LAKE MACQUARIE CITY

LAKE MACQUARIE COASTAL MANAGEMENT PROGRAM

Cover image:
Rock Women of Swansea Heads, Jodie Reynolds

Jodie Reynolds

Kamilaroi. Living and working on Awabakal Lands.

Rock Women of Swansea Heads 2021
(acrylic paint on canvas)

My artwork represents the Two Rock Women of Swansea Heads.

The Awabakal land is represented at the top of the piece, showing the different platforms of the landscape, it also shows the walking trails and tracks people would travel. The idea of fishing nets is also included as are the spears used for hunting.

The coal seams are represented going across the painting. More walking trails and meeting places in a larger scale representing the tribe's movement across the foreshore.

I have also incorporated the low tide line, people moving across the water, fishing from the shore and moving further into the water into fishing boats to catch their fish.

The red shapes in the water represent the many rocks, and the two most important rocks marked with a 'U' represent the two Rock Women of Swansea Heads.

The far left-hand corner represents Moon Island and the meeting place used for the Awabakal men. Down the left-hand side the coal seam that formed and the petrified forest is represented again.

The significance of this site is also highlighted by the crystalised water glistening over the area.

ACKNOWLEDGEMENT OF COUNTRY

We remember and respect the Ancestors who cared for and nurtured this Country.
Dhumaan ngayin ngarrakalu kirraanan barayidin.

It is in their footsteps that we travel these lands and waters.
Ngarrakalumba yuludaka bibayilin barayida baaduka.

Lake Macquarie City Council acknowledges the Awabakal people and Elders past, present and future.
Lake Macquarie City Council dhumaan Awabakala ngarrakal yalawaa, yalawan, yalawanan.

Wording by the Aboriginal Reference Group and translated by Miromaa Aboriginal Language and Technology Centre.

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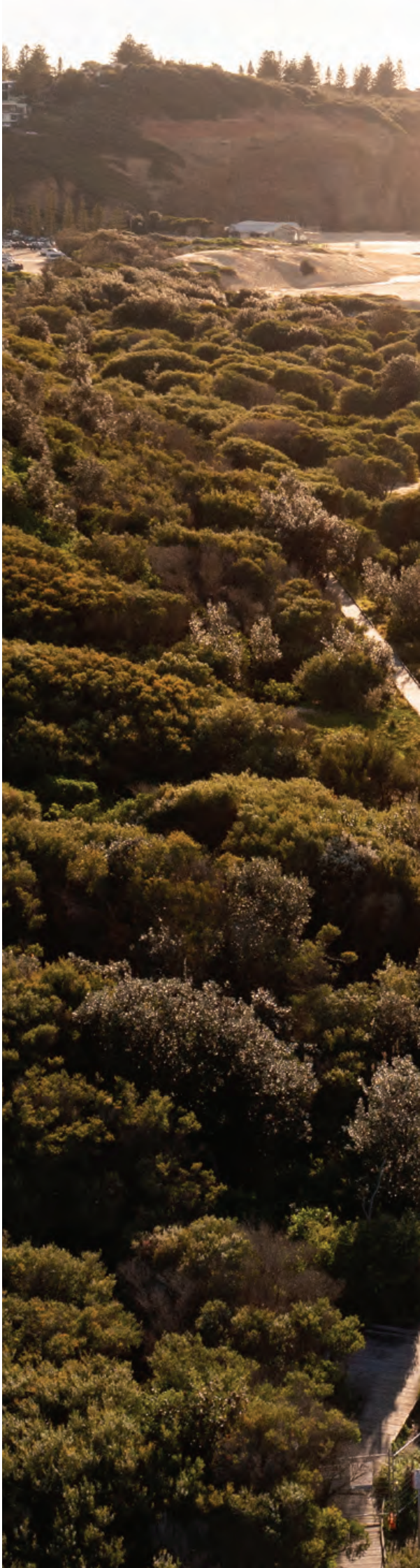


Appendices

MAPS

EXECUTIVE SUMMARY

Lake Macquarie City is located in the NSW Hunter Region, approximately 120km north of Sydney. The defining feature of the city is Lake Macquarie, the largest coastal lake in NSW. The lake is connected to the ocean and open coast via Swansea Channel.

The coastal zone of Lake Macquarie spans the lake and part of its catchment, the coastline and Swansea Channel. The southern part of the lake's foreshore and catchment area incorporates land within the Central Coast local government area. The coastline of Lake Macquarie shares a sediment compartment with the City of Newcastle to the north.

The Lake Macquarie coastal zone is ecologically rich, physically dynamic and an attractive place to visit and live. It is part of the traditional country of the Awabakal people. Awabakal people have lived around Lake Macquarie and utilised its aquatic resources for thousands of years. The natural assets in the city provide a quality lifestyle highly valued by the Lake Macquarie community. The coastal zone is heavily utilised by residents and visitors, particularly during summer.

In 2015, a Coastal Zone Management Plan (CZMP) was prepared for the Lake Macquarie Coastal Zone, in accordance with the objects of the *NSW Coastal Protection Act 1979*.

This Coastal Management Program (CMP) for the Lake Macquarie coastal zone provides an update of the CZMP and responds to the objects of the *Coastal Management Act 2016* and meets all necessary requirements identified in the Act and NSW Coastal Manual. The CMP builds on the successes of the CZMP and other previous programs, which have proven to be highly successful in restoring the health of the Lake Macquarie estuary and embedding systems to mitigate the impacts of coastal hazards, while continuing to provide healthy coastal environments enjoyed by the community.

The CMP identifies 114 priority actions across the three parts of the coastal zone: our coastline (Part A), our estuary (Part B) and Swansea Channel (Part C). While Lake Macquarie City Council is responsible for a large proportion of these actions, effective management of the coastal zone cannot be achieved by local government alone. The CMP identifies collaborative governance arrangements with all relevant stakeholders including state agencies, businesses and residents. It also includes a business plan which demonstrates the benefits of the CMP actions, and a framework to fund these actions into the future.

The CMP provides a pathway to achieve its vision of achieving "a healthy, resilient coastal zone".

VISION

A healthy, resilient coastal zone.

Marung, Birirral bunaba

Well, strong, sand place (sand being from a beach)

(Wording translated by Miromaa Aboriginal Language and Technology Centre)

MESSAGE FROM THE MAYOR

It really is no wonder Lake Macquarie City is such a highly sought-after place to settle, work and play. It has access to beaches, the lake, the bush and the mountains. Our residents and visitors can enjoy surfing, boating, fishing, walking or just exploring the city's natural beauty.

The Lake Macquarie Coastal Management Program (CMP) aims to preserve and enhance the environmental value of the coastline, estuary and channel amid increased visitation and pressure from urban development across the city, and the ever-increasing impacts of a changing climate.

The CMP has been prepared in collaboration with the NSW Department of Planning and Environment, as well as other agency and community stakeholders. This program puts forward priority actions to be implemented for our coastline, our estuary and the Swansea Channel.

Many of the actions within this CMP are the responsibility of Lake Macquarie City Council. However, a healthy coastline, in a growing and active urban community is not achieved by the work of local government alone. The CMP highlights collaborative arrangements with state agencies, businesses and residents as key contributors to the ongoing success of coastal management within the city.

Other land managers and public authorities, including the Department of Planning and Environment, Crown Lands, Department of Primary Industries (Fisheries Division), Transport for NSW, Hunter Water Corporation, Local Land Services, and Belmont Wetlands State Park have an important role to play in delivering the actions outlined in this program.

I encourage all stakeholders to engage this plan to secure the lifestyle of the community and visitors of Lake Macquarie, and build upon the significant improvements in coastal health achieved over the last 20 years.

Councillor Kay Fraser
Mayor

INTRODUCTION

Lake Macquarie City, covering 757km^2, is a coastal destination featuring magnificent natural assets, including the lake, beaches and mountains.

Its main natural features include:

- the largest coastal saltwater lake in NSW, with a circumference of 174km
- 32km of coastline to the east
- Watagans National Park to the west.

The city is a diverse coastal destination abundant with natural assets that provide a distinct sense of place and uniqueness. The population of Lake Macquarie is dispersed across 95 communities, with nine economic centres across the city. More than 1.36 million people visit Lake Macquarie annually (Tourism Research Australia four-year average).

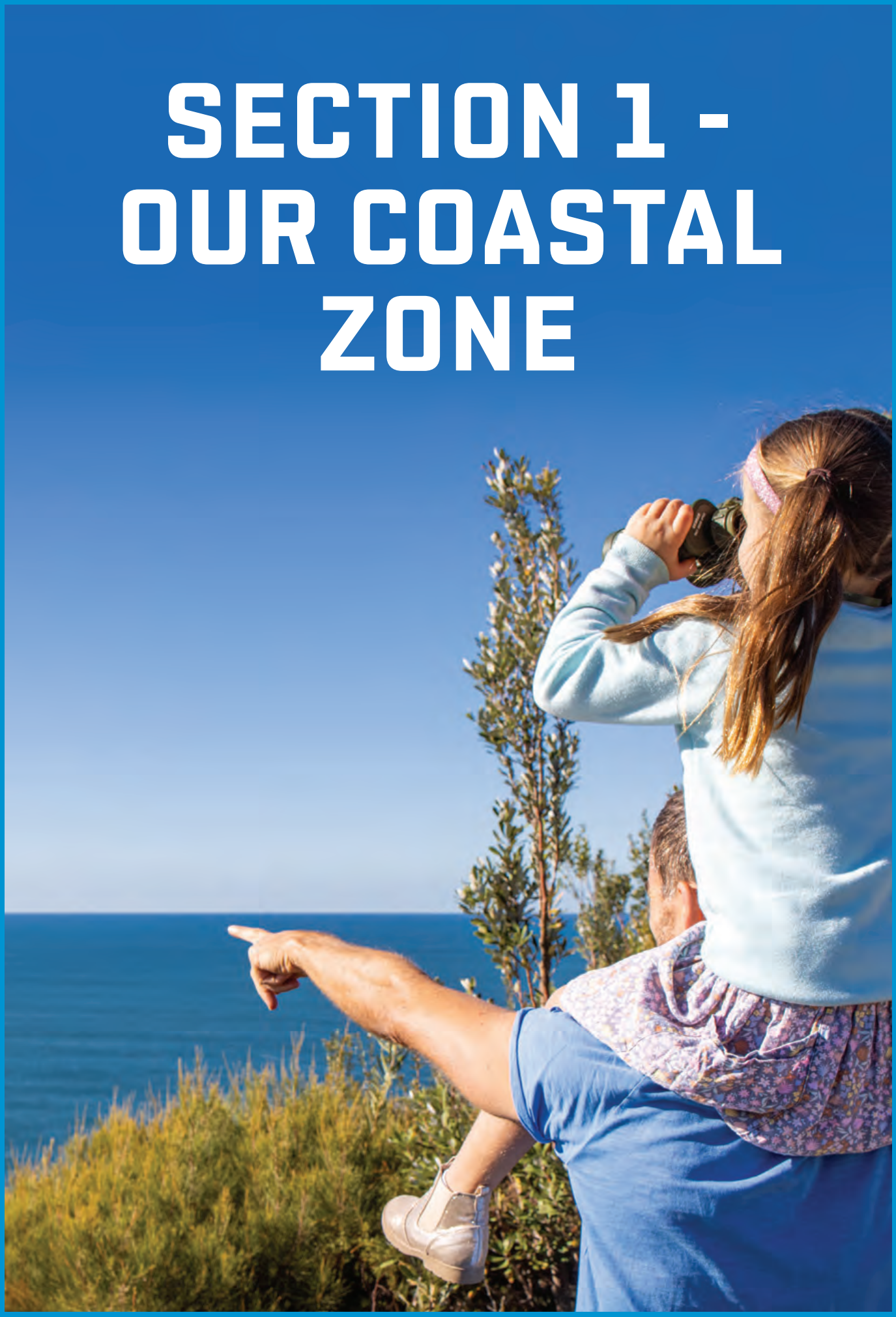
The mapped coastal zone comprises 32 per cent of the Local Government Area (20 per cent of the land area) and is home to an estimated 45 per cent of the city's population.

The sustainable management of Lake Macquarie's coastal zone is required to ensure the intrinsic environmental, social, economic and recreational qualities of the coast are maintained and enhanced for the use and enjoyment of the community.

Management of the coastal zone has significant challenges. These include:

- development pressure and use of the coastal zone
- impacts from urban pollution on coastal and oceanic environments
- the impacts of climate change.

SECTION 1 - OUR COASTAL ZONE



1.1 Environmental context

The coastal zone environment is dynamic. Estuary processes operate at different time scales, varying from hours and days to decades or more. Some processes such as tides vary in predictable ways. For others, the extent and rate of change is much more uncertain.

Coastline

The Lake Macquarie coastline is part of the Newcastle Coast sediment compartment (Schedule 1 of the *Coastal Management Act 2016*). City of Newcastle and Central Coast Council (Wyong) also share this sediment compartment.

The sandy and rocky coastline is an important part of the character of Lake Macquarie City. As a physical feature, it is the interface between the marine environment and the terrestrial environment. While the Watagan Range forms the western backdrop to the city, the ocean dominates its eastern landscape.

Some of the ecological communities on the Lake Macquarie coastline are rare or endangered, including native Themeda grasslands on headlands, and littoral rainforest at Swansea Heads. In addition, many coastal habitats support high biological diversity and rare species such as endangered shorebirds and animals that live off the rock platforms. Importantly, these ecological communities together with the geomorphic structure of the coast creates a scenic landscape of beaches, headlands and shore platforms highly valued for recreation by locals and visitors.

The ecological condition and value of the coast has been affected by historical mining and extractive industries (Nine Mile Beach, Caves Beach and Catherine Hill Bay). Urban development has encroached on coastal headlands at Redhead, Swansea Heads and Caves Beach, as well as behind the coastal dunes at Redhead and Blacksmiths. Old access tracks constructed for these land uses have opened pathways for walkers, cyclists and off-road vehicles. Despite this disturbance, much of the coast is in a relatively natural condition, including land managed in National Parks, State Parks, State Conservation Areas and by Council as community land.

Estuary

Lake Macquarie, classified as a barrier lagoon in geomorphic terms, is the largest coastal lake in NSW, covering an area of approximately 110km^2 with a catchment of approximately 650km^2. It is situated between Sydney and Newcastle and is bordered by residential, industrial, rural and undeveloped land. The lake is of significant ecological value, while also providing for a range of aquatic and land-based recreational activities.

Lake Macquarie has approximately 174km of foreshore. The foreshores of the lake comprise: rock-based slopes (common along the western side), rock-based slopes of lower gradient, sandy shorelines that are back-barrier deposits, creek delta deposits, creek floodplain deposits and modified shorelines with seawalls of varying designs.

Foreshore erosion in the lake is primarily driven by wind waves, allowing wave energy to impact the shoreline. Waves over one metre high are not uncommon. Additional natural processes affecting foreshore erosion are longshore drift and incoming stream flows.

Areas affected by lake flooding occur around the entire foreshore. Issues of catchment inundation and flood risk are managed by Council through a separate program, however these management actions and objectives need to align with our coastal management program.

Presently, there is approximately 12.4km^2 of seagrass coverage in Lake Macquarie. This is the third largest area of seagrass in NSW. Lake Macquarie supports a variety of seagrass species. The most abundant and widely distributed species in the lake is *Zostera capricorni*, though the threatened seagrass species, *Posidonia australis* is also present. Other species found include *Halophila ovalis* and *Ruppia megacarpa*. Seagrass is the main source of primary production for the food web within the lake and is used by invertebrate species to recycle organic matter and nutrients.

Cooling water from the Eraring and Vales Point Power Station discharges into the lake, and large ash dams associated with the operation of these power stations are located close to the lake foreshore. In addition, some coal mines in the Lake Macquarie catchment are licensed to discharge mine water, which then flows into the lake. The legacy of contamination from the former Cockle Creek lead and zinc smelter also continues to impact on northern Lake Macquarie.

Water quality in the lake has improved significantly over the past 20 years, following significant investment in ecological health by local and state government. Expansion of reticulated sewerage, stormwater management, foreshore stabilisation and sediment control measures have systematically improved the ecological function of the lake environment, primarily by reducing excess nutrient loads.

Table 1 Characteristics of Lake Macquarie and the catchment

Characteristic	Unit	Value
Lake surface area	ha	11,000
Average lake volume	ML	666,190
Max lake depth^	m	13
Average lake depth^	m	8
Length of shoreline perimetre	km	174
Area of seagrasses*	ha	1,246
Area of wetland	ha	1,961
Area of mangrove	ha	159
Area of saltmarsh	ha	78
Stream network (length creek lines in LMCC LGA)	km	2,424
Total surface flows from catchment (estimate)#	LM/y	85,256
Total suspended solids - TSS exported to the Lake (estimate)#	tonnes/y	5,577
Total nitrogen - TN exported to the lake (estimate)#	kg/y	139,236
Total phosphorous - TP exported to the Lake (estimate)#	kg/y	16,612

* Date from seagrass mapping by DPIE SEI in 2017.
^From bathymetry mapping by DPIE SEI in 2011.
Estimated surface flow (ML/y), TSS, TN, TP loads (kg/y) are from the Lake Macquarie catchment model.
Other data provided by LMCC from various mapping projects.

(Source: DPIE State of the Estuary Report 2021)

Swansea Channel

Swansea Channel connects the main body of Lake Macquarie to the ocean. The channel is located entirely within the Lake Macquarie Local Government Area. The construction of entrance breakwaters, Swansea Bridge and revetments has modified processes in the channel. Broadly, the channel can be divided in two at Swansea Bridge, which carries the Pacific Highway across the channel and connects the suburbs of Blacksmiths to the north, and Swansea to the south. The channel downstream (East) of Swansea Bridge is affected significantly by oceanic swell waves that penetrate the widely spaced breakwaters at the entrance. Upstream, the dominant coastal processes relate to tidal currents and the transport of sediment. The combination of waves downstream of the bridge and tidal currents throughout the channel has caused significant erosion (particularly in Salts Bay and between Mats Point and the entrance to Black Neds Bay) and causes sand to be transported upstream to the 'drop-over' at the lake end of the channel.

Management of the channel over the past few decades has involved repeated dredging campaigns and various works, such as partial closure of the southern entrance to Swan Bay, commonly to address issues with navigation and foreshore erosion. The channel has a persistent, dynamic nature which creates challenges for those tasked with its integrated management. The combined impact of tides and waves with future sea level rise will further complicate these challenges.

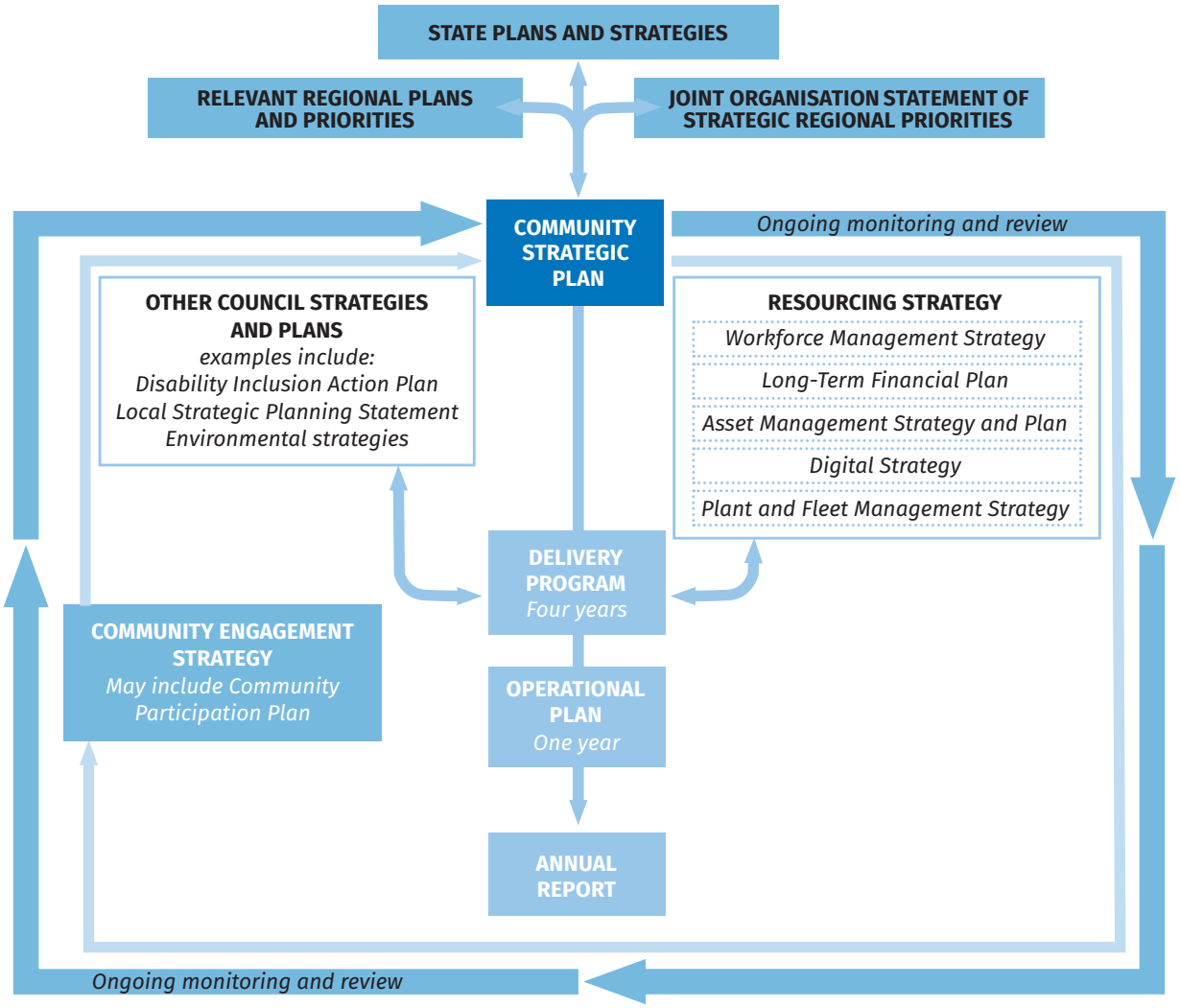
1.2 Planning context

Integrated Planning and Reporting Framework

The Community Strategic Plan specifies the city vision and community values for a 10-year period. There are seven key focus areas identified in Council's Community Strategic Plan: unique landscapes, lifestyle and wellbeing, mobility and accessibility, diverse economy, connected communities, creativity, and shared decision-making. The plan also identifies various strategies, performance measures and objectives.

The CMP is a strategic plan under the Local Strategic Planning Statement and will be delivered through Council's Delivery Program and annual Operational Plan.

