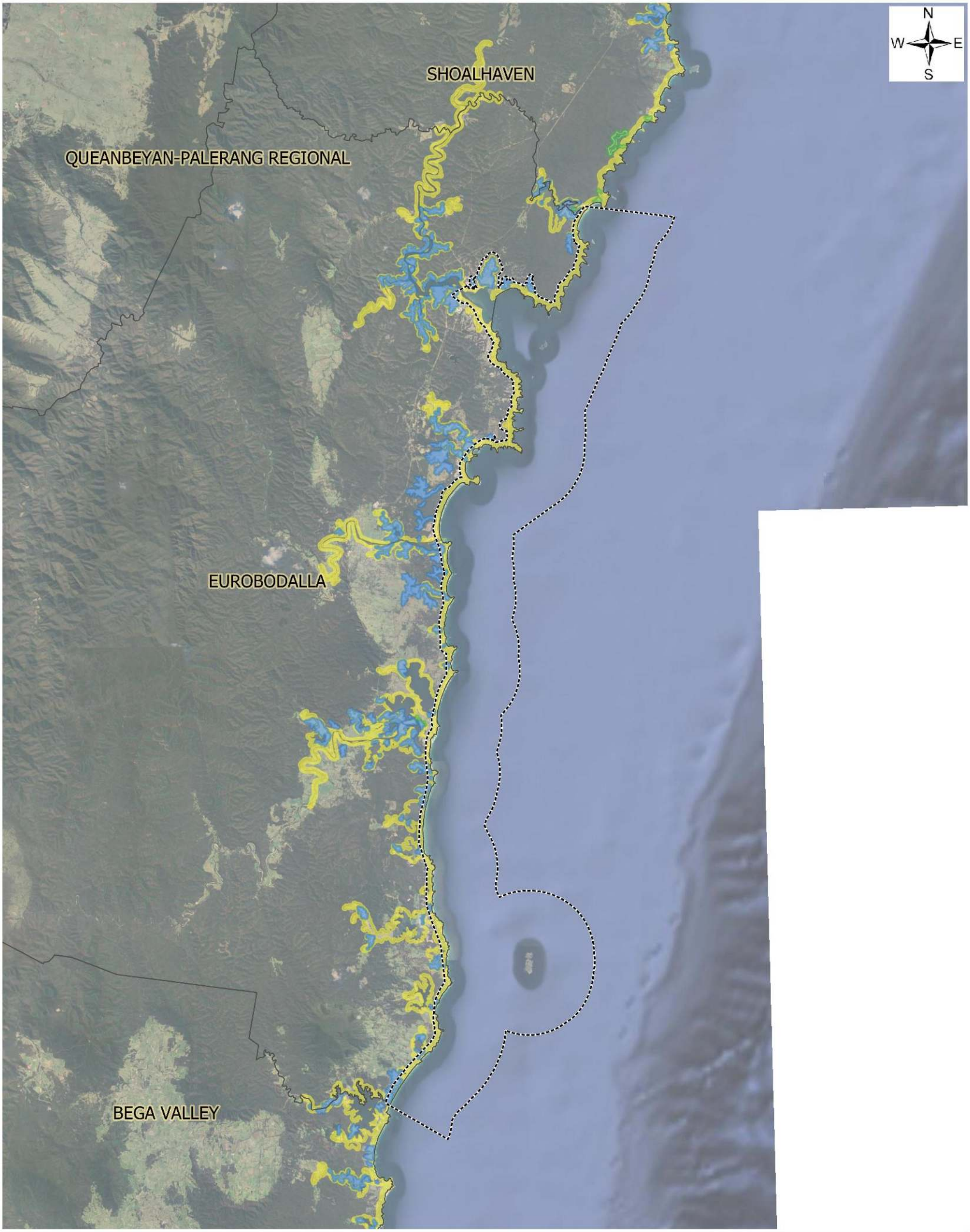
Rhelm

0 0.4 0.8 1.2 1.6 2 km

- Study Area
- Bangalay Sand Forest
- Coastal Saltmarsh
- Freshwater wetlands on coastal floodplains
- Littoral Rainforest
- Lowland Grassy Woodland
- River-flat Eucalypt Forest on Coastal Floodplains
- Swamp oak floodplain forest
- Swamp sclerophyll forest on coastal floodplains
- Themeda Grassland on seacliffs and coastal headlands