Figure 1: Integrated Planning and Reporting Framework



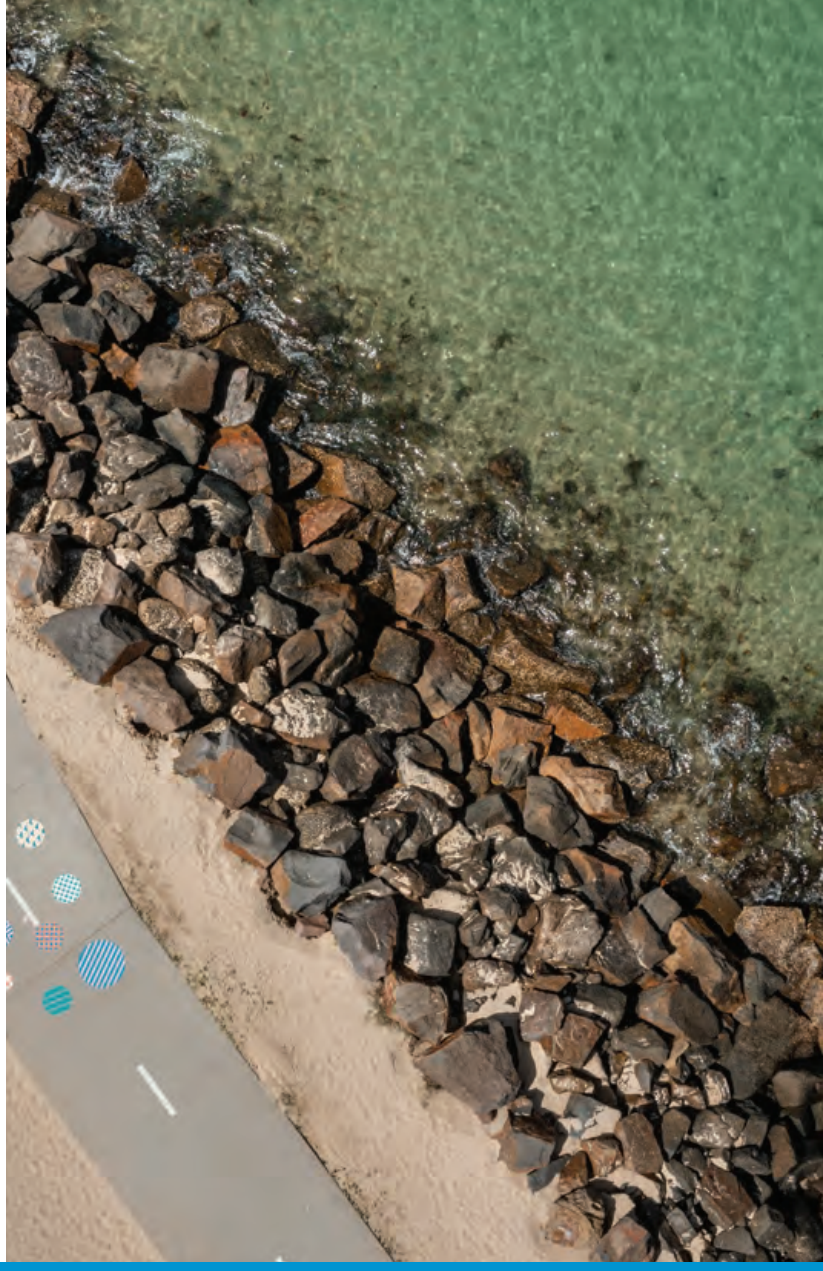
Local Strategic Planning Statement

The Lake Macquarie Local Strategic Planning Statement (LSPS) provides a strategic direction for the city, the following reference being particularly relevant to management of the coastal zone:

...the 'jewel in the crown, for the City will be the abundance of high quality indoor and outdoor spaces to connect with others, enjoy nature, relax or get active. These spaces may be bushland reserves, the lake and foreshore, parks, a quiet garden area within a busy centre, or a purpose-built area within a multi-use building.

The LSPS specifies the following actions relating to the CMP:

- 6.2 Prepare Coastal Management Program for the Lake Macquarie coastal zone to provide a strategic program for coastal, estuary and waterway management
- 6.6 Implement priority actions in the Lake Macquarie Coastal Zone Management Plan, such as continuing to prepare adaptation plans, to develop resilient coastal landscapes and communities
- 7.9 Develop and implement local adaptation plans to address current and emerging climate change risk.



1.2.1

NSW Coastal Management Framework - Whether the CMP identifies recommended changes to the relevant planning controls, including any proposed maps.

In 2016, the NSW Government established a new framework to manage the coastal environment in an ecologically sustainable way for the social, cultural and economic wellbeing of the people of NSW (Figure 2). The cornerstone of this framework, the *Coastal Management Act 2016*, requires Council to develop a long-term strategy to manage our coastal zone.

This CMP does not identify a coastal vulnerability area or propose changes to the relevant planning controls, including any proposed maps.

Figure 2: The Coastal Management Framework

Coastal Management Act 2016 and Resilience and Hazards SEPP 2021

The *Coastal Management Act 2016* (CM ACT) establishes the framework and overarching objectives for coastal management in NSW.

The purpose of the CM Act is to manage the use and development of the coastal environment in an ecologically sustainable way for the social, cultural and economic wellbeing of the people of NSW.

The CM Act also supports the aims of the *Marine Estate Management Act 2014*, as the coastal zone forms part of the marine estate.

The CM Act outlines coastal management areas. Lake Macquarie has three distinct coastal management areas (refer to Figures 3, 4 and 5):

1. coastal wetlands and littoral rainforest areas – areas which display the characteristics of coastal wetlands or littoral rainforests that were previously protected State Environmental Planning Policy 14 and SEPP 26
2. coastal use areas – land adjacent to coastal waters, estuaries and coastal lakes
3. coastal environment areas – areas that are characterised by natural coastal features such as beaches, rock platforms, coastal lakes and lagoons, headlands and marine and estuarine waters.

The CM Act refers to a fourth coastal management area:

4. coastal vulnerability area - areas subject to coastal hazards. The coastal vulnerability area is intended to cover areas subject to coastal hazards such as coastal erosion and tidal inundation. This CMP does not identify a coastal vulnerability area or propose changes to the relevant planning controls, including any proposed maps.

   Lake Macquarie is subject to coastal hazards including foreshore erosion, inundation due to catchment rainfall and/or elevated ocean water levels (also termed coastal inundation), and ongoing changes in mean and tidal water levels. Inundation relating to catchment rainfall coinciding with storm event elevated ocean water levels is also managed through the NSW floodplain risk management framework.

Figure 3: Coastal wetlands and littoral rainforest areas in Lake Macquarie

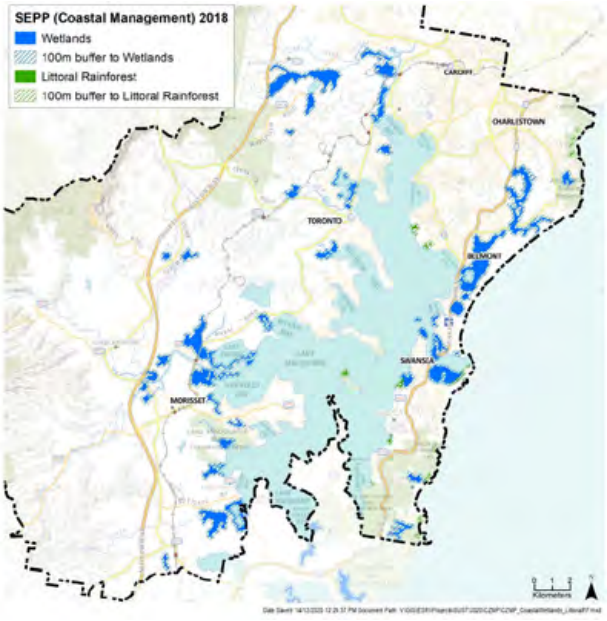


Figure 4: Coastal environment area in Lake Macquarie

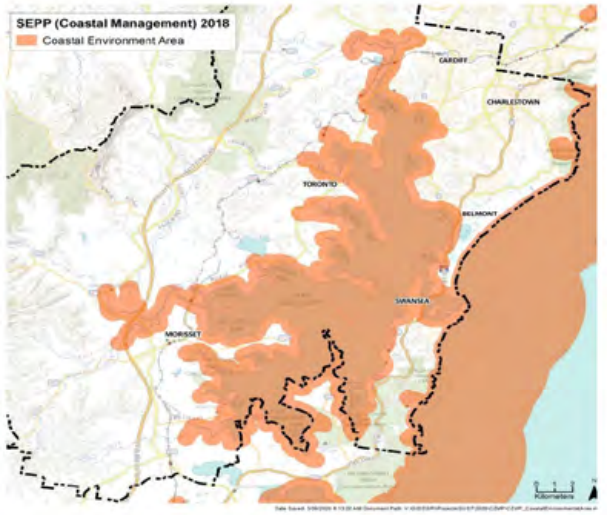
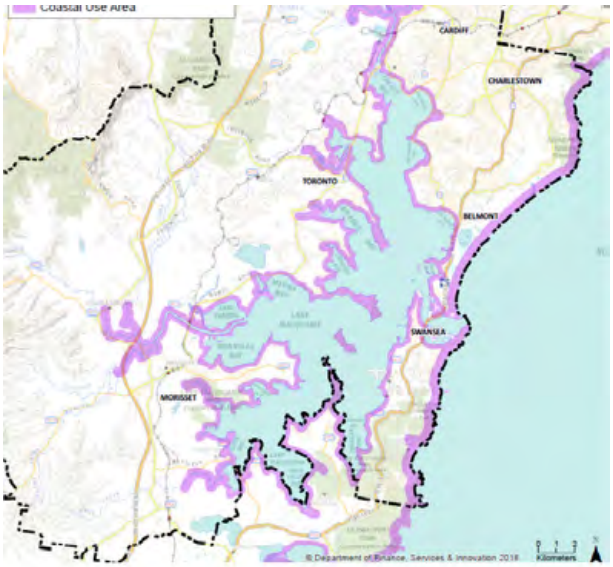


Figure 5: Coastal use area in Lake Macquarie



Glenrock Lagoon

Objects and management objectives of the Coastal Management Act 2016

The CMP considers and promotes the objects of the CM Act and management objectives of the coastal management areas.

A detailed explanation of how these objects and management objectives have been addressed is provided in Table 3 of Appendix 1.

The objects of the CM Act were also addressed in the evaluation of each of the actions contained in the implementation plan. The feasibility criteria used to evaluate actions included an assessment of how each action promotes and gives effect to the objects of the CM Act (refer to Appendix 9).

Integration with the Marine Estate Management Strategy (MEMS)

The Marine Estate Management Strategy (MEMS) (2018-2028) was developed by the Marine Estate Management Authority to respond to high risks identified in the state-wide Threat and Risk Assessment (TARA) for the Marine estate. The TARA also provides a regional scale risk assessment, with Lake Macquarie identified in the Central Region.

Overall, the TARA identified urban and rural discharges and runoff, climate change and disturbance of estuary habitats (from various sources) as major threats. Lake Macquarie is affected by these threats, which have informed the priorities for the CMP. In the Central Region, which includes most of the densely settled urban areas of NSW, pollutants and disturbance from boating activity, sewerage systems, service infrastructure and industrial/thermal discharges are also significant threats.

The MEMS also notes the emerging threat of loss of cultural and heritage values, and emerging safety concerns around interactions of marine species and recreational/tourism waterways.

The CMP includes actions which address these issues in the local context, including a strong focus on urban stormwater, actions relating to overflows from the sewerage system, further studies of the cumulative and long term effects of historical industrial and power generation discharges, projects to investigate interactions of recreational use and the natural systems of the coast, controls on boating activity in high vulnerability seagrass communities, stronger protections for important natural areas and actions to provide further opportunities for Aboriginal community involvement.

The CMP will provide a direct contribution to better management of MEMS priorities. The high risk environmental threats identified in the Central NSW TARA (and found to be relevant to Lake Macquarie and its catchment), are shown in Table 3 of the State of the Estuary Report.

1.3 Cultural and social context

Aboriginal cultural heritage

Lake Macquarie, the coast and the catchment extending to the Watagan Ranges are part of the traditional country of the Awabakal people. Awabakal people have lived around Lake Macquarie and used its aquatic resources since the early Holocene period, more than 8000 years ago. They also occupied this landscape before it arrived at its current form, when sea levels were much lower.

Awabakal ancestors were custodians of the landscape and this tradition has been passed on to Awabakal people today. Physical evidence of past Awabakal life around the estuary includes grinding groove sites, middens, campsites, scar trees and rock shelters. These sites are vulnerable to disturbance by development and recreation. The vegetation and fauna of the lake and its foreshores and catchment are also highly valued by Awabakal people and these are the resources of which they are custodians.

In June 2017, *A Commitment to the Aboriginal and Torres Strait Islander people of Lake Macquarie* was adopted by Council. This commitment recognises the contribution of Aboriginal culture to the city's landscape and to its social and cultural diversity. The Aboriginal Heritage Management Strategy sets out how Council and the local Aboriginal community will work as partners to implement the Statement of Commitment. The strategy introduces the concept of Sensitive Aboriginal Cultural Landscapes (SACL). These more sensitive landscapes are defined and mapped from known archaeological evidence, the predicted extent of archaeologically significant areas, places associated with records of traditional Awabakal stories and practices, places that conserve important traditional resources and places that are important in the shared history of the city since European settlement. SACL mapped include the lake shore, ocean shore, terraces, deltas and riparian foot-slopes along creek corridors and upper catchments, and escarpments of the Watagan and Sugarloaf Ranges.

Threats to these landscapes include:

- Historical use of the lake foreshore and lower reaches of estuarine creeks and wetlands for rail, power generation, sewerage and other infrastructure, which has destroyed middens and open campsites.
- Filling and formalisation of lake shorelines with sea walls, construction of slipways, boat sheds and residences. All these activities have transformed the lake shore landscape, as well as damaging middens close to the lake shore. Some archaeological material remains in less formal foreshore reserves and where old houses or boat sheds are on piers rather than slab foundations.
- Foreshore and nearshore reserve management, including filling of low-lying areas, mowing, installation of playing fields and parkland equipment, which has destroyed middens and open campsites. Scarred trees have also been lost from foreshore locations and lower reaches of major creeks and their catchments, such as Dora Creek and Cockle Creek.
- Land clearing for agricultural, industrial and urban uses, which has removed scarred trees and disturbed the structure and context of open sites. Stone arrangements have also been damaged or destroyed by land-clearing activities.
- Land management within urban subdivisions, which has changed flows in creeks, increased erosion or sedimentation and encouraged invasion of culturally valued vegetation communities by weeds. Transport, water, sewerage and power infrastructure to support urban development can cause significant disturbance of long corridors across the landscape.
- Poor control of access within lake shore and bushland reserves (Crown Land, community land and private land), which has contributed to erosion, rubbish dumping and damage to vegetation associated with illegal four-wheel drive and trail bike activity.
- Industrial development along major tributary creeks (for instance in the lower freshwater and estuarine reaches of Cockle Creek), which has removed or damaged surfaces that would once have been associated with diverse Aboriginal community resources and archaeological evidence of past occupation.
- Coal mining (both open cut and underground), which has contributed to the loss of Aboriginal sites and changes to cultural landscapes, either directly through extraction or indirectly due to subsidence impacts. It should also be noted, however, that underground mining in the western part of the city has helped to maintain some relatively natural landscapes in this area.

Many of the threats to SACLs are similar to those that impact the ecological features of the estuary and therefore estuary management actions are likely to enhance cultural, as well as natural values.

European heritage

Lake Macquarie and its estuarine tributary creeks also have a strong heritage values, with European settlement from the early nineteenth century driven by the discovery of coal in the late eighteenth century originating in Newcastle, then spreading to the shores of Lake Macquarie within a few years. Lake Macquarie's heritage includes coal mining, forestry, farming, boat building and fishing. The lake served as an important transport corridor for these industries, prior to the development of road transport.

The estuary also has an important history and continuing value as a training ground for national and international sailors. These heritage and cultural values are separate from, but associated with, the natural values and systems of the estuary.

Population demographics

Local population trends

The population of the city is growing. Over the next two decades, new urban areas and urban intensification are proposed in the north-west (Speers Point to Glendale), north-east (Charlestown), south-east (Caves Beach and Catherine Hill Bay) and south-west (Morisset and Cooranbong).

Three potential growth scenarios have been identified. The first scenario reflects current economic, population and demographic trends. In this scenario, the population is expected to grow from approximately 210,000 in 2021 to about 225,000 by 2036. Successful attraction of investment, business activity and jobs could alter the current trend leading to higher population growth scenarios.

The second scenario sees a greater recognition of the Lower Hunter (and Lake Macquarie) as a preferred place to live and work. In this scenario, the population potentially grows to more than 250,000 by 2036.

The third scenario considers the Hunter region within the reach of the expanding global city of Sydney. Liveability pressures in Sydney, emerging remote working trends, digital connectivity, and enhanced transport links from Newcastle to Wollongong have potential to create significant growth. In this scenario, population could grow to more than 300,000 by 2036.

There are various social, economic and environmental implications associated with each of these scenarios. Related opportunities and pressures will need to be managed well. Demand for land and infrastructure along with environmental constraints of each scenario will need to be identified, monitored and responded to appropriately.

Lake Macquarie City has many of the characteristics

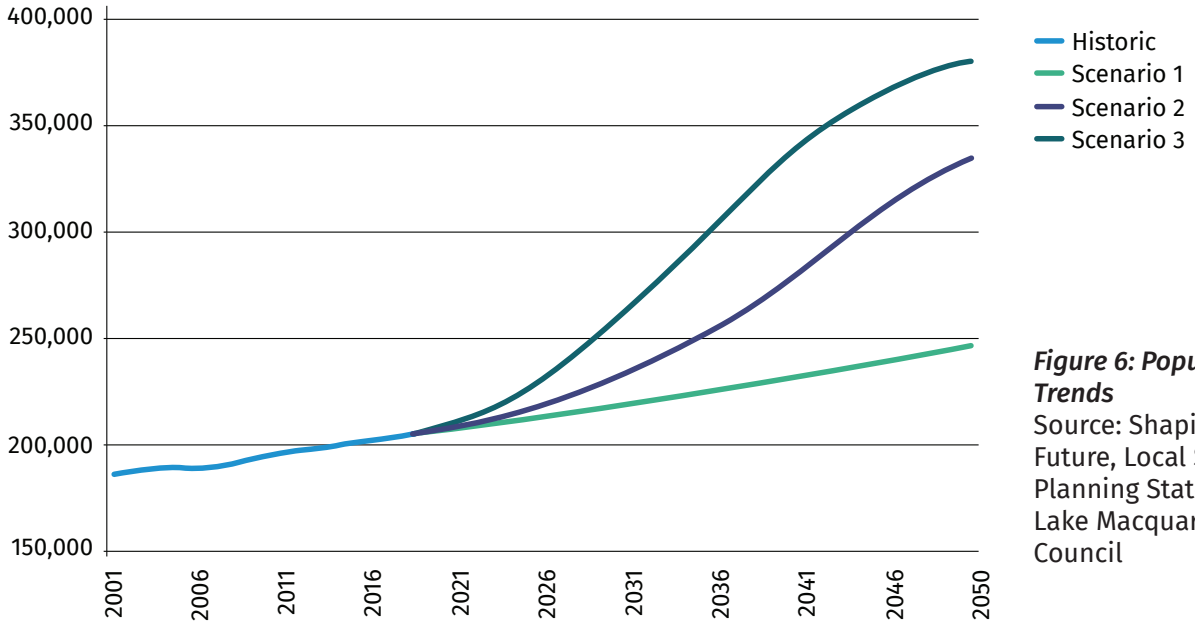


Figure 6: Population Trends
Source: Shaping the Future, Local Strategic Planning Statement, Lake Macquarie City Council

of a relatively socially conservative area, including an older population, lower education levels, strong history of mining and power generation employment (even though neither now dominate the workforce), and stable residency, with multigenerational families living in the city. The city is suburban, and village based, so for recreation, local access opportunities are important.

The lake is an important recreational asset for all growth areas, but particularly for the north-west and south-west. For these areas, Lake Macquarie is the nearest aquatic recreation place. The Lake Activation Strategy provides a strategic framework, service levels and actions to ensure community needs for lake access and foreshore infrastructure are improved over the next 10 years (Umwelt 2021).

Regional population trends

Demand for recreational access to Lake Macquarie also comes from our regional neighbours. This includes Newcastle and other cities and towns across the Lower Hunter, as well as the Central Coast and Sydney. Regional visitors are the largest group of day and overnight visitors to Lake Macquarie. Lakeside centres likely to receive increasing regional visitors include the Morisset Peninsula, Toronto, Rathmines, Wangi Wangi, the Booragul to Speers Point area in the north and the Belmont to Swansea area in the east.

There are strong flows of people between Newcastle and Lake Macquarie. Focal destination centres include Charlestown, Speers Point, Warners Bay, Croudace Bay and Belmont, across the northern and eastern shores of Lake Macquarie.

Over the next decade, Newcastle Airport will be upgraded to receive international air traffic, which will increase accessibility to Lake Macquarie for overseas travellers.

Lake Macquarie community values

The lake and coastline are important natural features of our city. Climate change and projected sea level rise are two global challenges that our city needs to consider for future planning in these areas. Community engagement is vital to ensuring the history, values and knowledge of local areas are embedded within the decision-making of policy and plans.

Past and current planning for coastal areas and the lake have used community representative groups, workshops, drop-in sessions and online and postal surveys to engage local residents and key stakeholders to share their knowledge. As part of the development of the CMP's scoping study, community members provided information about what is important to them and what they thought should be included in a vision for the coastal zone. Comments provided have been used to inform the vision for Lake Macquarie's CMP, and have also been translated into coastal values, along with the addition of items included in the Marine Estate Management Authority Threat and Risk Assessment (TARA) final report.

The table below indicates the primary economic, social and environmental community coastal values. These have been considered in the context of state-wide risk issues (as identified in the *Marine Estate Management Strategy 2016*).

Table 2: Community coastal values and cumulative state-wide risk issues

Economic	Social	Environmental
Proactive management of coastal climate risks	Educated community	Healthy coastal zone
Strong tourism economy	Good public access	Stable and resilient channel
Accessible surf breaks	Surf amenity	Healthy, sustainable, resilient estuary
	Culturally respectful activities	Clean and healthy lake supporting natural ecosystems
	Resilient & accessible lake	Wildlife refuge
	Aboriginal cultural heritage and use	Healthy connection between lake and ocean
		Data accessibility
		Fisheries – fish assemblage management & uncertainty of impact of fishing activities
		Estuaries – role as receiving water quality environment & holistic management
		Threatened Species (Biodiversity Conservation Act)
		Climate Change – practical adaptation/resilience building actions

Source: Lake Macquarie City Council Coastal Management Program Scoping Study 2020

1.4 Economic context

The Lake Macquarie City Economic Development Strategy identifies the vision for Lake Macquarie's economic future as:

In 20 years, Lake Macquarie will be one of the top 10 most liveable cities in Australia.

It includes the strategic objectives: identity, investment, infrastructure and innovation.

This strategy sets targets for the city well beyond growth forecasts provided by the NSW Department of Planning and Environment.

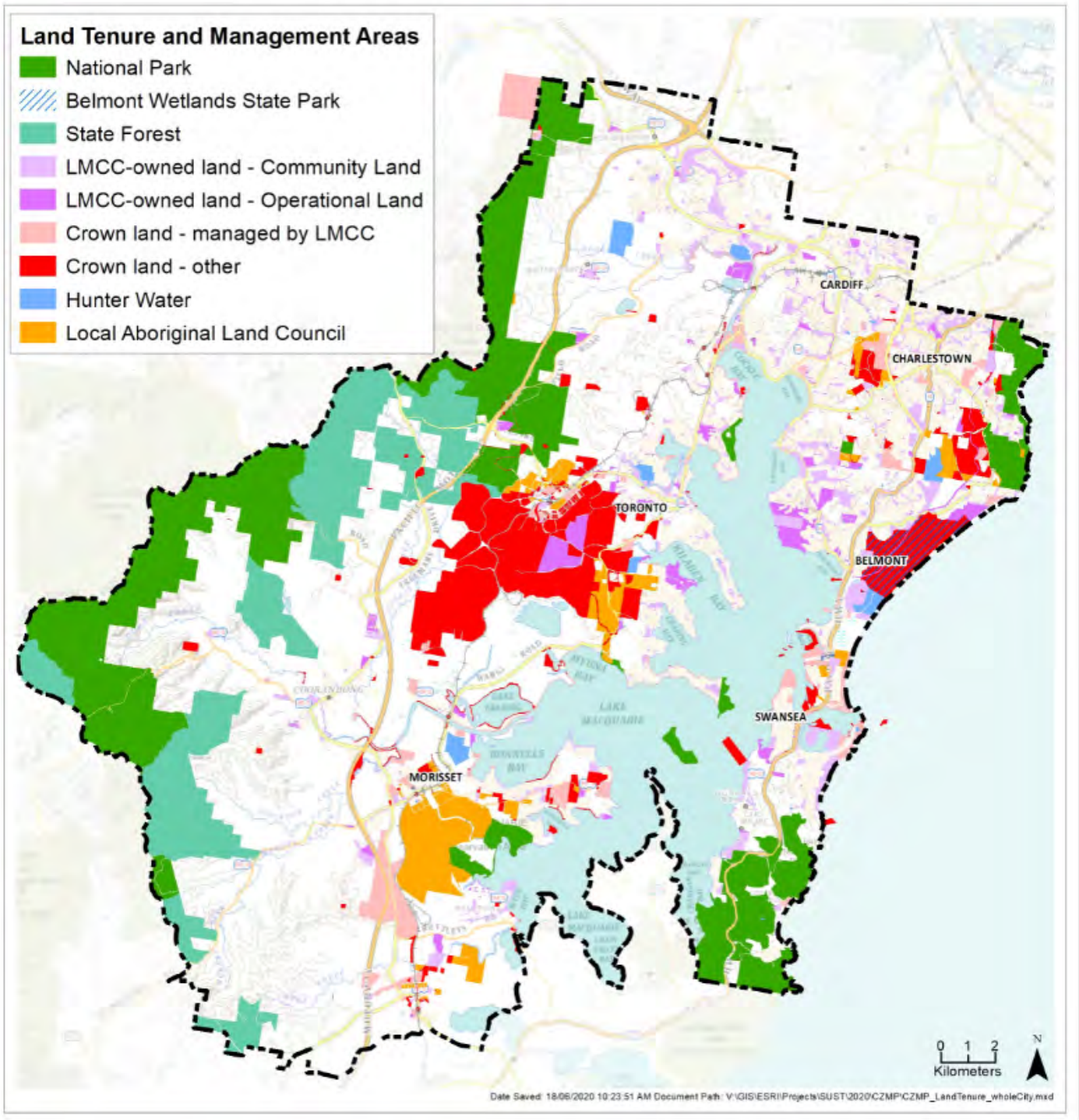
1.5 Governance context

Shared responsibility

The coastal zone is owned and/or managed by a number of different government agencies, private individuals and other organisations. Council recognises the key role of the city's Sustainable Neighbourhoods Alliance, Landcare Network and other community groups in sustainability project collaboration.

The map below indicates the land tenure and management areas for the coastal zone in Lake Macquarie.

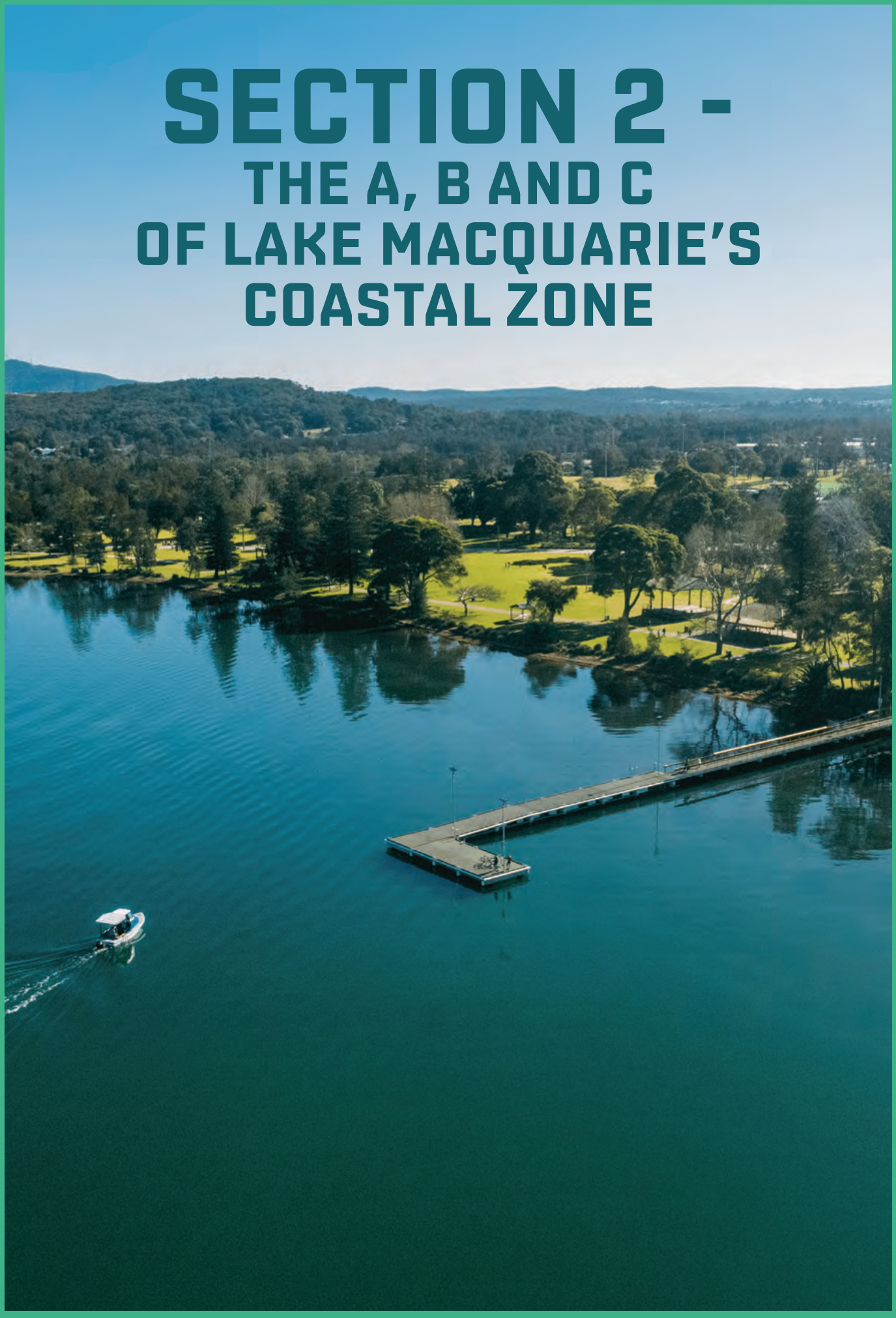
Figure 7: Land tenure and management areas in Lake Macquarie



Sustainable Development Goals (SDGs)

Council's decision making in the CMP has been guided by the framework of the Sustainable Development Goals (SDGs), in accordance with Council's Sustainability Policy. United Nations SDGs have been mapped to the actions in this CMP as detailed in the Implementation Plan (section 4.4). The main SDGs addressed in this plan are:

SECTION 2 -
THE A, B AND C OF LAKE MACQUARIE'S COASTAL ZONE



Lake Macquarie's Coastal Management Program (CMP) area has three zones:

Part A: Coastline (beaches, dunes, rock platforms, headlands and wetlands)

Part B: Estuary (and its tributaries: Cockle Creek, LT Creek, Stony Creek, Dora Creek, Wyee Creek and North Creek) and part of catchment area including wetlands and part of the mapped coastal zone within the Central Coast local government area bordering the Lake Macquarie estuary.

Part C: Swansea Channel

This area provides for an integrated coastal zone management approach across the whole local government area. This area is equivalent to that contained in the Lake Macquarie Coastal Zone Management Plan 2015, maintaining consistency for our local community and other stakeholders.

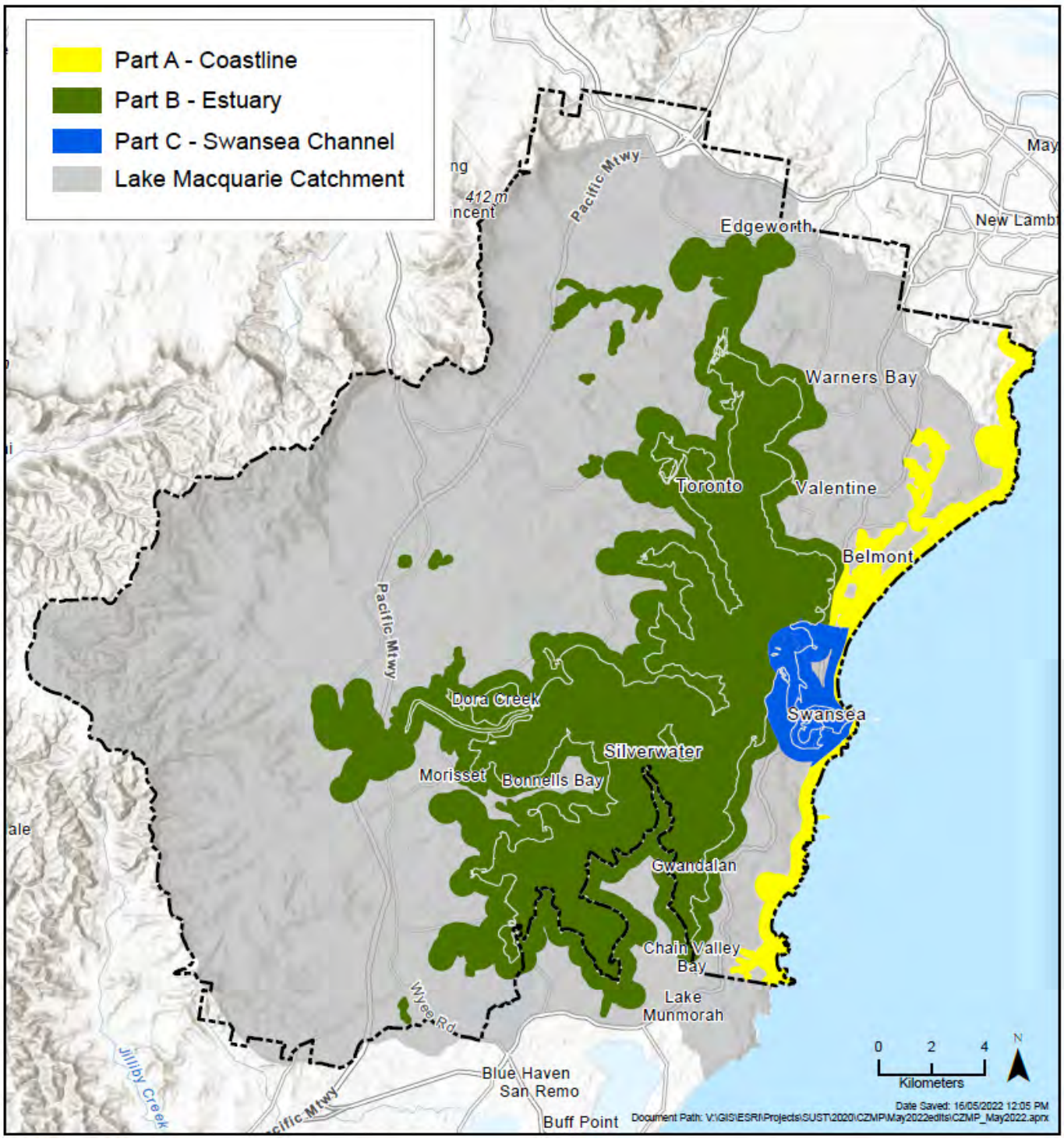


Figure 8: Coastal zone in Lake Macquarie

This section summarises the issues and challenges in the three parts of CMP that have been reflected in the implementation plan (section 4.4). Council has developed, evaluated, prioritised and costed corresponding management actions to addresses these issues and challenge.

2.1 Snapshot of issues

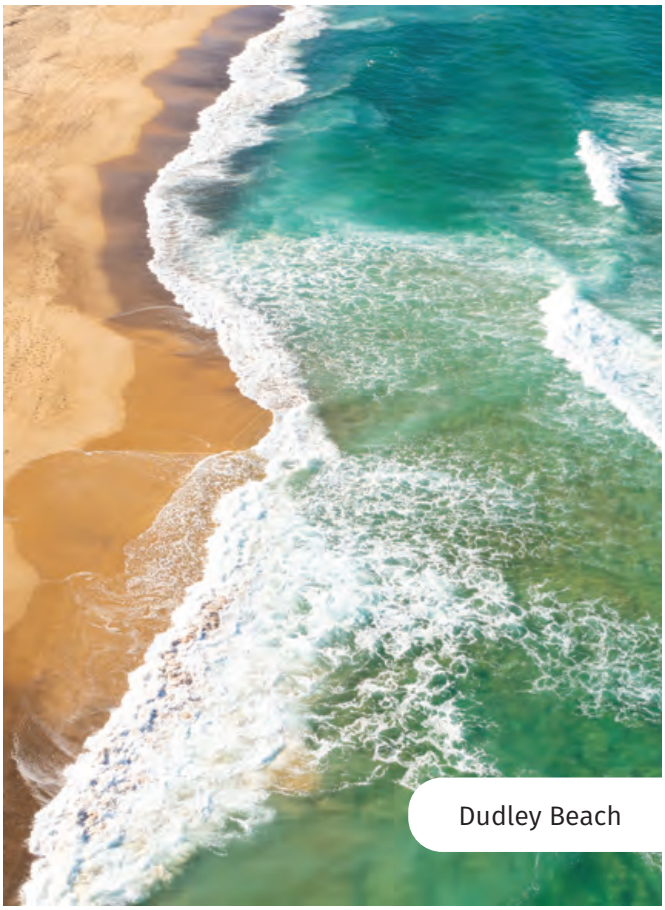
Part A: Coastline

Defining features of the Lake Macquarie coastline

- A diverse coastal landscape with high sandstone and conglomerate cliffs, sea caves, shore platforms, long barrier beaches (up to 13km), pocket beaches and coastal dune systems of Holocene and late Pleistocene age
- A predominantly high energy coast, with highest waves associated with east coast low events and active frontal dune processes during storm events, but relatively low risk due to setback of development from the beach
- Historical records indicate a stable, sandy coastline with periodic erosion and accretion, and slight rotation on longer beaches
- A key coastal risk area at Blacksmiths where there is potential for interaction of coastal erosion/recession and lake inundation over the next century
- An entrance to Lake Macquarie with control structures (training walls) that have been affected by coastal processes since the late nineteenth century
- Potential for block failure on coastal cliffs
- Part of Newcastle coastal sediment compartment (shared also by City of Newcastle and Central Coast Council)
- Rare or endangered ecological communities, including Themeda grasslands on the headlands and the littoral rainforest at Swansea Heads
- High biological diversity and rare species such as endangered shorebirds and animals that live off the rock platforms
- Ecological communities combined with the geomorphic structure of the coast in a scenic landscape of beaches, headlands and shore platforms, highly valued for recreation by locals and visitors
- Ecological condition and coastal value affected by historical mining and extractive industries
- Urban development encroachment on coastal headlands at Redhead, Swansea Heads and Caves Beach as well as behind the coastal dunes at Redhead and Blacksmiths beaches
- The majority of the coast in a relatively natural condition, including land managed in National Parks, State Parks, State Conservation Areas and by Council as community land

Key management issues and challenges for the coastline

- Land tenure of areas such as Nine Mile Beach (multiple agencies responsible)
- Balancing recreational use: four-wheel driving, surfing amenity, informal access with the need for ecosystem protection
- Coastal erosion, wave overtopping, dune health, beach rotation and coastal inundation



Dudley Beach

Part B: Estuary

Defining features of Lake Macquarie's estuary

- The Largest coastal lake in NSW, covering an area of about 110km^2, with a catchment of about 650km^2, formed over the past 6000 years from flooding of coastal zone by sea level rise
- Significant ecological values, providing for a range of aquatic and land-based recreational activities (refer to Table 1 for more information about the characteristics of the Lake Macquarie catchment)
- Complex estuary hydrodynamic processes and responses
- Small tidal range of about 100mm each tidal cycle (range can be wider with rainfall and offshore tidal condition changes)
- Approximately 174km of foreshore
- Foreshore erosion mainly due to wind waves
- Rising sea level and lake levels
- Local government areas of Lake Macquarie, Central Coast, Wollongong, Shoalhaven and Rockdale identified as having greatest risk of inundation from sea level rise (to 1.1m), (Department of Industry, Science, Energy and Resources 2009) representing more than 50 per cent of residential buildings at risk in NSW
- Areas affected by flooding around entire foreshore
- 12.4km^2 of seagrass coverage in Lake Macquarie (third largest area of seagrass in NSW), with most abundant species being *Zostera capricorni*. Threatened species *Posidonia australis*, as well as *Halophila ovalis* and *Ruppia megacarpa*, also present.
- Cooling water from Eraring and Vales Point power stations discharge into Lake Macquarie
- Some coal mines licensed to discharge mine water at the surface, flowing into the lake
- Improvement in water quality over the past 20 years, mainly by reducing nutrients and sediments entering the lake
- Mix of shallow sand nearshore areas, deeper rocky foreshores and shorelines thinly mantled with muddy sands
- Strong influence from catchment on the health of the estuary
- Extensive urban and industrial development, particularly low-lying development
- Increasing demand for land and water based recreational opportunities

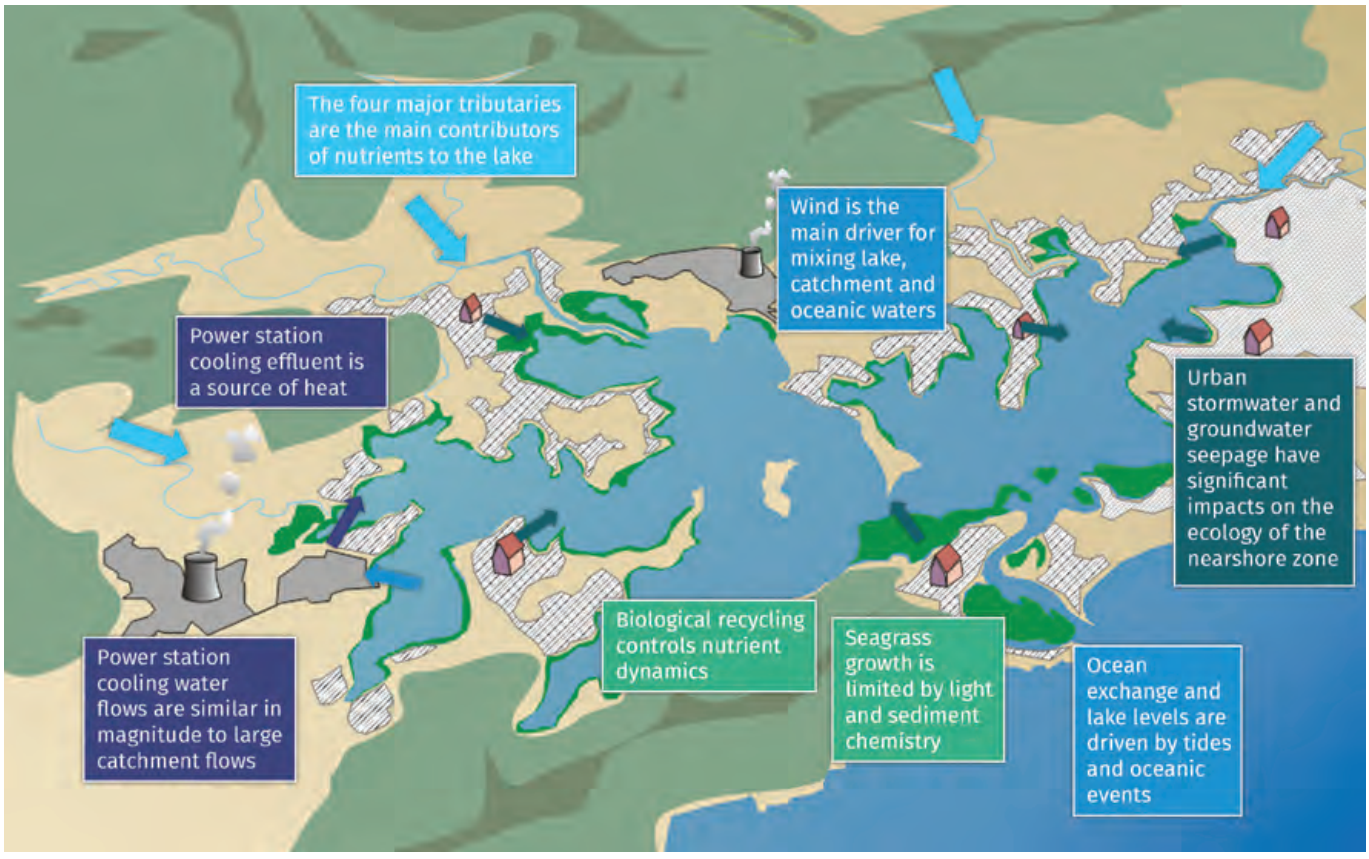


Figure 9: Conceptual model of estuary processes

Second Creek, Redhead

Key management issues and challenges

- Controls on catchment yields of sediments, nutrients and organics are key strategies for managing the ecological health of Lake Macquarie
- Minimising the impact of stormwater pollution
- Areas respond differently to the inflows of stormwater from development in the immediate catchment, with long reaches of poorly flushed estuarine creeks affected by both sediment load and impacts of development on riparian vegetation
- Delivering a whole-of-government approach with improvement in managing coastal issues across local government boundaries
- Funding uncertainty for ongoing lake and catchment improvement works
- Monitoring of climate change impacts on foreshore improvement assets (particularly foreshore stabilisation assets)
- Balancing recreational demand with the need to manage impacts on the estuarine environment.