RG-03-02
EEC Locations

Glasshouse Rock to Wallaga Beach



Rhelm
engineering | environmental | economics | engagement

Scale : 1:30,000@A3
Date : 23 March 2021
Revision : A
Created by : LRE
Coordinate System : MGA94/56

0 5 10 15 20 25 km

Legend

- Study Area
- LGA Regions
- Coastal Wetland
- Coastal Wetland Proximity Area
- Littoral Rainforest
- Littoral Rainforest Proximity Area
- Coastal Use Area

RG-03-03
SEPP Zones

SHOALHAVEN

SHOA

EUROBODALLA

BEGA VALLEY

EUROBODALLA

Rhelm

0 0.5 1 1.5 2 2.5 km

Scale : 1:30,000@A3
Date : 23 March 2021
Revision : A
Created by : LRE
Coordinate System : MGA94/56

Legend

- study-area_002_R
- CMP Assessment Locations - trimmed
- Carparks
- Litter Bins
- Patrolled Beaches

Marine Infrastructure

- Boat Ramp
- Fish Cleaning Table
- Fishing Platform
- Jetty
- Pontoon
- Wharf

RG-03-04
Marine Infrastructure

South Durras to Lilli Pilli Suburb Coastline

SHOALHAVEN

EUROBODALLA

BEGA VALLEY

EUROBODALLA

Rhelm

Scale : 1:30,000@A3
Date : 23 March 2021
Revision : A
Created by : LRE
Coordinate System : MGA94/56

0 0.8 1.6 2.4 3.2 4 km

Legend

- study-area_002_R
- CMP Assessment Locations - trimmed
- Carparks
- Litter Bins
- Patrolled Beaches

Marine Infrastructure

- Boat Ramp
- Fish Cleaning Table
- Fishing Platform
- Jetty
- Pontoon
- Wharf

RG-03-04
Marine Infrastructure

Malua Bay to Congo Point

SHOALHAVEN

EUROBODALLA

BEGA VALLEY

EUROBODALLA

Rhelm

0 0.8 1.6 2.4 3.2 4 km

Scale : 1:30,000@A3
Date : 23 March 2021
Revision : A
Created by : LRE
Coordinate System : MGA94/56

Legend

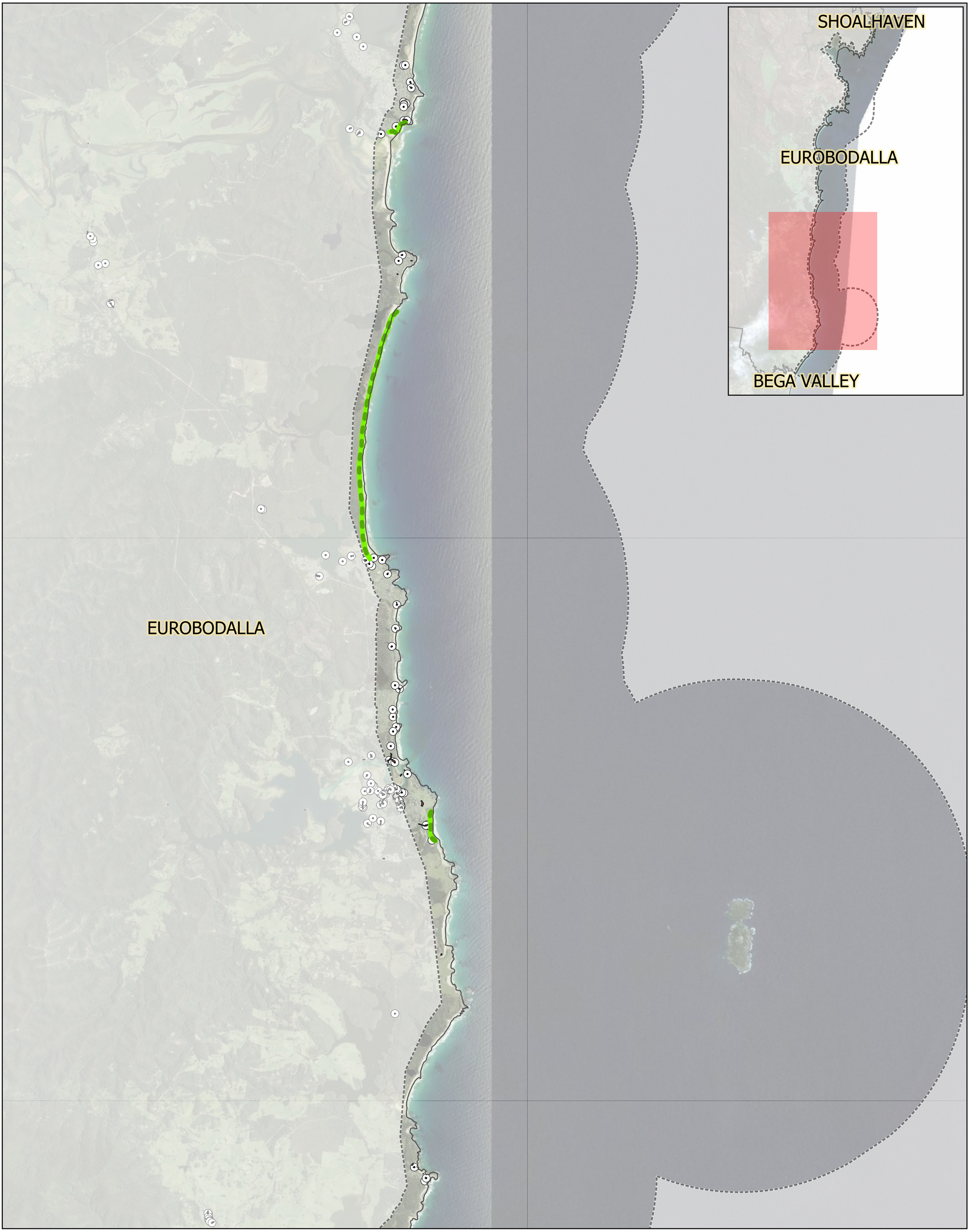
- study-area_002_R
- CMP Assessment Locations - trimmed
- Carparks
- Litter Bins
- Patrolled Beaches