Part C: Swansea Channel

Defining features of Swansea Channel

- Connects main body of Lake Macquarie to the ocean
- Broadly divided in two at Swansea Bridge, which carries traffic across the channel and connects Blacksmiths and Swansea – see Figure 10
- Downstream impacted by oceanic swell waves
- Upstream, dominant coastal processes relate to tidal currents and transport of sediment
- Increased flow velocity and scour upstream resulting in failure of foreshore protection works
- Rapid shoaling upstream of the entrance to Swan Bay
- Highly modified entrance with training walls constructed in the 1890s
- Waves downstream of bridge, tidal currents and upstream transport of sand have caused erosion
- Significant erosion in Salts Bay and between Mats Point and entrance to Black Neds Bay
- Important shallow seagrass habitats for fish breeding and migratory birds, particularly from Belmont through to Swansea Flats
- Variable tidal range, decreasing from 1.7m at the entrance, 1.3m at Swansea bridge to less than 0.2m at the western end of the channel

Swansea Heads and Blacksmiths

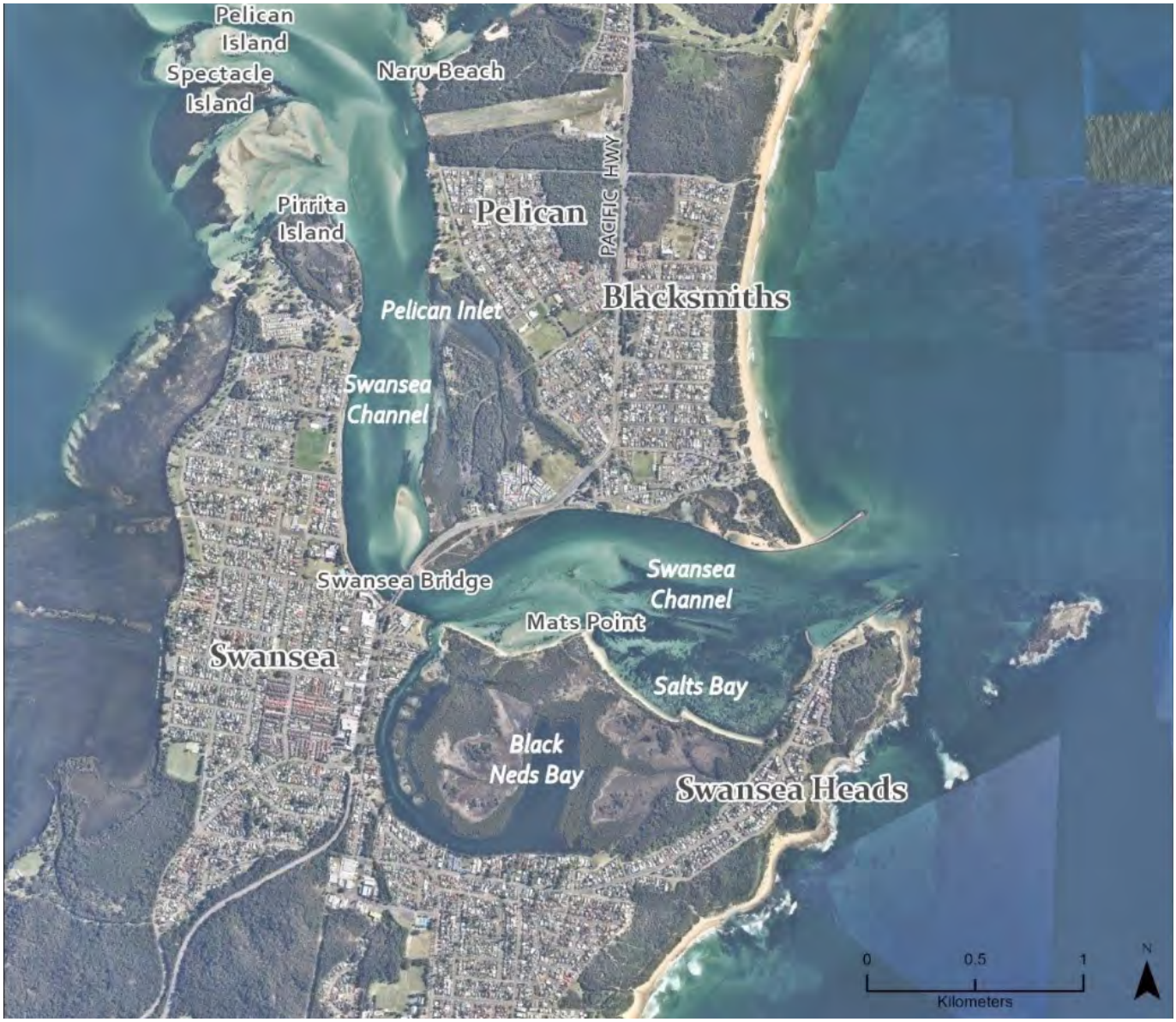
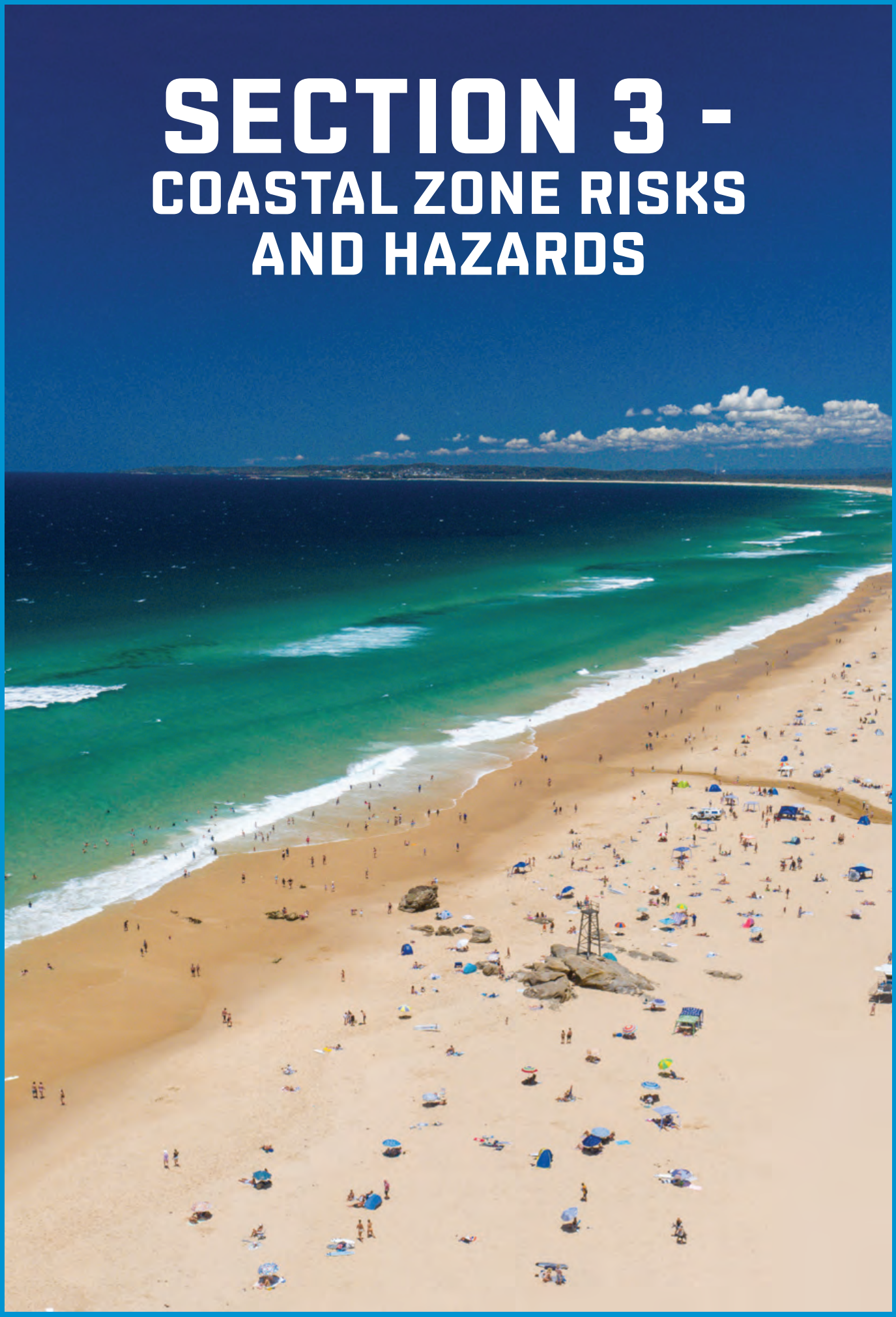


Figure 10: Key locations in Swansea Channel

Key management issues and challenges for Swansea Channel

- Differing objectives regarding the use, funding and ecological health of Swansea Channel
- Defining responsibilities for dredging, foreshore works and maintenance of coastal protection assets
- Effective management of hydrodynamic processes to achieve appropriate long-term management
- Channel depth can impact the boating recreation sector and opportunities for the lake to become a significant tourism destination
- Impacts of training walls
- Dynamic nature of channel form, especially foreshore erosion
- Repeated dredging and works such as partial closure of southern entrance to Swan Bay over the past decade as part of channel management
- Channel evolution – channel gradually changing over time
- Vulnerability of the suburbs surrounding the channel to inundation
- Competing needs of multiple stakeholders and finite funding
- Impacts of tides and waves, combined with future sea level rise
- Dynamic nature, presents challenges for integrated management
- Structures, such as Swansea Bridge, bank protection works, dredge spoil islands and extensive works at the entrance to Swan Bay have contributed to modified hydrodynamic conditions and channel characteristics

SECTION 3 - COASTAL ZONE RISKS AND HAZARDS



3.1 Risk assessment

In preparing the CMP, environmental and socio-economic threats for the coastal zone were assessed and rated. Threats rated high and extreme are indicated in Table 5 below.

Extreme threats for the Lake Macquarie coastal zone were identified for: ecosystems' impacts from climate change and coastal hazards (coastline) and social and economic impacts from climate change and coastal hazards (Swansea Channel). Water quality impacts were rated as a priority threat across both the environment and social/economic impacts.

This risk assessment process was adapted from the Australian Standard Risk Management Principles and Guidelines ISO 31000:2009. It is consistent with the Marine Estate Threat and Risk Assessment (TARA) (Section 5) and, where possible, consistent terminology has been applied.

The risk assessment has been conducted for four planning horizons: present day, 2040, 2070 and 2120. The trajectory for future planning horizons assumes no management action taken beyond current practices.

Further details with respect to the likelihood and consequences assessment are provided in the Scoping Study (Appendix 2):

It considered the impact of the threat across the following risk categories:

- **Environmental** – impact resulting in harm to ecosystems, loss of biodiversity and unsustainable use of natural resources.
- **Socio-economic** – impacts to community services, liveability, culture and well-being, businesses, employment, property values, visitor economy.

Documented information was used in conjunction with local knowledge to assign a risk level. Risk assessment results were reviewed by Council's Coastal Zone Management Committee, interdepartmental Council staff as well as government agencies and community members who are part of the project stakeholder group.

Refer to Appendix 2 Scoping Study for a summary of risk ratings for the environmental and socio-economic threats applicable to the coastal zone in Lake Macquarie.

3.2 Coastal hazards

Section 4(1) of the CM Act defines seven coastal hazards which affect coastline, estuary and channel in different ways. Lake Maquaries coastal zone is subject to a range of these hazards as detailed below.

A detailed hazard and risk assessment formed part of the 2015 CZMP for Lake Macquarie. Consideration of the work done as part of this initial assessment informed the level of hazard analysis required in this CMP.

In addition to climate change, this section specifically considers inundation, combined flooding and inundation, coastal and beach erosion, coastal inundation due to wave overtopping, the impact of sea level rise on wetlands, coastal cliff and slope stability, and the evolution and stability of the Swansea Channel entrance.

It also considers the plans and strategies already in place to mitigate these risks.

Refer to Table 5 in the Scoping Study (Appendix 2): for a list of studies relating to coastal hazards in the Lake Macquarie coastal zone.

Climate change

The Hunter and Central Coast Regional Environmental Management Strategy (HCCREMS) identifies some of the key impacts of climate change on the Hunter and Central Coast regions, including increased sea levels, higher average and extreme temperatures, and increased intensity and frequency of extreme events, including storm events.

Given the geography of the coastal zone, with a significant portion of land adjacent to the coast, estuary, and channel being relatively low-lying, a key concern is sea level rise. With the lake being connected to the open coast, the issue broadens to also include lake level rise.

In 2009, The Department of Climate Change (2009) (now the Department of Industry, Science, Energy and Resources) identified the local government areas of Lake Macquarie, Wyong, Gosford, Wollongong, Shoalhaven and Rockdale as having the greatest risk of inundation from sea level rise (to 1.1m) collectively representing over 50 per cent of residential buildings at risk in NSW. It was determined that between 5100 and 6800 buildings in the Lake Macquarie LGA may be affected by sea level rise and storm tide inundation by 2100, with the upper range representing approximately 10 per cent of the 2009 residential building stock.

The 2016 NSW Estuary Tidal Inundation Exposure

Assessment identified that "on a proportion-of-area basis, the Central Coast region is the most exposed in the state and Lake Macquarie is the most exposed individual estuary. Overall, the Hunter and Central Coast regions contribute 18 per cent each to the statewide exposure across all scenarios. Here extensive development has occurred on the low-lying areas adjacent to the coastal lake systems" (OEH 2016).

Inundation (CM Act – Coastal Hazards D, F & G)

The 2012 Lake Macquarie Waterway Flood Risk Management Study and Plan identified a number of areas around the lake already experiencing the effects of inundation and property damage and highlighted the need to plan for projected sea level rise.

Council currently has a Waterway Flooding and Tidal Inundation Policy that sets a planning level benchmark of 2.82m Australian Height Datum (AHD) for the year 2100. This factors in a 1:100-year lake flooding event (inundation heights are impacted by both elevated ocean conditions coincident with heavy catchment rainfall) with a sea level rise of 0.9m by 2100. Coastal hazard and risk studies are based on these adopted levels. However, with the ongoing review of climate change projections, the understanding of coastal risks also changes. The CMP will be reviewed in 10 years to ensure development of the most suitable solutions, based on current advice from the Intergovernmental Panel for Climate Change (IPCC) and Federal and State Governments.

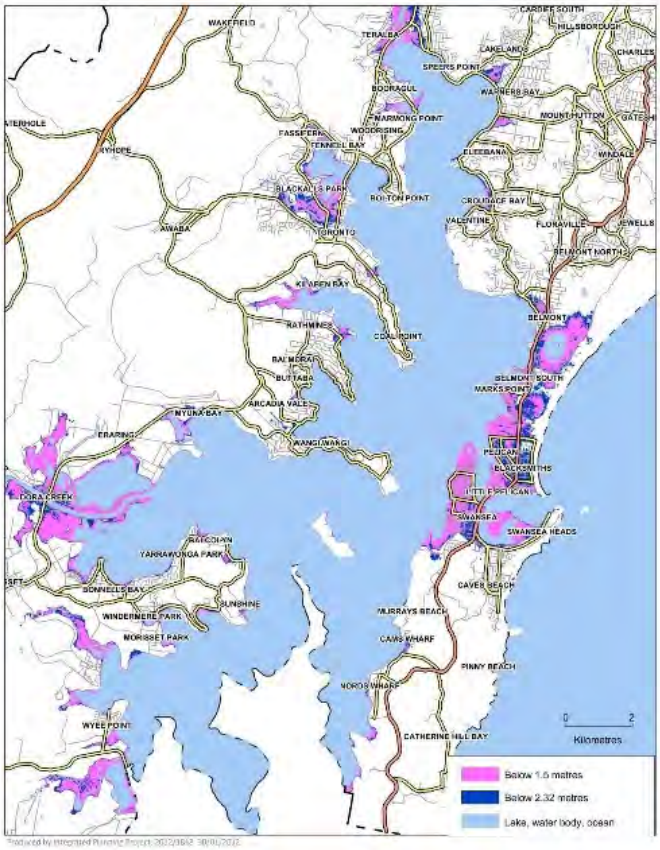


Figure 11: Low-lying areas affected by inundation

		CURRENT RISK			FUTURE RISK 2040			FUTURE RISK 2070			FUTURE RISK 2120		
		Estuary	*Coastline*	*Swansea Channel*	*Estuary*	*Coastline*	*Swansea Channel*	*Estuary*	*Coastline*	*Swansea Channel*	*Estuary*	*Coastline*	*Swansea Channel*
	Threat	Risk L, M, H, E	Risk L, M, H, E	Risk L, M, H, E	Risk L, M, H, E	Risk L, M, H, E	Risk L, M, H, E	Risk L, M, H, E	Risk L, M, H, E	Risk L, M, H, E	Risk L, M, H, E	Risk L, M, H, E	Risk L, M, H, E
	ENVIRONMENT												
1	Ecosystem impacts from climate change and coastal hazards	Medium	Medium	High	High	Extreme	High	Extreme	Extreme	Extreme	Extreme	Extreme	Extreme
2	Water quality impacts	High	Low	Low	High	Low	Low	High	Low	Low	High	Low	Low
3	Catchment vegetation modifications	High	Medium	Medium	High	Medium	Medium	High	High	Medium	High	High	Medium
4	Waterway modifications	High	Medium	High	High	Medium	High	High	Medium	High	High	Medium	High
	SOCIAL AND ECONOMIC												
5	Social and economic impacts from climate change and coastal hazards	High	High	Extreme	High	High	Extreme	High	High	Extreme	Extreme	High	Extreme
6	Water quality impacts	High	High	Medium	High	High	Medium	High	High	Medium	High	High	Medium
7	Access to marine estate	Medium	Medium	Medium	High	High	High	High	High	High	High	High	High
8	Governance	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium

Table 4: Assessment for current and future risks to the coastal zone

Council uses the following water levels and associated controls to manage inundation hazards:

Level	Measure	Basis of Calculation	Planning & Development Conditions
0.10 mAHD	Year 2011 lake mean still water level	Approx 30 years lake tide gauge average (Flood Study – Reference 6)	
< =1.00 mAHD	Below Year 2100 lake mean still water level	Hazard to land use, infrastructure, buildings, and services from progressive rise in permanent lake levels to Year 2100	High hazard permanent lake inundation area and high hazard lake flood area (flood fringe)
1.00 mAHD	Year 2100 lake mean still water level	Year 2011 lake level + 0.9 m sea level rise	
1.23 mAHD	Year 2011 20 year Annual Recurrence Interval (ARI) flood	Flood Study – Reference 6	
< =1.50 mAHD	Below Year 2011 100 year ARI flood	Assessment of depth/velocity of Year 2100 100 year ARI flood and other hazard factors	High hazard lake foreshore area (flood fringe)
1.50 mAHD	Year 2011 100 year ARI flood	Flood Study – Reference 6	
1.61 mAHD	Year 2050 20 year ARI flood level	Flood Study – Reference 6	Flood planning level for non- habitable buildings with Year 2050 asset life
1.50 mAHD – 2.32 mAHD	Between high hazard flood level and Year 2100 100 year ARI flood level		Low hazard lake foreshore area (flood fringe)
1.86 mAHD	Year 2050 100 year ARI flood level	Flood Study – Reference 6 – includes 0.4 m sea level rise	
2.10 mAHD	Year 2100 20 year ARI flood level	Flood Study – Reference 6 – includes 0.9 m sea level rise	Flood planning level for non- habitable buildings with Year 2100 asset life
2.32 mAHD	Year 2100 100 year ARI flood level	Flood Study – Reference 6 – includes 0.9 m sea level rise	Flood planning level for habitable buildings with Year 2050 asset life
2.36 mAHD		Year 2050 Flood Planning Level	Year 2050 100 year ARI flood level + 0.5 m freeboard
2.45 mAHD	Year 2011 Probable Maximum Flood (PMF)	Flood Study – Reference 6	
2.81 mAHD	Year 2050 PMF	Flood Study – Reference 6 – includes 0.4 m sea level rise	
2.82 mAHD	Year 2100 Flood Planning Level	Year 2100 100 year ARI flood level + 0.5 m freeboard	Flood planning level for habitable buildings with Year 2100 asset life
<=3.00 mAHD	Year 2100 Flood Planning Level “rounded up”	Year 2100 100 year ARI flood level +0.5 m freeboard “rounded up” to allow for plus-or-minus 0.15 m margin in aerial survey	Nominated as “flood control lot” for purposes of Exempt and Complying Development Codes SEPP
3.27 mAHD	Year 2100 PMF	Flood Study – Reference 6– includes 0.9 m sea level rise	Flood planning level for “sensitive development” such as hospitals, aged-care facilities

Table 5 Lake Macquarie waterway levels relating to sea level rise

Local adaptation planning

One of the key recommendations of the CZMP and Lake Macquarie Waterway Flood Risk Management Study and Plan was to prepare Local Adaptation Plans (LAPs) for priority areas/catchments to guide future decisions by Council and the community in adapting to climate change.

A LAP was developed for Marks Point and Belmont South in 2016 (Marks Point & Belmont South LAP) that outlined methods to manage the risk of current and future flooding and permanent tidal inundation resulting from rising lake levels. The LAP provided residents with increased certainty about future development in the area and included a range of measures, including raising and improving the design of infrastructure such as drains and roads, constructing new buildings with floor levels above projected flood levels and raising homes if required.

In 2021, a LAP for Swansea and surrounds was prepared to help the community to plan for the worst and act when necessary in response to flooding and sea level rise (Swansea and surrounds LAP). The intent of this LAP is for actions to be trigger-based, particularly for larger, complex and/or costly actions. That is, actions can be planned and implemented depending on whether they are triggered by an event, such as rising water levels which reach a predefined threshold. Trigger-based action will avoid maladaptation, and actions will be implemented when and where necessary. The preparation for these actions should be completed in advance; i.e. 'shovel-ready' actions.