Marine Infrastructure

- Boat Ramp
- Fish Cleaning Table
- Fishing Platform
- Jetty
- Pontoon
- Wharf

RG-03-04
Marine Infrastructure

Congo Point to Jemisons Beach



Rhelm

Scale : 1:30,000@A3
Date : 23 March 2021
Revision : A
Created by : LRE
Coordinate System : MGA94/56

0 0.8 1.6 2.4 3.2 4 km

Legend

- study-area_002_R
- CMP Assessment Locations - trimmed
- Carparks
- Litter Bins
- Patrolled Beaches

Marine Infrastructure

- Boat Ramp
- Fish Cleaning Table
- Fishing Platform
- Jetty
- Pontoon
- Wharf

RG-03-04
Marine Infrastructure

Jemisons Beach to Glasshouse Rock

EUROBODALLA

BEGA VALLEY

SHOALHAVEN

EUROBODALLA

BEGA VALLEY

Rhelm

0 0.8 1.6 2.4 3.2 4 km

Scale : 1:30,000@A3
Date : 23 March 2021
Revision : A
Created by : LRE
Coordinate System : MGA94/56

Legend

- study-area_002_R
- CMP Assessment Locations - trimmed
- Carparks
- Litter Bins
- Patrolled Beaches

Marine Infrastructure

- Boat Ramp
- Fish Cleaning Table
- Fishing Platform
- Jetty
- Pontoon
- Wharf

RG-03-04
Marine Infrastructure

Glasshouse Rock to Wallaga Beach

N
W E
S

Mogood
SHOALHAVEN
Cockwhy
Pretty Beach
QUEANBEYAN-PALERANG REGIONAL
Pebbly Beach
BATEMANS BAY
Depot Beach
Nelligen
Surfside
Long Beach
Batemans Bay
Maloneys Beach
Batehaven
Sunshine Bay
Surf Beach
MOGO
Malua Bay
Rosedale
Tomakin
Guerilla Bay
Broulee
COBOWRA
Moruya
Mynora
EUROBODALLA
Congo
BODALLA
Tuross Head
Potato Point
Dalmeny
WAGONGA
North Narooma
Narooma
Mystery Bay
MERRIMANS
BEGA VALLEY
Wallaga Lake
Bermagui

Rhelm
engineering | environmental | economics | engagement

Scale : 1:30,000@A3
Date : 23 March 2021
Revision : A
Created by : LRE
Coordinate System : MGA94/56

0 5 10 15 20 25 km

Legend
- Study Area
- LGA Regions
- batemans bay marine park region
- Local Aboriginal Land Councils

Governance
- Australian Government
- Crown Lands
- Freehold
- Local Government
- NSW Government

RG-05-01
Governance

SHOALHAVEN

QUEANBEYAN-PALERANG REGIONAL

NSW08

Batemans Bay

Murramurang

Moruya River

EUROBODALLA

NSW09

Eurobodalla coast

BEGA VALLEY

Mount Dromedary coast

Rhelm
engineering | environmental | economics | engagement

Scale : 1:30,000@A3
Date : 23 March 2021
Revision : A
Created by : LRE
Coordinate System : MGA94/56

0 5 10 15 20 25 km

Legend
- Study Area
- LGA Regions
- Primary compartments
- Secondary compartments

RG-05-02
Primary and Secondary Sediment Compartments

SHOALHAVEN

South Durras (Cookies Beach and Mill Beach)

Cullendulla Entrance (and surrounds)

EUROBODALLA

Surfside (incl. Wharf Road)

Long Beach

Wasp Head to North Head

Batemans Bay (Princes Hwy to Corrigans Beach)

Maloneys Beach

Corrigans Beach

Caseys Beach

Sunshine Bay (suburb coastline)

North Head to Reef Point

Denhams Beach, Surf Beach and Wimbie Beach

Lilli Pilli Suburb Coastline

Malua Bay Coastline (excl. Malua Beach)

Malua Bay Beach

Rhelm

Scale : 1:50,000@A3
Date : 11 May 2021
Revision : A
Created by : LRE
Coordinate System : MGA94/56

0 1 2 3 km

Legend

- Study Area
- Princes Highway

Forward Plan

- Stages 2 & 3 Required
- Stage 2 complete, Stage 3 Required
- No identified risk or further analysis required

RG-09-01
First Pass Risk Assessment

Malua Bay Beach
Malua Bay Coastline (excl. Malua Beach)
Rosedale Suburb Coastline
Guerilla Bay Beach
Barlings Beach
Tomakin Cove (incl. Tomakin Beach)
EUROBODALLA
Guerilla Bay Coastline (excl. Guerilla Bay Beach)
Mossy Point to Candlagan Creek
Broulee Beach to Broulee Island
Bengello Beach
Moruya Heads and Moruya River Entrance
Toragy Point to Congo Point

Rhelm

Scale : 1:50,000@A3
Date : 11 May 2021
Revision : A
Created by : LRE
Coordinate System : MGA94/56

0 1 2 3 km

Legend
Study Area
Princes Highway

Forward Plan
Stages 2 & 3 Required
Stage 2 complete, Stage 3 Required
No identified risk or further analysis required

RG-09-01
First Pass Risk Assessment

Toragy Point to Congo Point

Congo Point to Mulimburra Point

Mulimburra Point to Bingie Bingie Point

EUROBODALLA

Coila Beach and Bingie Beach

Tuross Head

Turos River Entrance (south) to Potato Point

Jemisons Beach and Potato Beach

Jemisons Point to Lawlers Creek Entrance

Rhelm

Scale : 1:50,000@A3
Date : 11 May 2021
Revision : A
Created by : LRE
Coordinate System : MGA94/56

0 1 2 3 km

Legend

- Study Area
- Princes Highway

Forward Plan

- Stages 2 & 3 Required
- Stage 2 complete, Stage 3 Required
- No identified risk or further analysis required

RG-09-01
First Pass Risk Assessment

Turos River Entrance (south) to Potato Point

Jemisons Beach and Potato Beach

Jemisons Point to Lawlers Creek Entrance

Dalmeny Suburb Coastline

EUROBODALLA

Duesburys Point to Kianga Point

Bar Beach North

Wagonga Head

Narooma Golf Club Rocky Foreshore

Surf Beach, Cemetary Rocky Foreshore and Narooma Beach

Glasshouse Rock to Corunna Point

Rhelm

Scale : 1:50,000@A3
Date : 11 May 2021
Revision : A
Created by : LRE
Coordinate System : MGA94/56