The LAP includes 30 actions ranging in scale and complexity. Some actions can be managed within Council's existing operational frameworks, while others require extensive planning, stakeholder engagement, analysis, design and even piloting to understand the technical, social, ecological, and/or economic feasibility and suitability.

There are two timescales:

- **10-year action plan**
  During the first 10 years of this LAP, there are no actions that are expected to be triggered by rising sea levels. This is mostly because climate change and sea level rise occur over a longer period. This 10-year action plan is the first stage of a longer-term strategic plan to adapt to climate change and sea level rise.
- **Longer-term strategic plan**
  In the longer term, trigger values will play an important role in determining when actions will be implemented as rising water levels begin to have a larger impact on these communities. Triggers for the hazard of flooding and sea level rise were adopted for the purposes of the economic feasibility study as shown in Table 2.4. In the future, if a specific flood event (e.g. 10 per cent Annual Exceedance Probability (AEP), one per cent AEP etc.) reaches the base of a property or asset, this would trigger an action to raise the land and asset. The triggers used in the economic feasibility study will be reviewed and updated as part of the 10-year action plan.

Option	Trigger to raise land
AC1 - Raise and fill residential areas (house sites and yards)	10% AEP
AC2 - Raise transport infrastructure (over and above gradual raising of roads through maintenance)	this option was not trigger based – requires investigation
AC3 - Raise other infrastructure (power, water, sewer, stormwater, telecommunications)	This option was not trigger based – requires investigation
AC4 - Raise and fill education land (schools)	1% AEP
AC5 - Raise and fill public recreation land such as foreshore reserves and playing fields	This option was not trigger based – requires investigation
AC6 - Raise and fill Swansea Holiday Park	**18% AEP**
AC7 - Raise and fill commercial land in the Central Business District (CBD)	**1% AEP**

For further details on options in table above *please see the economic feasibility study undertaken as part of the LAP (The CIE, 2020) .*

AEP = Annual Exceedance Probability and means the probability (%) an inundation event (m AHD) would occur in any year.

Table 6: Triggers addressing inundation in Swansea & surrounds LAP

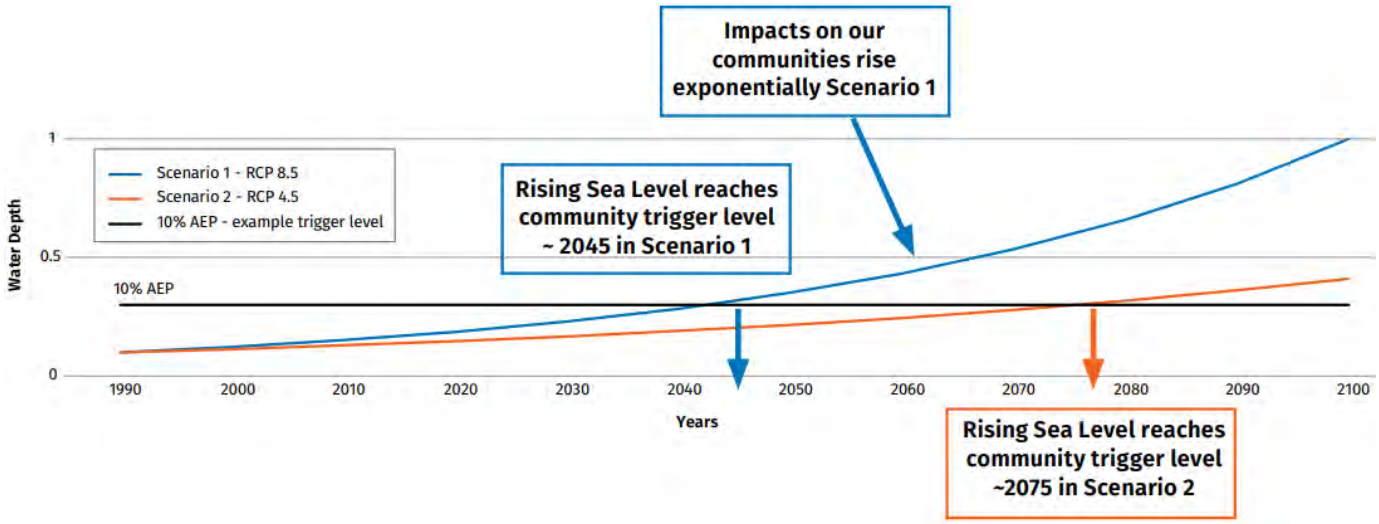


Figure 12: Longer term triggers

***Coincident/combined flooding and inundation** (CM Act – Coastal Hazard G)*

In 2019, Council commissioned a detailed technical assessment of flooding in the LAP area around the entrance channel suburbs of Pelican, Blacksmiths and Swansea.

The assessment assisted in understanding the likelihood of flooding and addressed the requirements of the NSW Coastal Management Framework. This assessment, called a Probabilistic Hazard and Damages Assessment (PHA) was carried out to determine the probability of lake flooding, ocean flooding and the combination of lake and ocean flooding.

The PHA developed a statistical model using historical data and best practice methods for the assessment of catchment flooding and ocean modelling to predict future lake and channel water levels between 2020 and 2120.

The model provided a list of water levels over time for hydraulically similar areas. Additionally, potential damages at 2020, 2040 and 2070 were presented for a range of public and private assets.

Beach erosion and coastal recession
(CM Act – Coastal Hazards A & B)

During severe storms or a series of storms, increased wave heights and elevated water levels result in wave attack of the beach berm and foredune region. Storm events generate transport of sand offshore, with sand eroded from the beach face and transported to the seabed to form a sand bar roughly parallel to the shoreline. Sand is also transported along-shore (i.e. along the beach) either up-coast or down-coast depending on wave direction.

The result is erosion on the beach face that may pose a hazard to back beach land and assets. The short term storm related cross shore sand transport and longshore drift occur simultaneously. Their effects are additive, although the beach itself (above mean sea level) will erode predominantly during storm events.

Beach accretion may occur where longshore transport brings in more sand than is taken away. Shifts in transport direction can also result in a shift in sand from one end of the beach to the other and a slight change in beach alignment between the controlling headlands. During calmer weather, sand slowly moves onshore from the nearshore bars to the beach, forming a wave built berm under the action of swell waves. From the berm, wind blows sand to form incipient dunes and foredunes.

As part of developing Lake Macquarie's CZMP, BMT WBM (2015) assumed the average net regional longshore sediment transport rate to be approximately 20-30,000 m^3/year in Newcastle. The studies indicated clearly a northwards net littoral transport under the predominant south easterly waves at beaches south of the Hunter River, and it is assumed this would also be the case along the Lake Macquarie coast. For Lake Macquarie, a regional longshore transport rate of 21,000 m^3/year was adopted as the upper limit scenario.

The severity of wave attack at the dune is dependent on wave height, elevated water level (the combination of tide, storm surge and wave setup) and preceding beach condition (i.e. if the beach is accreted or eroded prior to the storm). In addition, depending on the orientation of the coastline relative to the direction of the incoming storm, the beach may either experience unimpeded wave power and severe erosion, or may be shadowed and protected from incoming wave energy.

Beaches can be subject to longer term trends of erosion or accretion associated with the gradual net removal or addition of sand to the active nearshore profile. Long term recession is frequently associated with a longshore sediment transport differential, where the supply of sediment into the system is less than the sediment losses from the system.

Recession of the shoreline is also expected to occur in response to sea level rise. In this case, there is an upward and landward translation of the entire beach and dune position as the shoreline reaches a new equilibrium with the new sea level position.

Immediate Beach Erosion Hazard	Almost Certain	Unlikely	Rare
Catherine Hill Bay (+Moonee, Pinny, Stinky Pt & Dudley)	25 m	40 m or limit of bedrock	65 m or limit of bedrock
Caves, Hams (+Crabs)	20 m	50 m or limit of bedrock	75 m or limit of bedrock
Blacksmiths Beach	20 m	65 m	85 m
Redhead Beach	40 m	100 m	140 m

Table 7: Adopted immediate beach erosion extents

The Lake Macquarie Coastal Zone Management Plan (2015) also took into consideration the effects of climate change in each of the three study areas: the open coast, the estuary, and the channel, with the objective to encourage and promote plans and strategies for adaptation in response to coastal climate change impacts. In evaluating the three zones in the CZMP, climate change considerations were made in assessing the coastal hazards, with parameters such as rainfall intensity and frequency, sea level rise, change in storm waves, and change in wave direction.

The CZMP also included triggers for enhanced management intervention along the coastline.

Table 8 below provides an overview of proposed change action triggers for development along the coastline of Lake Macquarie.

Type of development	**Triggers for enhanced management intervention**		**Explanation**
	Commence planning for management change (Risk is increasing)	**Commence on ground works (Risk of continuing current management is unacceptable)**	
Major infrastructure	Immediately, with reviews at five-year intervals until the 'commence on-ground works' trigger condition is met.	When actual coastal recession reaches the 2050 Coastal Risk planning Line (2050 'unlikely' hazard line) as currently mapped.	Long term planning is required because of complexity of issues and significance to community wellbeing; extremely high investment required (e.g. for waste water treatment plant or Swansea Channel training walls – see also Part C), so long term budget planning also required.
Local roads, water supply and sewerage reticulation	When actual erosion or recession reaches 2050 Coastal Risk Planning Line (2050 'unlikely' hazard line) as currently mapped.	When actual erosion and recession reaches the 2050 'rare' hazard line, or is no more than 15m from the infrastructure alignment; or the infrastructure is inundated by marine processes during events estimated to have a one in 20-year recurrence interval; or infrastructure reaches its asset life.	These assets service existing development. The triggers are intended to recognise the costs of maintaining functioning infrastructure in situ, as opposed to relocating/ redesigning at the end of the assets life.

Type of development	Triggers for enhanced management intervention		Explanation
	Commence planning for management change (Risk is increasing)	Commence on ground works (Risk of continuing current management is unacceptable)	
Existing dwellings	When actual erosion or recession reaches the 2050 Coastal Risk Planning Line (2050 'unlikely' hazard line), as currently mapped; or the property is inundated by marine processes having a one in 20-year recurrence interval	When actual erosion or recession escarpment is no more than 20m from the dwelling; or the dwelling is inundated by marine processes at intervals of less than two years.	New dwellings can have consent conditions linked to the triggers. For existing development, the consent provisions cannot be used. However, a similar trigger for retreat would apply because the dwelling would cease to be occupiable.
Other existing buildings (commercial and industrial)	When actual erosion/ recession reaches the 2050 Coastal Risk Planning Line; or the property is inundated by marine processes having a one in 20-year recurrence interval.	When actual erosion or recession is no more than 20m from the building.	As above
Recreation infrastructure such as pathways, lookouts	Review of designs should commence immediately, to allow the seaward toe of access ways to adjust. Emergency closures should commence immediately, when required for safety.	Review situation at intervals of ten years or at asset life/major review. Relocate landward as necessary and feasible, when the erosion or recession reaches to no more than 5m (along the beach) pathways and lookouts.	The triggers are linked to expected asset life of this infrastructure.
Recreation infrastructure – facilities in coastal reserves	Review of landscape plans should commence immediately, to incorporate dune enhancement works and appropriate access ways. Locate picnic facilities, new amenities etc. landward of the immediate Coastal Risk Planning Line.	Review landscaping plans and designs of facilities with asset life of these facilities – likely to be at ten-year intervals.	Trigger is linked to asset life of facilities in public reserves and to review periods for Plans of management for reserves.
Private recreation – Belmont Golf & Bowls	Planning for fairway and green design and planting that accommodates coastal processes should commence now and be gradually introduced.	Seaward parts of the course would be abandoned when the cost of maintaining fairways and greens exceeds the value obtained from use. Likely to be linked to sand and/or wave inundation of the seaward part of the golf course at intervals of not more than two years. Indicatively, this could occur by 2050.	Trigger to be confirmed by Golf Club executive and members.

Table 8: Triggers for enhanced management intervention for the Lake Macquarie coastline

Coastal Risk Planning Lines and periods for development controls

Since 2016, Council has implemented planning controls for certain types of development in areas seaward of the 2050 and 2100 Coastal Risk Planning Lines. These planning controls are consistent with the NSW government guidelines for land use planning in coastal risk areas. The aim of these controls is to limit the risks for land holders and also limit emergency response requirements during severe coastal storms that drive rapid erosion and cause inundation from wave overtopping of frontal dunes.

Council's planning controls are based on the asset life of different types of development, whether infrastructure provides a critical service for community wellbeing, and the sensitivity of the land users. Table 9 shows the Coastal Risk Planning Line relevant to different types of development.

Land use	Estimated asset life	Relevant Planning Line	Rationale
Critical utilities:	100 years	2100 (rare)	These are major infrastructure developments, and once in place, the assets are difficult to retrofit or relocate without major disruption. Community risk from disruption of services due to erosion impacts is very high, with many people affected.
Essential community facilities (e.g. Hospitals, hospices)	100 years	2100 (rare)	These facilities have a long asset life and provide services for the frail, ill or elderly. Very high emergency management requirements if the facilities are impacted by an erosion or inundation event.
Aged care facilities (e.g. Nursing homes, hostels)	100 years	2100 (rare)	These facilities have a long asset life and provide services for the frail, ill or elderly. Very high emergency management requirements if the facilities are impacted by an erosion or inundation event.
Subdivision	100 years	2100 (unlikely)	New subdivisions provide the planning context and direction for subsequent development.
Medium density housing	100 years	2100 (unlikely)	These are more complex developments and have a higher density than single unit dwellings, so risks are higher
Seniors housing	100 years	2100 (unlikely)	These are more complex developments and have a higher density than single unit dwellings, so risks are higher
Mixed use development	100 years	2100 (unlikely)	These are more complex developments and have a higher density than single unit dwellings, so risks are higher
Dual occupancies	50 years	2050 (unlikely)	Dwelling footprint of new dual occupancy dwellings (i.e. dwellings that are replacing an existing dwelling or are infill development in an existing subdivision)
Residential (single dwellings)	50 years	2050 (unlikely)	Dwelling footprint of new dwellings (i.e. dwellings that are replacing an existing dwelling or are infill development in an existing subdivision)
Commercial/ retail/industrial	50 years	2050 (unlikely)	In general, such development will require large area slab foundations, so it is difficult to adapt to climate change impacts over time.
Tourism development	50 years	2050 (unlikely)	E.g. Hotels, resorts or other tourism-based development

Land use	Estimated asset life	Relevant Planning Line	Rationale
Private recreational buildings and facilities	50 years	2050 (unlikely)	E.g. RSLs, bowling club buildings, golf course club houses, golf courses, tennis courts, bowling greens
Public recreational facilities	40 years	Immediate (unlikely) (Note: Structures that provide an essential access for safety purposes, can be located seaward of the Immediate Planning Line)	E.g. Parks, public open space/recreation, cycleway/ shared pathways, lifeguard towers

Table 9 Coastal Risk Planning Lines and periods for development controls

Refer to Appendix 6 for a map showing Planning Lines for the Lake Macquarie coastline.

Coastal inundation due to wave overtopping (CM Act – Coastal Hazard D)

Stage One of the development of the CMP (scoping study) identified wave overtopping as an information gap. During Stage Two of the CMP, a Wave Overtopping Assessment was prepared. Refer to section 4.3.1 for details on this assessment.

Impacts of sea level rise on wetlands (CM Act – Coastal Hazards F and G)

In 2010, an inventory of all low-lying wetlands in Lake Macquarie LGA was compiled from existing data and field investigation. This inventory was then used to analyse the likely impacts of sea level rise on wetlands (up to the 90cm benchmark adopted by the NSW Government at the time) and these wetlands' capacity for retreat.

The results of the sea level rise analysis indicated that approximately 680ha or 28 per cent of the current extent of low-lying wetlands will be inundated with 90cm sea level rise by 2100. However, the impact of sea level rise differs greatly between wetland types. Spatially, the areas to experience the most significant inundation of wetlands are Dora Creek, Cockle Creek, the eastern coastal areas around Swansea and low lying lake foreshore areas. Saline wetlands are likely to be the most affected. Wetlands that occur at higher elevations were predicted to experience less frequent saltwater inundation and therefore ere at lower risk of material changes to existing status (Umwelt, 2015).

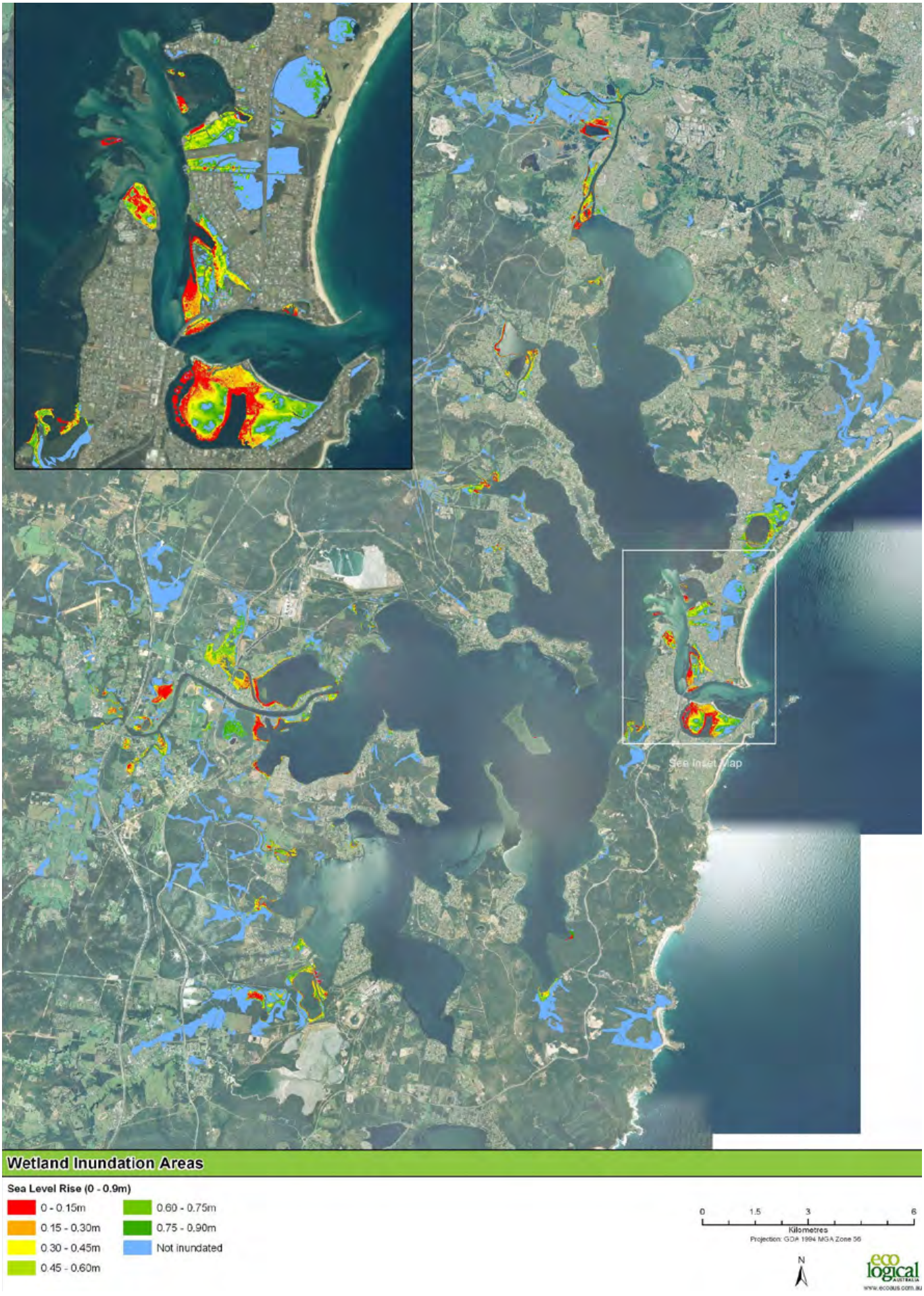


Figure 13: Potential wetland inundation areas

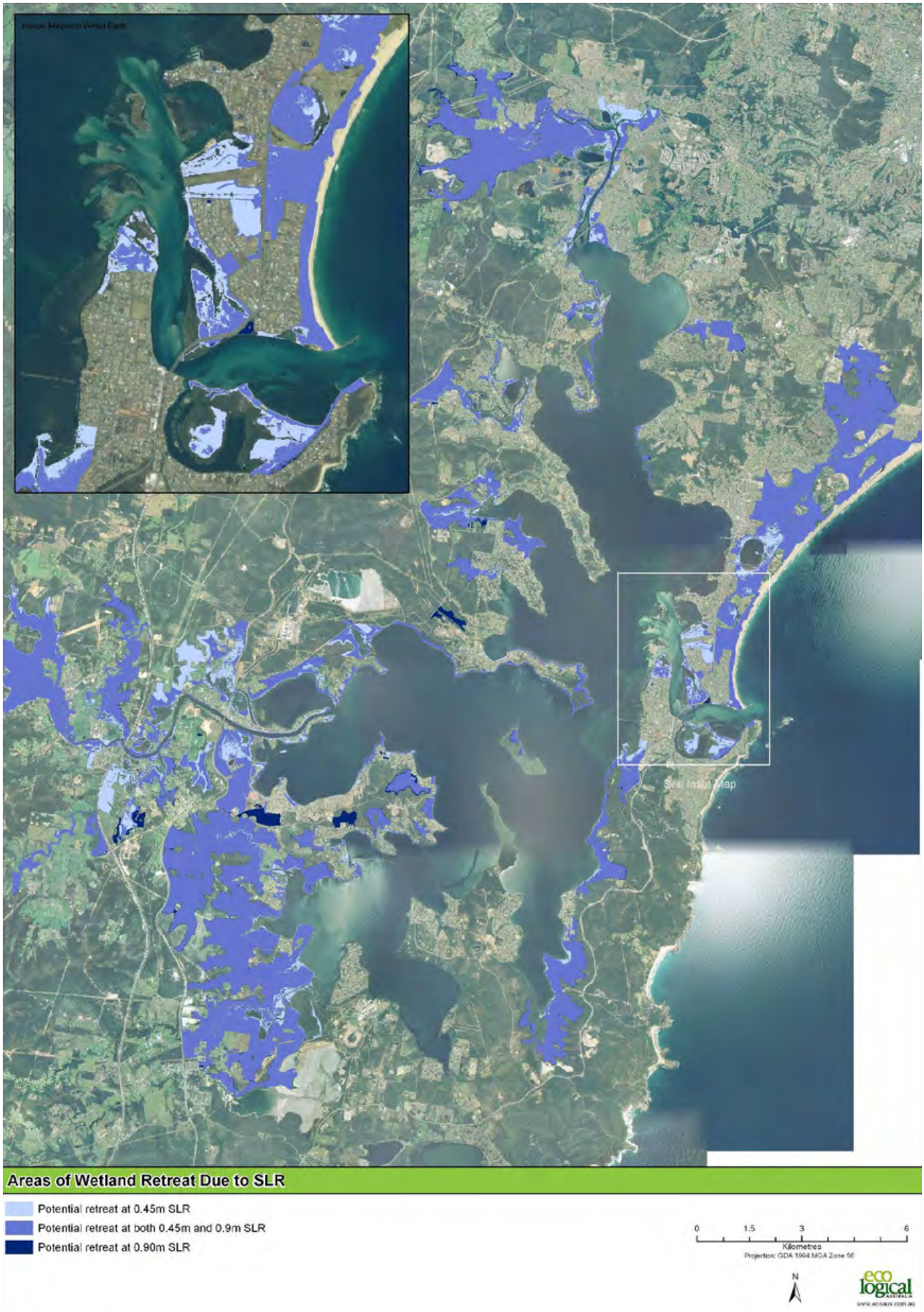


Figure 14: Potential wetland retreat areas

Wetland communities may have the capacity to retreat (upslope) from rising sea levels, such that some or all of their current aerial extent is preserved. For most wetland types, the potential retreat area is over 10 times greater than the area that will be inundated with sea level rise. There is potential for wetlands to migrate upslope as sea levels rise, and some climate change impacts may be able to be mitigated with the exception of mangroves.

The potential retreat areas in Lake Macquarie are concentrated in three main locations – in the coastal dune system around Belmont, along the floodplain of Cockle Creek and in the south-western foreshore and floodplain of Lake Macquarie around Morisset and Wyee Point. These regions are the largest patches of vegetation at low elevation (Eco Logical Australia, 2010).

Saltmarsh is particularly vulnerable to the impacts of sea level rise due to its position in the landscape and the nature of saltmarsh as a community. Saltmarsh requires particular gradients, salt to maintain a competitive advantage and a location in the intertidal range. It is vulnerable to threats such as weed invasion, fire and fragmentation. It is also readily invaded by mangroves in dynamic estuarine situations.

Coastal cliff and slope stability
(CM Act – Coastal Hazard E)

The hazards posed by coastal cliff instability have been previously assessed in the CZMP and other studies including: Preliminary Landslide Risk Zoning of Coast Line Cliffs and Slopes (RCA 2013) report, Coastal Cliff Stability and Safety Assessment (Cardno 2015) and Geotechnical Assessment - Clifftop Stability in High Hazard Coastal Locations (Cardno 2017).

The focus of these studies has been locations at Redhead Bluff, Swansea Head, Caves Beach South, Spoon Rocks South, Middle Camp Beach centre headland and Catherine Hill Bay south headland.

Council manages these hazards through the application of Coastal Planning Lines (Appendix 6) which include identified cliff stability hazards in the immediate planning line. As a result of the CZMP, work was undertaken to reduce hazards at several priority locations with the installation of safety fencing, rockfall catch-fences, access controls and safety signage (noting that ongoing works will be required to maintain and upgrade measures into the future).

Entrance channel stability and evolution (CM Act – Coastal Hazard C)

Research indicates that over time, Swansea Channel will deepen and widen, increasing tidal inflows so the tidal range in Lake Macquaire (the hight of high and low tides) will become more similar to the ocean.

The geology, geomorphology and future evolution of Swansea Channel has been the subject of significant study over many years. A summary of historical information was compiled in the Swansea Channel Hazard Study and Risk Assessment (BMT 2015) that informed the CZMP. This included information on the ongoing increase in depth and width of the channel as it evolves to reach equilibrium with the configuration of the entrance breakwaters, which are generally accepted being constructed too far apart.

A series of papers has been published by Nielsen and Gordon (2008, 2011, 2015, 2017), dealing with the stability and behaviour of the trained entrances to lake systems along the NSW coast, including Lake Macquarie. Nielsen & Gordon (2008) stated that: *Without geomorphological constraints, the channel area could continue to scour some five-fold, allowing for the tidal range in the lake to reach 77 per cent of the full ocean tidal range, at current rates of change, this could take some 650 years.*

Watterson et al. (2010) undertook numerical modelling of Swansea Channel to study how it may respond to sea level rise. They found that the tidal range in the lake could double by 2100, with a sea level rise of 0.91m, corresponding to a tidal prism increase of 225 per cent.

The work by Nielsen and Gordon and Watterson et al. has generally agreed that:

- the "stable equilibrium" entrance cross sectional area is around 5000-8000m^2
- at this stable equilibrium area, the tidal range in Lake Macquarie will be close to that in the ocean

Further analysis was undertaken by Wainwright et al. (2022) as part of the Pelican Foreshore Stabilisation Project, including recalculation of parameters affecting the modelled rate of channel evolution, particularly the potential of morphological change to accelerate in a strongly non-linear manner.

This work indicates: *With the analysis presented here that at recently measured or 'current' rates of change, the entrance would take hundreds of years to evolve to its so-called equilibrium. Based on the data presented here, we would estimate a value of around 480 years if current rates are followed. The issue with this assessment is that, as velocities through the channel increase, morphological change will accelerate in a strongly non-linear manner, as represented by the model of Larson et al. (2020). When the acceleration is considered, a five to six-fold increase of the channel area could be expected within a substantially shorter period based on the present analysis.*

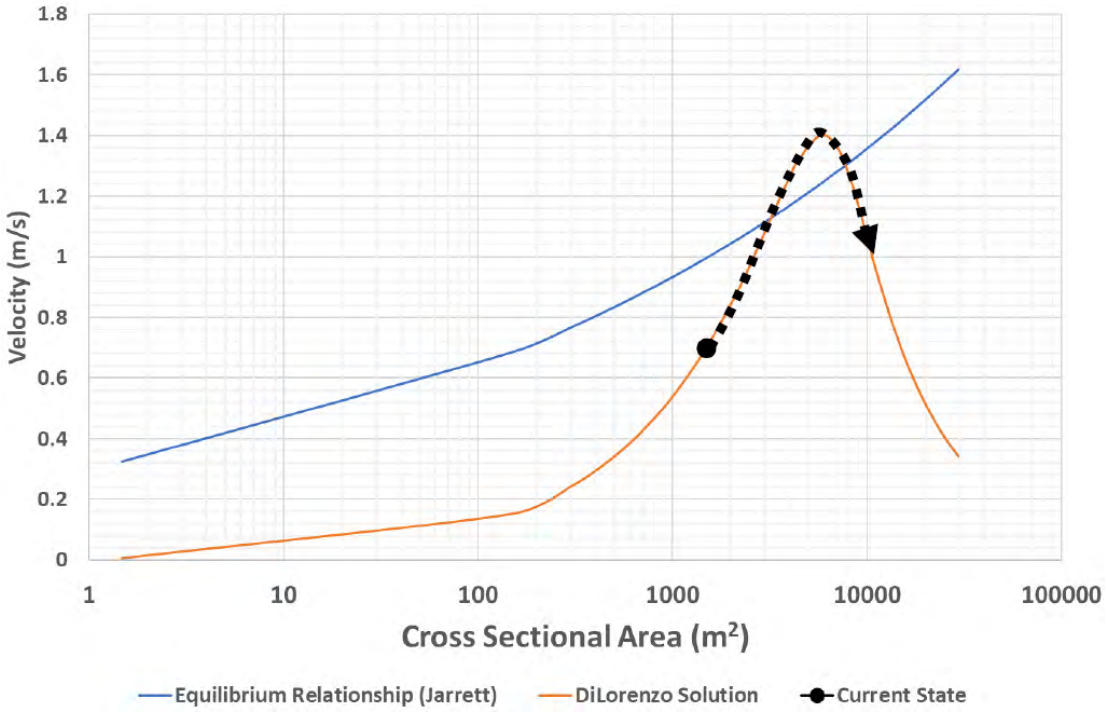


Figure 15: Escoffier diagram (using DLorenzo's method and Jarrett's relationship) for Swansea Channel *(Source: Salients 2021)*

Further information on the evolution of the channel is detailed in the **Pelican Foreshore Stabilisation project**.

3.3 Coastal Zone Emergency Action Subplan

Council is required to develop a Coastal Zone Emergency Action Sub-Plan (CZEAS) under Clause 15(1)(e) of the CM Act. The CZEAS forms part of this CMP and is included in full as Appendix 5.

The purpose of a CZEAS is to identify and facilitate the implementation of appropriate emergency responses for coastal hazard related emergencies. The aims of the plan are to:

- protect human life and public safety
- minimise damage to property and assets
- minimise impacts on social, environmental and economic values
- not create additional hazards or risks

Clause 15(3) of the CM Act specifies:

A CZEAS is a plan that outlines the roles and responsibilities of all public authorities (including the local council) in response to emergencies immediately preceding or during periods of beach erosion, coastal inundation or cliff instability, where they occur through storm activity or an extreme or irregular event. For the purposes of this CZEAS, those roles and responsibilities include the carrying out of works for the protection of property affected or likely to be affected by beach erosion, coastal inundation or cliff instability.

A CZEAS must identify any requirements for how emergency coastal protection works, within the meaning of the State Environmental Planning Policy (Resilience and Hazards) 2021 (R&H SEPP), are to be carried out. Clause 19(4) of the R&H SEPP defines emergency coastal protection works to mean '*works comprising the placement of sand, or the placing of sandbags, for a period of not more than 90 days, on a beach, or a sand dune adjacent to a beach, to mitigate the effects of coastal hazards on land*'.

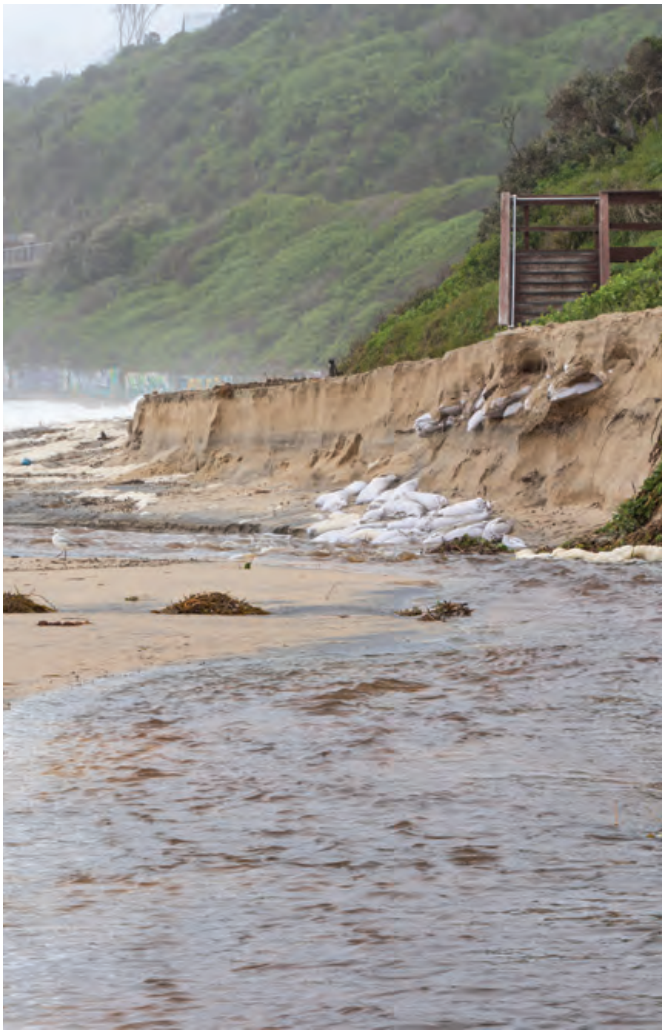
The CZEAS has been prepared to facilitate effective emergency responses by:

- defining a coastal emergency and triggers for emergency response actions
- identifying the locations that may be affected by beach erosion, coastal inundation or cliff instability that would constitute a coastal emergency
- outlining the roles and responsibilities of all public authorities (including Council) and coordinating their response to emergencies immediately preceding or during periods of beach erosion, coastal inundation and cliff instability
- identifying the locations and types of works that may be undertaken for the protection of property and assets
- outlining what actions are to be undertaken in the prevention, preparation, response and recovery phases of emergency management
- informing the public and potentially affected property owners about their responsibilities during a coastal emergency and what actions they are and are not permitted to undertake.

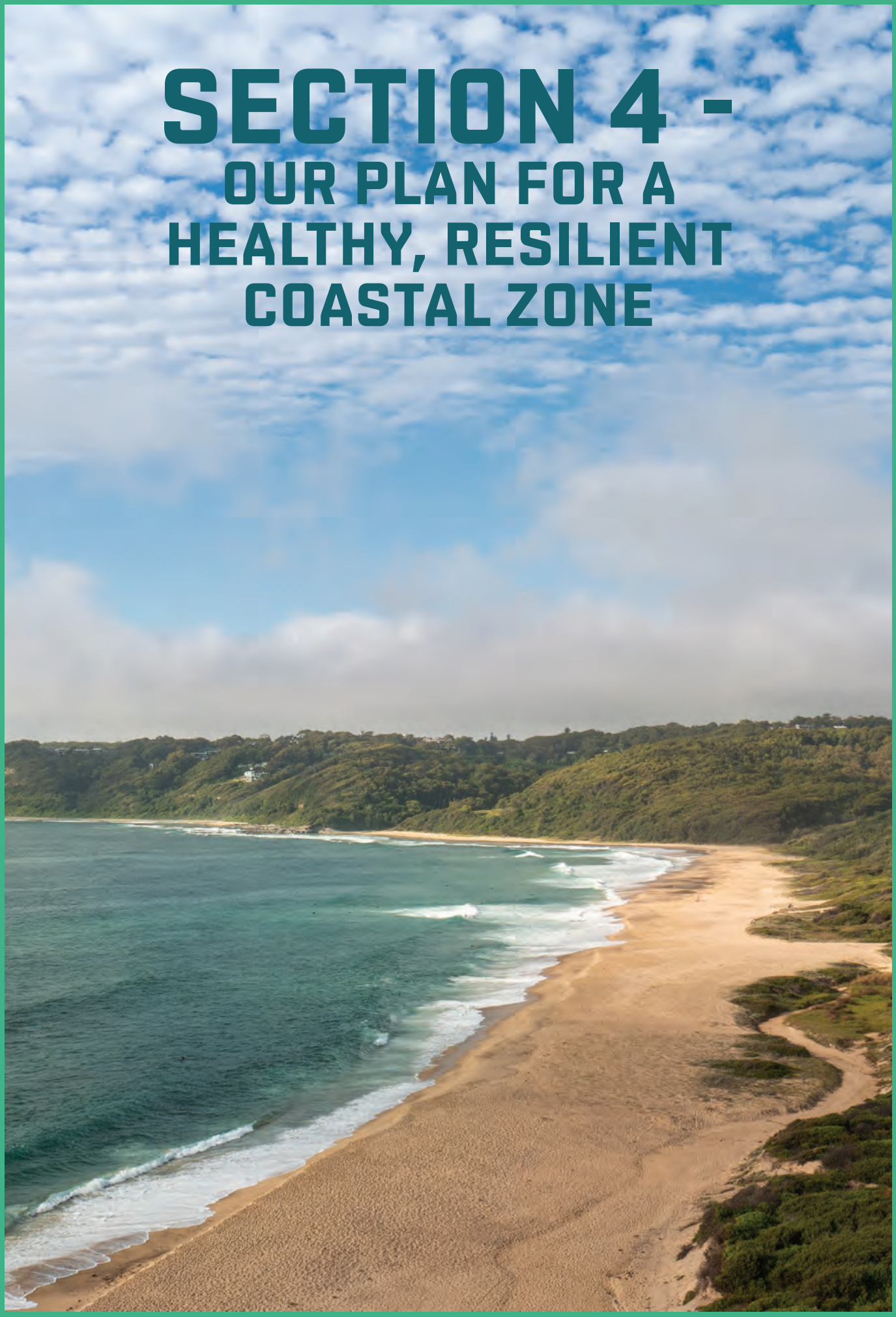
This plan does not include:

- matters dealt with in any plan made under the *State Emergency and Rescue Management Act 1989* (SERM Act) in relation to the response to emergencies
- proposed actions or activities to be carried out by any public authority or relating to any land or other assets owned or managed by a public authority, unless the public authority has agreed to the inclusion of those proposed actions or activities in the program.

See Appendix 5 for further details.



SECTION 4 -
OUR PLAN FOR A HEALTHY, RESILIENT COASTAL ZONE



4.1 Preparing the CMP

Council's approach to preparing the CMP is outlined below.

STAGE 1
Identify the scope of CMP

STAGE 2
Determine risks, vulnerabilities and opportunities

STAGE 3
Identify and evaluate options

STAGE 4
Prepare, exhibit, finalise, certify and adopt the CMP

STAGE 5
Implement, monitor, evaluate and report

Stage One

The scoping study prepared as part of Stage One of the CMP was completed in December 2020 and is provided in Appendix 2.

Stage Two

During Stage Two, a wave overtopping assessment for the coastline and a surf amenity assessment for Blacksmiths Beach were carried out. A State of the Estuary Report was also completed, and a water level analysis. Refer to section 4.3.

Recommendations and identified options from these studies have been considered and incorporated into the Implementation Plan.

Stage Three

Stage Three of the CMP involved the identification and evaluation of options. A detailed options evaluation process was undertaken with the assistance of Umwelt and is provided in Appendix 8.

This process was undertaken to fulfil the mandatory requirements of the Coastal Manual, being:

- MR6(iii) During preparation of a CMP, a council is to evaluate and select coastal management actions (to address the most important risks)
- MR8(v) A CMP must identify how the coastal management actions have been considered and evaluated, including without limitation, how the council has evaluated the coastal management actions in light of the functions and responsibilities of council under legislation other than the CM Act.

Options were identified by reviewing the implementation status of CZMP actions, addressing issues and gaps identified in Stages One and Two and through consultation with the community and relevant stakeholders.

An evaluation of these options was then carried out. The aim of the evaluation was to determine if strategic actions offer good value for money. Where an action was modified from a previous management response, the evaluation should show how the new option offered better value for money than the previous approach.

The existing management of the coastal zone of Lake Macquarie, including management responses for risks in the main body of the estuary, the channel and for the open coastline, is the 'base case' for this assessment.

Short benefit statements have been prepared for all actions to describe the technical benefits provided by the action. In addition to these technical evidence benefits, Council's community satisfaction survey results provide evidence that investment in projects that protect, restore and enhance the natural environment is highly regarded by the community.

Coastal zone management (lake, foreshore, coastline) is identified as a very important service, with high levels of satisfaction. This management protects one of the most valued reasons for living in Lake Macquarie.

By identifying environmental concerns as a priority over the next decade, the community has recognised there are significant challenges for the coastal zone and ongoing investment in the health of coastal systems and the benefits they provide for the community, is important and supported.

The outcome of this evaluation has resulted in 114 priority actions identified in the CMP. These actions make up the Implementation Plan included as section 4.4.

Stage Three also involved the preparation of a business plan, which was prepared by Umwelt to meet the following mandatory requirements.

- MR8(x) A CMP must include a business plan
- MR9(i) The business plan must identify all proposed management actions identified elsewhere in the CMP
- MR9(ii) The business plan included in the CMP must identify the full proposed capital, operational and maintenance costs and recommended timing of proposed coastal management actions.

The business plan is detailed in section 4.5 and Appendix 4.

Stage Four

Stage Four is to prepare, exhibit, finalise, certify and adopt the CMP and associated documentation.

Community and stakeholder engagement

A Community Engagement Plan was prepared for Stages 1-5 of the Lake Macquarie CMP. Refer to Appendix 3 for details on engagement activities.

The stakeholder groups involved in preparation of the CMP included Council's Coastal Zone Management Committee and an external stakeholder group, with membership from:

- Hunter Water Corporation
- DPI Fisheries
- Marine Infrastructure Delivery Office
- Environment Protection Authority
- City of Newcastle
- NSW National Parks and Wildlife Service
- Sustainable Neighbourhood Groups
- Hunter Surf Life Saving
- Central Coast Council
- Local Aboriginal Land Councils
- Aboriginal traditional owners groups
- Roads and Maritime Service
- Belmont Wetlands State Park
- Transport for NSW
- Local environmental advocacy groups
- Department of Planning, Industry and Environment
  - Biodiversity and Conservation Division
  - Science, Economics and Environment division
  - Crown Lands

Council's online Shape Lake Mac platform was used to deliver updates, documents and studies to the community, with online workshops and presentations provided at key milestones and contribution points during Stages 1-4.

Aboriginal community groups (Land Councils and traditional owner groups) were contacted individually, seeking their comments and contributions to the CMP.

During Stage Two, an online meeting was held with the external stakeholder group to share findings from the studies carried out during this stage, with recommendations from the studies informing the actions developed in Stage Three. At each meeting of the Coastal Zone Management Committee, an update on the CMP was provided.

During Stage Three (October 2021), a series of external stakeholder workshops were held online to review the draft CMP actions for each area of the coastal zone. These workshops resulted in the generation of 30-40 new actions for inclusion, and amendments and additions to many existing actions. Identifying partners to implement each action was a significant part of this engagement.

Engagement with Council staff and elected representatives has occurred during preparation of the CMP. An internal interdepartmental working group was formed in Stage One of the CMP and this group has been involved with the risk assessment analysis and actions development and review.

Detailed discussions have occurred with other agencies identified as a lead or action partner to establish commitment and determine funding mechanisms.

The draft CMP was publicly exhibited from 29 November 2022 till 3 February 2023.

4.2 Principles for the Coastal Management Program

The following principles have been identified to assist in the formulation and evaluation of options and guide implementation.

Contribution to global sustainability

Council's Sustainability Policy commits us to making an equitable contribution to all aspects of sustainability (economic, environmental, social and sustainable governance) for the organisation and the city. It also commits us to demonstrate leadership by undertaking decision-making through the integrated framework of the United Nations Sustainable Development Goals.

Evidence based approach

Making informed decisions based on the best available evidence.

Focus on the causes

Determine the root cause of issues and make strategic decisions that address this cause rather than reactively addressing symptoms.

Build upon success of catchment management and soft engineering

For the past two decades, Council's approach to managing the estuary has been based on applying catchment management principles and soft engineering techniques. This approach has proven to be beneficial and is to be continually applied across the coastal zone.

Integrate coastal hazards and ecological health across the coastal zone

Where possible, management strategies should work to mitigate the impacts of coastal hazards and improve ecological health in an integrated manner.

Build on the success of local adaptation planning using a locally based, community co-design approach

Council's approach to climate change adaptation planning, based on embracing locally based community co-design principles, is well recognised as being highly successful, and should be applied to all aspects of coastal management, where feasible.