0 1 2 3 km

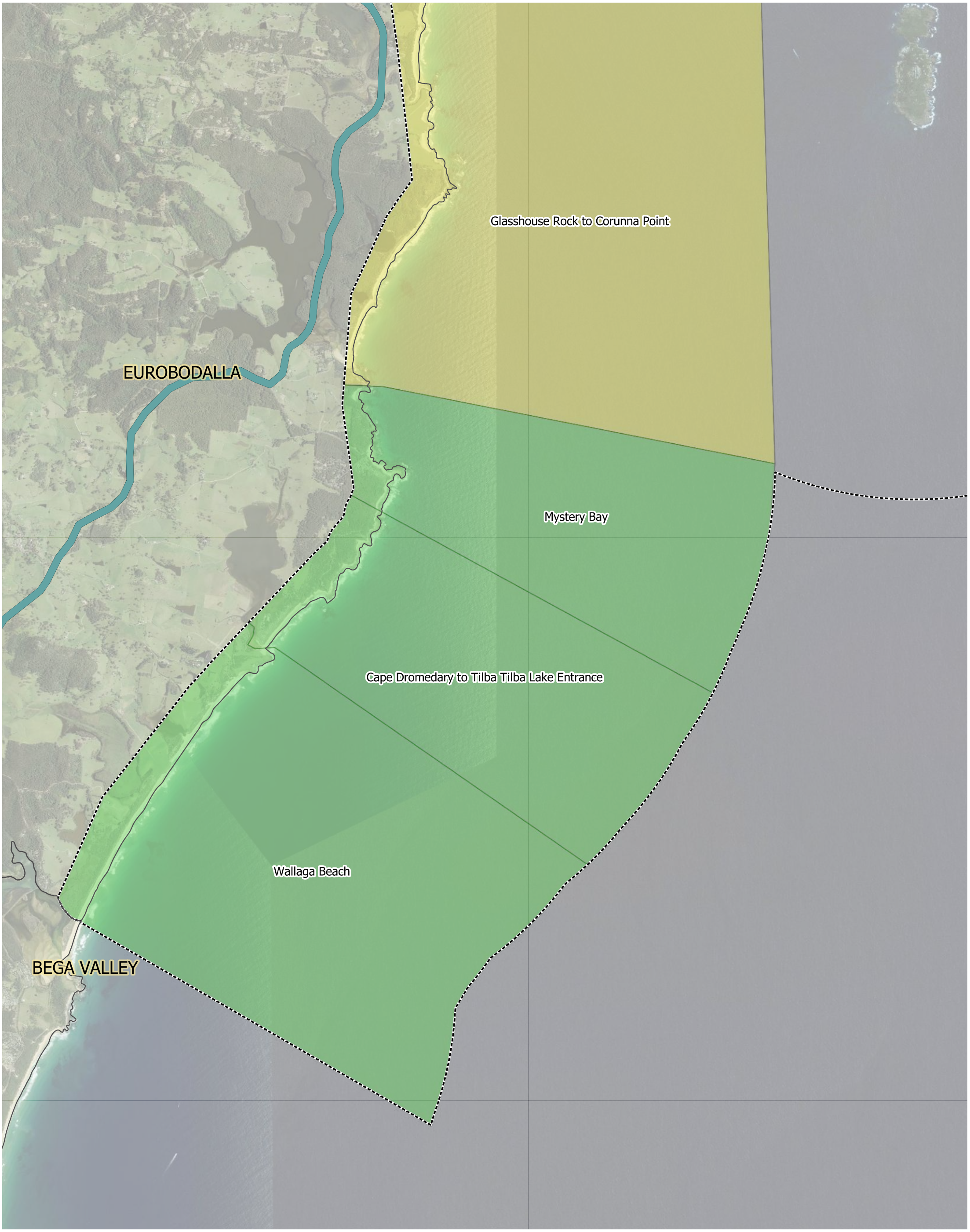
Legend

- Study Area
- Princes Highway

Forward Plan

- Stages 2 & 3 Required
- Stage 2 complete, Stage 3 Required
- No identified risk or further analysis required

RG-09-01
First Pass Risk Assessment



Rhelm

Scale : 1:50,000@A3
Date : 11 May 2021
Revision : A
Created by : LRE
Coordinate System : MGA94/56

0 1 2 3 km

Legend
- Study Area
- Princes Highway

Forward Plan
- Stages 2 & 3 Required
- Stage 2 complete, Stage 3 Required
- No identified risk or further analysis required

RG-09-01
First Pass Risk Assessment