Build upon the success of community and volunteer engagement

Council has been successful in engaging and mobilising our community through programs such as Landcare and the Sustainable Neighbourhoods program. The benefits of community and volunteer engagement will be continually applied to coastal zone management.

Enhance Aboriginal involvement in coastal zone management

The Aboriginal and Torres Strait Islander community should be actively involved in decision making and management of the coastal zone.

Apply an adaptive approach

The dynamic nature and uncertainty involved in coastal environments and processes should be recognised, and adaptive strategies including monitoring, triggers and no-regrets actions developed to manage this uncertainty.

Embed climate change and circular economy principles

Consideration and incorporation of climate change and circular economy principles flow into decision making processes.

Recognise multiple benefits

The multiple benefits provided by coastal areas, including provision of essential ecosystem services, recreation, cultural, health, wellbeing and economic benefits, should be recognised when making decisions concerning management of the coastal zone.

Utilise the best available tools

Making use of the best available tools including technology, innovation, land acquisition, planning controls and economic analysis to manage the coastal zone, whilst recognising proven traditional approaches.

4.3 Stage Two studies

State of the Estuary Report

A State of the Estuary Report was compiled to summarise the findings of all relevant estuary research projects in Lake Macquarie, including analyses of trends in water quality in the lake, and recommendations for lake management.

Urban stormwater discharges from the fringing catchment and diffuse source runoff from the wider catchment are the largest ongoing threats to the ecological health of Lake Macquarie, and the benefits a healthy lake provides to the community.

The northern and western bay ends (e.g. Cockle Bay, Fennell Bay, Bonnells Bay, and Wyee Bay) are the most sensitive zones of the lake, with poor water quality (high nutrients and suspended sediments).

The central region of the lake is relatively resilient to nutrient enrichment due to the combination of relatively smaller catchment inputs, deep water and proximity to the ocean entrance.

This report also highlighted the need to recognise and respond to pressures placed on seagrass in the lake.

Wave overtopping assessment

The scoping study identified the need for an updated wave overtopping assessment for the Lake Macquarie coastline to fill current data gaps and to inform the development of management options during Stage Three.

Management options were assessed using a multi-criteria stakeholder analysis and key recommendations are as follows:

- Redhead Beach: continued monitoring of Nine Mile Beach will show whether the surf club relocation might need to be considered prior to the end of life of the surf lifesaving club.
- Belmont Wastewater Treatment Works/Pony Club site: medium-term option of fencing and formalising the access to the beach recommended. No immediate need to complete works.
- Blacksmiths residential area: issue of overtopping is not critically important, however is not to be ignored. Raising and formalising of low points in the dunes at Blacksmiths Beach to be considered in the first five years of the CMP.

Surfing amenity assessment

Blacksmiths Beach has a long surfing history and strong surfing culture. Swansea-Belmont Surf Life Saving Club was formed in 1927 and the Nine Mile Beach Surfboard Club was formed in 1965. Long-term surfers at Blacksmiths Beach have reported a decline in surf quality, leading to the creation of the community group 'Bring Blacksmiths Back'. The need to assess the surfing amenity at Blacksmiths Beach was identified during Stage One of the CMP.

Short-term options

For improved alongshore access, steep dune scarps can be reprofiled to a nominal angle of 34° (range 25°-40°). Subject to ecological and botanical expertise, vegetation of the seaward portion of the dunes should consider low density species. Dune cross-section and planform designs would be required.

Medium-term options

The following medium-term studies and actions were identified to further understand or improve surfing amenity at Blacksmiths:

- Investigate the feasibility of an artificial sand bar placement for future dredging campaigns
- Smart cameras to assist with monitoring changes to beaches and capturing extreme weather events
- Trial of drone based bathymetry monitoring (to understand the movement of sand banks)
- Ongoing monitoring and analysis of changes to beach landforms

Long-term options

- Investigate feasibility of a sand transfer scheme
- Consider surfing amenity in any breakwater alterations, which could arise due to damage, repairs or upgrade, noting that it is presently unlikely that removal (partial or complete) of the breakwater would be acceptable to the broader community.

Pelican foreshore stabilisation project

Pelican foreshore contains some of NSW's most vulnerable assets at risk from coastal erosion. In 2016, erosion resulted in the sudden collapse of the Pelican Marina complex, including the marina buildings, a restaurant, a business and a residential apartment. Assets currently threatened by ongoing erosion include several essential emergency service facilities (NSW Coastal Patrol, NSW Maritime/ Fisheries, Northern NSW's Rescue Helicopter) and recreational assets (including Lake Macquarie Airport, foreshore reserves, boat ramps etc). If left unchecked, ongoing eastward erosion will eventually threaten residential housing.

Figure 16: Collapse of Pelican marina complex - February 2016 (Source: S Walpole)

The cause of this erosion (ongoing migration of Swansea Channel) is becoming better understood as the form of the channel continues to enlarge to achieve a stable state to match the configuration of the entrance breakwaters (estimated to be a five to eight-fold increase of the current channel cross sectional area).

The largely unprotected stretch of foreshore at Pelican will continue to claim assets unless foreshore protection works are effectively designed, costed and installed. The high vulnerability of the Pelican area to sea level rise means various adaptation pathways must be considered. The Pelican Foreshore Remediation Project is a key management action in the Local Adaptation Plan for Pelican, Blacksmiths, Swansea, Swansea Heads and Caves Beach.

Since the collapse of the marina complex, studies have been completed to further understand the issue, including the formulation of probable hazard lines for foreshore erosion in this area, and the preparation of concept designs for protection works.

During conceptual design, Pelican foreshore was divided into four precincts to facilitate design and assessment, considering the uses and constraints of different lengths of foreshore. The precinct approach also provides for a staged approach to construction (based on a design philosophy of building stabilisation works between four 'fixed' points along the foreshore). Three separate options (schemes A, B and C) for each precinct were prepared, ranging from a 'minimalist approach' (scheme A) to a 'full protection approach' (scheme C).

Economic assessment of each of the options was undertaken through a cost benefit analysis that considered the probability of shoreline recession (based on the outcomes of the probabilistic hazard assessment). Detailed designs for recommended foreshore protection schemes have been prepared using the outcomes of the cost benefit assessment and multi-criteria analysis.

The recommended foreshore stabilisation options are identified in the table below.

Precinct	Location	Recommended option	Benefit cost ratio	Multi-criteria analysis ranking	Detailed design cost estimate (draft)
A	Naru Point to Lake Macquarie Airport excluding former Pelican Marina site	Scheme B Rock bag structure	1.09	1	$4.6 million
B	Former Pelican Marina site Soldiers Road public wharf	Scheme B Spur dyke	0.10	1	$2.1 million
C	Soldiers Road public wharf to Pelican boat ramp	Scheme B Rock bag structure	0.70	2	$3.75 million
D	Pelican boat ramp to Entrance to Little Pelican	Scheme B Spur dyke	1.87	2	$950,000

Table 10: Pelican foreshore stabilisation options

Benefit costs ratio >1 indicates that the benefits exceed the costs

The detailed design and associated cost estimates have been completed to a '90 per cent' stage based on bathymetric survey. Due to the rapidly changing nature of the channel, a revised survey and commensurate upgrade of the design alignments and volumes, along with cost estimates, will be required closer to construction.

There is a possibility that substantial savings of up to 50 per cent for some precincts could be realised if more testing is completed on the performance of rock bags to be used in some of the structures. This testing would aim to prove whether a 'flat placed' configuration could provide enough protection, instead of the more expensive and more stable 'stepped' configuration adopted in the present design.

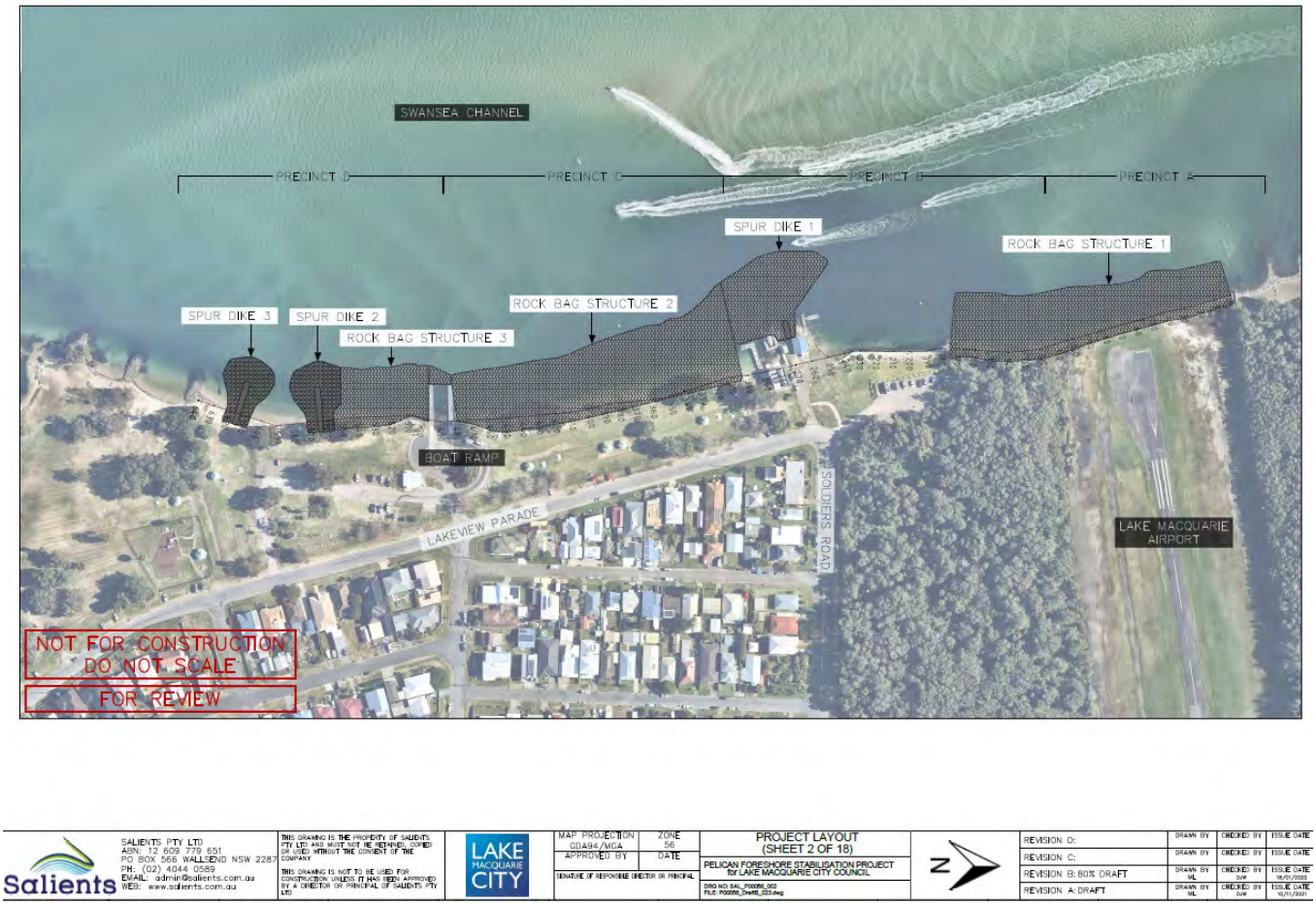


Figure 17: Proposed Pelican foreshore stabilisation works

Water level analysis

Council and the community are keen to understand how lake levels are changing over time to help inform our adaptation planning response. Council engaged Manly Hydraulics Laboratory (MHL) to update the previous analyses of water level trends and variability in Lake Macquarie using the last five years of data. This analysis covers water level trends in Lake Macquarie as compared to the open ocean, determination of a new mean high water (MHW) value for the Lake Macquarie foreshore, and analysis of key tidal harmonic constituents in relation to dredging of Swansea Channel (available at: Water Level Analysis).

The overall aim of the MHL study was to assist Council in understanding how lake levels are changing over time in order to effectively manage risks to coastal communities. From the results of this analysis, it can be concluded:

- ocean waters are rising between 2.0 and 3.5 mm/year. This was determined through water level trend analysis at Sydney (Middle Head) for the full period of record as well as last tidal epoch (2001-2020).
- water levels within Lake Macquarie are continuing to rise between 2.5 and 3.5 mm/yr. These results were calculated through water level trend analyses over different periods and multiple locations. The rate of rise in water levels at Belmont was calculated to be 2.7 and 3.1 mm/year, based on the full period of record and 2001-2020 tidal epoch, respectively.
- the rate of lake water level rise in the lake is accelerating. This was determined by comparing water level trends across multiple time scales at Belmont and Marmong Point.
- with the data currently available, the levels in the lake have been observed to be increasing at a higher rate compared to the ocean. This difference is partly due to the lower tidal range within the lake compared to the ocean and has the potential to change over time depending on the bathymetry of the Swansea Channel. As more data becomes available, greater confidence can be placed on water level trends observed in Lake Macquarie.
- the overall tidal range and mean tidal range are increasing within the lake. This could be partly attributable to changes within Swansea Channel, however, there is not enough information to confirm this.

It is recommended that a review be conducted at five-year intervals as the lake system becomes more tidally dominated to monitor rising water levels and associated changes in lake behaviour.

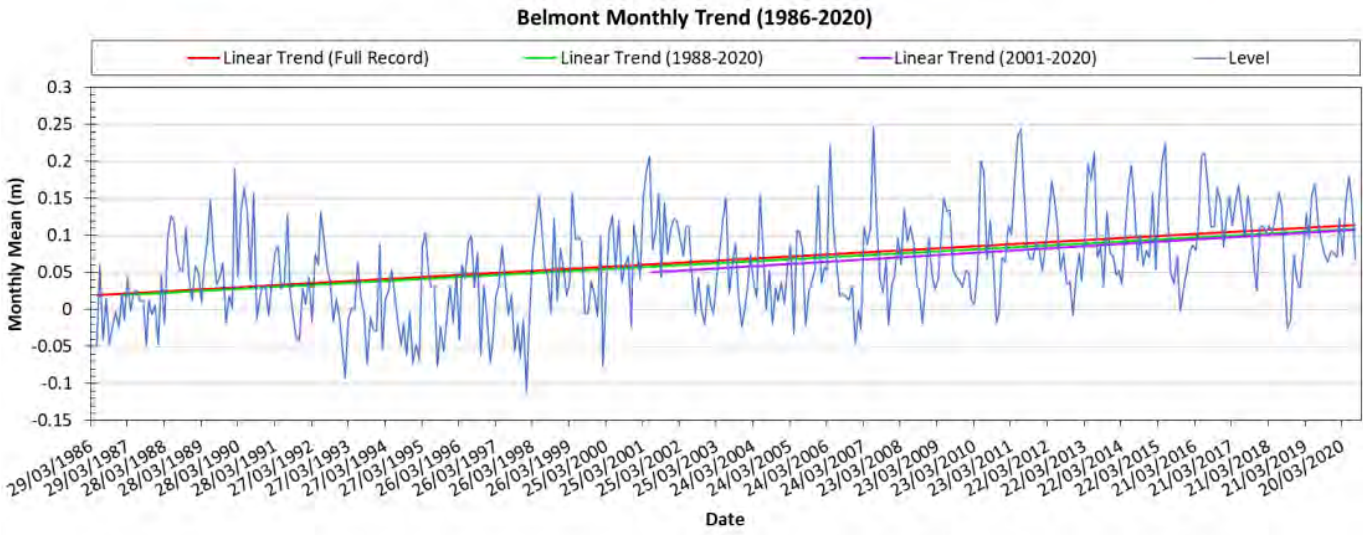


Figure 18: Trends on water levels at the Belmont gauge over varying time periods

4.4 Business Plan

4.4.1 Actions to be implemented by Council or by public authorities (Implementation Plan)

Component of management action included for certification under the CM Act Actions to be implemented by the council or by public authorities. All costs or funding sources are from various public funds (local, state and federal).

Part A – Coastline (37 actions)

Management Action	Timing (years until commencement)	Responsibility (Lead) (*Supporting Partner*)	Type of action (One-off or ongoing)	Staff Resource Required	Indicative capital cost	Indicative maintenance cost	Indicative operational Costs (excluding staff time)	SDG (Sustainable Development Goal)
Issue: 1 - Increase understanding of coastal risks								
A1.1 Conduct further analysis of the interactions of lake sourced inundation, coastal recession and marine inundation from overtopping, to clarify likely constraints to land use and potential for retreat.	5-10	**Council**, *DPE Science*	**Planning investigations** (One-off)	Low 1d/m	$0	$0	$10,000	13
A1.2 Encourage further research on the behaviour of dunes in pocket and long barrier coastal sediment compartments, as climate changes and sea level rises.	5-10	**Council**, *Universities, DPE*	**Planning Investigations** (Ongoing)	Low 1d/m	$0	$0	$10,000	13
A1.3 Expand beach camera network and connect with the need to monitor coastal change (Redhead, Blacksmiths, Caves, Catherine Hill Bay beaches)	2-5	**Council**	**Operations** (One-off)	Low 1d/m	$10,000	$1,000 /yr	$0	3, 13
A1.4 Continue to adopt use of technology (such as remote sensing) to support management of the coastline	2-5	**Council**	**Operations** (Ongoing)	Low 1d/m	$10,000	TBC	$0	9
Issue: 2 - Continue adaptive approach to managing coastal hazards where appropriate								
A2.1 Consider coastal hazards in future asset planning and determine trigger points for commencing detailed planning for protecting or relocating surf clubs	2-5	**Council**	**Planning** (One-off)	Med 1d/w	$0	$0	$0	3, 9, 13
A2.2 Implement a resilience planning approach to managing coastal risk, aligned with the NSW government approach	1	**Council**	**Planning** (Ongoing)	High 5d/w	$0	$0	$60,000 /yr	11, 13
A2.3 Hunter Water Corporation to consult with LMCC through detailed design, planning and assessment of the desalination plant proposed for Nine Mile Beach - Ensure that long term coastal hazards (erosion and wave overtopping) are addressed	1	**HWC**, *Council*	**Planning** (One-off)	High 5d/w	$0	$0	$20,000	6, 13

Management Action	Timing (years until commencement)	Responsibility (Lead) *(Supporting Partner)*	Type of action (One-off or ongoing)	Staff Resource Required	Indicative capital cost	Indicative maintenance cost	Indicative operational Costs (excluding staff time)	SDG (Sustainable Development Goal)
Issue: 3 Coastal dune stability is threatened by coastal erosion, disturbance, and unplanned access								
A3.1 Encourage community stewardship of natural areas through ongoing support of Landcare and increased awareness raising activities	2-5	**Council**, *Landcare, Land Councils*	Planning Operations **Engagement** (Ongoing)	Med 1d/w	$0	$0	Indicatively $1.3 million/year	3, 14, 15
A3.2 Continue with community activity programs focusing on coastline protection and key environmental issues	1	**Council**	Planning **Engagement** (Ongoing)	Med 1d/w	$0	$0	$10,000 /yr	11, 14, 15
A3.3 Maintain priority access to beaches, install fencing and matting on beach access ways to protect dune vegetation and habitats (priority locations are Blacksmiths, Caves and Redhead beaches). Include signage and other education material regarding domestic animals/4WD access	1	**Council**	**Operations** (Ongoing)	High 5d/w	$0		$0	3, 9, 13, 15
A3.4 Fence and formalise access to the beach at Belmont WWTW and Pony Club	2-5	**Council**	**Operations** (One-off)	Med 1d/w	$250,000		$0	3, 13, 15
A3.5 Develop and implement dune management plans for priority areas (Blacksmiths, Redhead, Nine Mile, Caves Beach and Catherine Hill Bay)	1	**Council**	**Planning** (One-off)	High 5d/w	$50,000 / yr for implementation	$0 see D3 for	20,000 per plan for development	3, 13, 15
A3.6 BWSP – review and improve permit issuing practices to manage vehicle numbers during peak periods and regulate waste dumping	1	**BWSP**, *Council, DPE, Crown Lands*	**Operations** Compliance (Ongoing)	Med 1d/w	$0	$0	Staff time only	3, 14, 15
A3.7 Assess vehicle use of other areas of Nine Mile Beach (outside the BWSP site) and which organisations have regulatory responsibilities	2-5	**BWSP, Council,** *DPE, DPE-Crown Lands*	**Planning** (One-off)	Med 1d/w	$0	$0	Staff time only	3, 14, 15
A3.8 Raise and reinforce low points in the dunes (using on-site sand, or sand sources from dredging works) Locations include Nine Mile Beach, Caves Beach and Catherine Hill Bay Beach. Priority area is Nine Mile Beach (southern portions). *Land owners/managers responsible for areas under their management*	1	**TfNSW Council,** *BWSP, DPE-Crown Lands, Hunter Water, Belmont Golf & Bowls*	**Operations** (Ongoing)	Med 1d/w	$50,000 per project	$0	$0	3, 13, 15

Management Action	Timing (years until commencement)	Responsibility (Lead) *(Supporting Partner)*	Type of action (One-off or ongoing)	Staff Resource Required	Indicative capital cost	Indicative maintenance cost	Indicative operational Costs (excluding staff time)	SDG (Sustainable Development Goal)
A3.9 Investigate the feasibility of a sand slug configuration placement for future dredging campaigns (southern corner of Blacksmiths beach). If feasible, undertake monitored trial(s) of configuration placement of sand slugs as sand becomes available.	2-5	**Council,** *DPE Science*	Planning **Investigation** (One-off)	Low 1d/m	$0	$0	$50,000 for investigation	3, 13
A3.10 Investigate the development of a concept design and detailed design for a sand transfer scheme and consider surfing amenity in any breakwater alterations at Blacksmiths or Swansea Heads.	2-5	**Council,** *DPE*	Planning **Investigation** (One-off)	Low 1d/m	$0	$0	$150,000 for assessment if detailed design is included	3, 14, 15
A3.11 Conduct beach management works to revegetate, reshape and increase dune volume/recovery after storms, and to control weeds. (Blacksmiths, Redhead, Nine Mile, Caves Beach and Catherine Hill Bay). *Land owners/managers responsible for areas under their management*	1	**Council, BWSP, HWC,** *DPE-Crown Lands,* **Belmont Golf & Bowls, NPWS**	**Operations** (Ongoing)	Med 1d/w	$30,000 /year	$0	$0	13, 15
A3.12 Discuss the transfer or acquisition of private land (only when requested and/or supported by the landowner) along the coast with high values for public access, scenic and ecological quality into public tenure (including potential application to DPE under the Coastal Lands Protection Scheme). Priority locations include private owned land in the mid portion of Nine Mile beach, headland at Dudley, and land in the Catherine Hill Bay SLSC and sports precincts.	2-5	**Council,** *DPE Planning*	Planning **Investigation** (One-off)	Low 1d/m	$0	$0	Staff time only	11, 13
A3.13 Prepare creek management and water quality improvement plans for small coastal creeks and lagoons, used for recreational swimming/splashing. (Priority locations are First Creek, Third Creek and Catherine Hill Bay) *Land owners/managers responsible for areas under their management*	2-5	**Council BWSP**	**Planning** Operations (One-off)	Med 1d/w	$0	$0	$20,000 per plan	6, 14
A3.14 Coordinate and implement monitoring and management efforts relating to recreational water quality on beaches and coastal creeks and lagoons (including links with state programs and ecological water quality monitoring)	1	**Council,** *Hunter Water, NPWS*	Planning **Operations** (Ongoing)	Med 1d/w	$0	$0	$30,000 /yr analysis costs	6, 14

Management Action	Timing (years until commencement)	Responsibility (Lead) *(Supporting Partner)*	Type of action (One-off or ongoing)	Staff Resource Required	Indicative capital cost	Indicative maintenance cost	Indicative operational Costs (excluding staff time)	SDG (Sustainable Development Goal)
Issue: 4 - Habitat for migratory shorebirds is threatened by coastal processes and recreational use								
A4.1 Research the impacts of sea level rise on migratory shorebirds	5-10	**DPE**, *Council, NPWS, Universities*	**Investigations** (One-off)	Low 1d/m	$0	$0	$5000-10,000	15
A4.2 Raise awareness of the importance of migratory shorebirds. Signage (about species and impacts of recreation) in key locations; investigate other awareness raising options	2-5	**Council**	Planning **Engagement** (Ongoing)	Low 1d/m	$0	Nil	$5,000 for design etc	15
A4.3 Protect little tern and pied oystercatcher nesting and feeding areas on beaches (Nine Mile Beach) and dunes, using fencing and vehicle access controls	1	**Council**, *DPE, HBOC NPWS*	**Operations** (Ongoing)	Med 1d/w	$0	$5000 /yr	$0	15
A4.4 Control domestic animal access (eg, fencing) to sensitive habitat area for migratory shorebirds. Domestic dogs are the highest priority. Domestic dogs are the highest priority	1	**Council**, *NPWS, LLS, DPE-Crown Lands*	Operations **Compliance** (Ongoing)	Med 1d/w	$0	$0	Staff time only (Rangers)	3, 15
Issue: 5 - Recreational and conservation values of headlands and rock platforms are managed								
A5.1 Headland management: review PoMs considering opportunities for improved management (vegetation, cultural, tourism and headland stability) at Swansea Heads and other prominent headlands	2-5	**Council**, *DPE-Crown Lands, NPWS (Involve LALCs)*	**Planning** (One-off)	Med 1d/w	$0	$0	$50,000 per POM	3, 11
A5.2 Identify and promote conservation status (Marine Protected area) for an intertidal area (Swansea Heads rock platform)	2-5	**Council**	Planning **Investigations** (One-off)	Med 1d/w	$0	$0	Staff time only	14, 15
A5.3 Investigate opportunities for awareness raising and enforcement activities to protect rock platform biodiversity *Land owners/managers responsible for areas under their management*	2-5	*Council* **NPWS**	**Planning** Compliance (Ongoing)	Low 1d/m	$0	$0	$5000 for resource development	14, 15
A5.4 Continue with community activity programs focusing on coastline protection and key environmental issues	1	**Council** *NPWS*	Planning **Engagement** (Ongoing)	Med 1d/w	$0	$0	$10,000 /yr	11, 13, 14, 15

Management Action	Timing (years until commencement)	Responsibility (Lead) *(Supporting Partner)*	Type of action (One-off or ongoing)	Staff Resource Required	Indicative capital cost	Indicative maintenance cost	Indicative operational Costs (excluding staff time)	SDG (Sustainable Development Goal)
A5.5 Assess hazards and risks and conduct a community awareness program about rock platform safety *Land owners/managers responsible for areas under their management*	2-5	**Council NPWS,** *SLSC*	**Planning Engagement** (One-off)	Low 1d/m	$0	$0	Staff time only	3, 13
A5.6 Review and upgrade the coastal walking path from Caves Beach to Catherine Hill Bay and further south to Munmorah SCA	2-5	**Council** *NPWS*	**Investigation** Planning Operations (One-off)	Med 1d/w	Not costed, but estimated as more than $2 million	$0	$500,000 over 4 years for studies and design	3
A5.7 Investigate stormwater impacts on headlands and rock platforms (i.e. erosion issues, water quality and litter)	2-5	**Council** *University*	**Investigation** (One-off)	Med 1d/w	$0	$0	$10,000 for monitoring over 4 years	6, 14
Issue: 6 - Manage (mitigate) risks to beach access and safety infrastructure								
A6.1 Investigate the refurbishment of revetment and adding a wave return wall at Redhead surf club	2-5	**Council**	**Operations** (One-off)	Med 1d/w	$850,000 capital cost	$1000 /yr	$20,000 for design	3, 9
A6.2 Investigate options to reduce coastal hazards to Redhead Surf Club and associated facilities	2-5	**Council**	**Investigation** Planning (One-off)	Med 1d/w	Note: estimated $5,800,000 capital cost for surf club if relocation required.	$0	$30,000 (initial studies)	3, 9
Issue: 7 - Cultural management actions								
A7.1 Translate educational material (about coastal processes and hazards, habitats and protected species) into languages that reflect visitor profiles	5-10	**Council**	**Engagement** (One-off)	Low 1d/m	$0	$0	$5000	3, 10
A7.2 Investigate pathways and feasibility for achieving co-management of Coastal Country	5-10	**Council** *DPE-Crown Lands, NPWS, LALCs*	**Investigations** Planning Staff time (Ongoing)	Med 1d/w	$0	$0	$20,000 for assessing pathways	17
A7.3 Build awareness of cultural values and sensitivity for council construction staff (inductions and procedures for Council staff and contractors)	1	**Council,** *LALCs*	**Operations** (Ongoing)	Med 1d/w	$0	$0	$10,000/ yr for staff training	16, 17
A7.4 Include cultural awareness programs, developed with the Aboriginal community, in community activities in the coastal zone	1	**Council,** *LALCs*	**Operations** (Ongoing)	Low 1d/m	$0	$0	$5000/ yr	17

Part B – The Lake Macquarie estuary (37 actions)

Management Action	Timing (years until commencement)	Responsibility (Lead) *(Supporting Partner)*	Type of action (One-off or ongoing)	Staff Resource Required	Indicative capital cost	Indicative maintenance cost	Indicative operational Costs (excluding staff time)	SDG (Sustainable Development Goal)
Issue: 1 - Hazard assessment and management are continually updated with new information to provide the best management processes and priorities								
B1.1 Identify and prioritise actively eroding creek bank sites on public land in the coastal zone	1	**Council**, *LLS*	**Investigation** Operations (Ongoing)	Med 1d/w	$0	$0	Staff time only	14, 15
B1.2 Conduct condition assessment of key sites impacted by lake foreshore erosion on public land	1	**Council**	**Planning** (Ongoing)	Med 1d/w	$0	$0	$60,000 per year	6, 13
Issue: 2 - Ongoing Community engagement is needed to support a resilient community								
B2.1 Continue adaptation collaboration and planning with affected communities and expand locally-led climate resilience and adaptation programs	1	**Council,** *Central Coast Council, DPE*	**Planning Engagement** (Ongoing)	High 5d/w	$0	$0	$40,000 plus staff time	13
Issue: 3 - Targeted studies and planning controls to be investigated								
B3.1 Review council's existing water cycle management development controls to improve water quality outcomes from new developments	1	**Council,** *Central Coast Council, DPE*	**Planning** (One-off)	Med 1d/w	$0	$0	Staff time only	6, 11, 15
B3.2 Investigate hydrological characteristics and water quality of Muddy Lake and develop and implement a suitable management approach which may include Environmental Protection Works	2-5	**Crown Lands,** *Council, DPE Science Origin Energy, Universities*	**Investigations** (One-off)	Med 1d/w	$0	$0	$100,000 Indicative cost for other research/ studies.	14, 15
B3.3 Seek funding to implement the LT Creek Dredging Plan to address historic sediment deposits in the upper tidal reaches and improve aquatic ecosystem health	1 for securing funding 2-5 for implementation	**Council**	**Planning** (One-off)	Med 1d/w	$0 for seeking funding $1.63 million for implementation	$0	Included in capital costs	14

Management Action	Timing (years until commencement)	Responsibility (Lead) *(Supporting Partner)*	Type of action (One-off or ongoing)	Staff Resource Required	Indicative capital cost	Indicative maintenance cost	Indicative operational Costs (excluding staff time)	SDG (Sustainable Development Goal)
Issue: 4 - Reduce urban stormwater impacts on lake water quality and estuary health								
B4.1 Monitor performance of Gross Pollutant Trap (GPT) type Stormwater Quality Improvement Devices (SQIDs) to inform the maintenance schedule, considering available sensors and other technology and modelling in the coastal zone	1	**Council**	**Monitoring** Planning Operations (Ongoing)	Low 1d/m	$10,000	Nil	Staff time	6, 9, 14
B4.2 Minimise the use of machinery by adopting a bush regeneration approach to maintenance of vegetated SQIDs in the coastal zone	1	**Council**	**Planning** (One-off)	Low 1d/m	$0	Council currently spends $1.6/yr on SQID maintenance	Staff time	6, 9, 14
B4.3 Investigate and undertake retrofit upgrades to existing SQIDs within the coastal zone to improve asset performance, targeting catchments with high concentrations of nutrients and/or high sediment loads to sensitive parts of the lake	1	**Council**	**Operations** (Ongoing)	High 5d/w	SQID Asset Replacement $125,000 New SQID (and retrofits) $450,000 /yr	Continue current resourcing commitments	Design and approval included in capital budget	6, 9, 14
B4.4 Investigate, install and maintain SQIDs within the coastal zone to reduce sediment and nutrient load, maximising pollutant removal efficiencies and prioritising catchments	1	**Council**	**Operations** (Ongoing)	High 5d/w	SQID Asset Replacement $125,000 New SQID (and retrofits) $450,000 /yr	Continue current resourcing commitments	Design and approval included in capital budget	6, 9, 14
B4.5 Continue compliance and education programs for the construction industry and residential property owners to promote best practice stormwater management	1	**Council**	**Operations** (Ongoing)	High 5d/w	$0	$0	Predominantly staff time $5,000/yr for development of educational resources	6, 9, 14
B4.6 Identify sediment and nutrient generation hotspots using spatially intensive, short term monitoring programs undertaken during a major rainfall event	1	**Council** *DPE Science University, Central Coast Council*	**Investigations** Planning Operations (One-off)	Low 1d/m	$0	$0	$50,000 for data collection	6, 9, 14

Management Action	Timing (years until commencement)	Responsibility (Lead) *(Supporting Partner)*	Type of action (One-off or ongoing)	Staff Resource Required	Indicative capital cost	Indicative maintenance cost	Indicative operational Costs (excluding staff time)	SDG (Sustainable Development Goal)
B4.7 Identify strategies to minimise erosion losses from unconsolidated road verges, building sites and other streetscape generation hotspots within the coastal zone	2-5	**Council**	**Planning** Operations (One-off)	Med 1d/w	$0	$0	10 sites at $75,000 each over the life of the CMP	6, 9, 14
Issue: 5 - Monitor changes in seagrass/wetland response to estuary processes, water quality and lake use								
B5.1 Continue seagrass mapping and health monitoring, and investigate partnership opportunities with other organisations monitoring to improve the health and extent of seagrass	1	**Council,** *DPI Fisheries, Central Coast Council*	**Monitoring** Planning (One-off, but repeat every 5yrs)	High 5d/w	$0	$0	DPI whole of lake mapping indicatively $150,000 (currently funded by MEMS). Targeted monitoring near boat ramps (20 sites, $2,000 per site)	14
B5.2 Continue to monitor lake health, identifying areas for partnering with industry. Expand scope of monitoring to include microplastics	1	**Council,** *DPE Origin Energy Delta, HWC*	**Monitoring** Planning (Ongoing)	Low 1d/m	$0	$0	$65,000 (investigate industry contribu-tion)	14
B5.3 Continue wetland/ saltmarsh rehabilitation program. Including investigation of removing potential barriers around wetland margins to facilitate migration of saltmarsh and other wetland species. (Refer to Appendix 8 – Environmental Protection Works in coastal wetlands and littoral rainforests for locations)	1	**Council** *DPI Fisheries, DPE Science Landcare*	**Operations** Planning (Ongoing)	Med 1d/w	$30,000/ yr (with matching grant funds). Also volunteer works by Landcare	Volunteer works by Landcare	Staff time	14, 15
Issue: 6 - Impact of stormwater and wastewater overflows on water quality for recreational use								
B6.1 Conduct monitoring of recreational swimming areas – monitoring bacterial counts to improve management of sewage and stormwater systems	1	**Council,** *Central Coast Council*	**Monitoring** Operations (One-off)	Med 1d/w	$0	$0	Sampling undertaken by Council staff (13 sites sampled weekly during swimming season). Cost of analysis is $15,000 /yr	3, 6, 14

Management Action	Timing (years until commencement)	Responsibility (Lead) *(Supporting Partner)*	Type of action (One-off or ongoing)	Staff Resource Required	Indicative capital cost	Indicative maintenance cost	Indicative operational Costs (excluding staff time)	SDG (Sustainable Development Goal)
B6.2 Implement recommendations from 'Effects based assessment of wastewater overflows in Lake Macquarie catchment' **(Prepared for HWC by DPE)** *Actions include: further investigation of pathogen profile and sources, implementing strategic improvement to sewerage network, and improved risk management systems*	2-5	**HWC,** *Council*	**Monitoring** Operations (One-off)	Med 1d/w	$0	$0	$100,000 for studies. No current budget allocation.	3, 6, 14
Issue: 7 - Improve catchment riparian and wetland vegetation around Lake Macquarie to reduce nutrient loads, and improve habitat								
B7.1 Continue streambank, riparian corridor rehabilitation program within the coastal zone (including locations such as Stony Creek)	1	**Council,** *DPE-Crown Lands*	**Operations** (Ongoing)	Med 1d/w	$200,000 /yr	$20,000 /yr	Staff time	14, 15
B7.2 Support community stewardship of natural areas through ongoing support of Landcare and other environmental volunteer programs	1	**Council,** *Central Coast Council, LLS, Landcre*	**Operations** (Ongoing)	Med 1d/w	$0	$0	$1,300,000 per year, note this is for the whole local council area, not just in the coastal zone or estuary context	14, 15, 17
Issue: 8 - Improve foreshore stability and ecological processes								
B8.1 Continue foreshore stabilisation program. Refer to Appendix 7 - Foreshore stabilisation works (Coastal Protection Works) prioritisation tool. *Land owners/managers responsible for areas under their management*	1	**Council, Central Coast Council**	**Operations** (Ongoing)	Med 1d/w	$140,000 /yr	$100,000 /yr	Staff time	14, 15
B8.2 Investigate and pilot an environmentally friendly seawall (retrofit an existing seawall structure). Refer to Appendix 7 - Foreshore stabilisation works (Coastal Protection Works) prioritisation tool.	2-5	**Council,** *Central Coast Council, DPE*	**Operations** (Ongoing)	Med 1d/w	$20,00 - 50,000 for design, con-struction, monitor	$0	Staff time	14, 15

Management Action	Timing (years until commencement)	Responsibility (Lead) *(Supporting Partner)*	Type of action (One-off or ongoing)	Staff Resource Required	Indicative capital cost	Indicative maintenance cost	Indicative operational Costs (excluding staff time)	SDG (Sustainable Development Goal)
Issue: 9 - Catchment vegetation modification – riparian and wetland vegetation around Lake Macquarie is extensively modified or removed, affecting nutrient loads, and habitat								
B9.1 Manage new outbreaks of aquatic weeds and pests.	2-5	**Council,** *DPE-Crown Lands, DPI, LLS*	**Operations** (Ongoing)	Low 1d/m	Dependant on nature of new outbreak.	$100,000 /yr	$10,000 – 50,000/yr Dependant on nature of new outbreak.	14, 15
B9.2 Explore opportunities to establish (and implement if feasible) an aquatic weed and pests surveillance program	2-5	**Council,** *DPI, LLS, DPE-Crown Lands, Universities*	**Investigations** (Ongoing)	Med 1d/w	Potentially capital items required (vessel, UAV etc)	$0	Staff time from relevant agencies	14, 15
B9.3 Evaluate opportunities local use of approved biocontrol applications for managing aquatic weeds and pests	1	**Council,** *DPI, LLS, DPE-Crown Lands, Universities*	**Investigations** (Ongoing)	Low 1d/m	$0	$0	Staff time only	14, 15
B9.4 Develop an awareness raising, education and safety risk management program for razor clams (particularly in enclosed swimming areas	2-5	**Council,** *Central Coast Council, DPI Fisheries*	**Planning Engagement** (On-off)	Low 1d/m	$0	$0	$5,000 for development of resources. Staff time	3, 14
Issue: 10 - Environmental issues associated with access to marine estate								
B10.1 Raise community awareness on the impact of boating on seagrass (focus on Posidonia)	2-5	**Council,** *Central Coast Council, DPI Fisheries, TfNSW*	**Engagement** (Ongoing)	L	$0	$0	$5,000 for development of resources. Staff time	14
B10.2 Undertake a research trial "Environmentally Friendly Mooring" (EFM) Trial	1	**TfNSW,** *DPI Fisheries*	**Investigations** (One-off)	M	$0	$0	MEMS funded	3, 14
B10.3 Develop consumer "Guidelines" for the installation, use, and maintenance of Environmentally Friendly Moorings	2-5	**TfNSW,** *DPI Fisheries*	**Engagement** (One-off)	M	$0	$0	MEMS funded	3, 14
B10.4 Consider the outcome of the Environmentally Friendly Moorings trial in relevant plans of management	2-5	**TfNSW,** *DPI Fisheries*	**Planning** (One-off)	M	$0	$0	Staff time only	3, 14
B10.5 Use the Jetty Impact Assessment Tool when assessing new applications for jetty construction and in the redesign of existing public jetties to minimise impacts on adjacent seagrass beds.	1	**Council,** *Central Coast Council, DPI Fisheries*	**Planning** (Ongoing)	L	$0	$0	Staff time only	14

Management Action	Timing (years until commencement)	Responsibility (Lead) *(Supporting Partner)*	Type of action (One-off or ongoing)	Staff Resource Required	Indicative capital cost	Indicative maintenance cost	Indicative operational Costs (excluding staff time)	SDG (Sustainable Development Goal)
Issue: 11 - Protect migratory shorebird and marine species habitat around Lake Macquarie is impacted								
B11.1 Review factors influencing the population and breeding success of migratory shore bird species	2-5	**DPE,** *NPWS,* Council	**Engagement** (Ongoing)	Low 1d/m	$0	$0	TBC	15
B11.2 Raise awareness of bird species especially migratory birds and their vulnerability to disturbance. (Sooty and Pied Oyster Catchers, and other species)	2-5	**Council,** *NPWS, DPE, Central Coast Council*	**Engagement** (One-off)	Low 1d/m	$0	$0	TBC	15
B11.3 Raise awareness of marine mammals and other protected species within the lake, such as seals, turtles, dolphins. Include advice on natural behaviours and appropriate interactions with people	2-5	**NPWS,** *Council, Central Coast Council, DPE*	**Engagement** (One-off)	Low 1d/m	$0	$0	TBC	14, 15
Issue: 12 - Access to the recreational boating								
B12.1 Provide public boating access infrastructure (including improved access for persons with a disability). Work to provide equitable provision of boating facilities around the Lake	1	**Council,** *TfNSW*	**Planning** (Ongoing)	Med 1d/w	Depen-dant on facility.	Depen-dant on facility and provision included in mainte-nance programs	Staff time	3, 14
Issue: 13 - Foreshores and wetlands of Lake Macquarie are considered a passive recreation asset								
B13.1 Monitor community use of the lake and foreshores to provide up to date information on recreational use, demand and patterns – consider technology applications such as QR codes etc	2-5	**Council,** *Central Coast Council*	**Monitoring** (Ongoing)	Low 1d/m	TBC	TBC	TBC	3, 14
B13.2 Investigate enhancement of passive recreation access to wetlands and foreshores in other public land – link to future Tracks and Trails Strategy.	2-5	**Council,** *NPWS, DPE-Crown Lands*	**Planning** (On-off)	Med 1d/w	$0	$0	Staff time plus integra-tion with Tracks and Trails Strategy	3, 14, 15

Part C – Channel (32 actions)

Management Action	Timing (years until commencement)	Responsibility (Lead) *(Supporting Partner)*	Type of action (One-off or ongoing)	Staff Resource Required	Indicative capital cost	Indicative maintenance cost	Indicative operational Costs (excluding staff time)	SDG (Sustainable Development Goal)
Issue: 1 - The collaborative framework for management across multiple agencies needs to be clearer and stronger								
C1.1 Maintain the entrance breakwaters in accordance with asset management framework; considering sea level rise & climate change	1	**TfNSW**	**Operations** (Ongoing)	Low 1d/m	TBC	TBC	$0	9, 13
C1.2 Conduct further investigations of sites or structures in the channel, assessed as high risk, and clarify responsibilities of agencies. *Land owners/managers responsible for assets under their management*	1	**Council, TfNSW, DPE-Crown Lands, DPE**	**Investigations** (One-off)	Med 1d/w	$0	$0 (maintenance addressed in C1)	Costs of site investigation will vary considerably depending on the nature of the site.	9, 13
C1.3 Develop interagency infrastructure design criteria for current and future coastal hazards *Land owners/managers responsible for assets under their management*	2-5	**Council, TfNSW,** *DPE-Crown Lands*	**Planning** (One-off)	Med 1d/w	$0	$0	Staff time only	9, 13, 17
C1.4 Consider coastal hazards and risks in Asset Category Plans and when planning major public infrastructure	2-5	**Council, TfNSW, DPE-Crown Lands, Hunter Water, Telstra, Ausgrid, NBN Co, Jemena**	**Planning** (One-off)	Med 1d/w	$0	$0	Staff time only	9, 13

Management Action	Timing (years until commencement)	Responsibility (Lead) *(Supporting Partner)*	Type of action (One-off or ongoing)	Staff Resource Required	Indicative capital cost	Indicative maintenance cost	Indicative operational Costs (excluding staff time)	SDG (Sustainable Development Goal)
C1.5 Commence feasibility and planning (and construct or retrofit when funds available) to upgrade coastal protection works by public land holders, in accordance with the R&H SEPP; incorporate environmentally friendly designs for all seawalls or revetments. Priority location is Belmont Street, Swansea. Other locations include revetments at Blacksmiths, Swansea Head and Swansea. *Land owners/managers responsible for assets under their management* **Refer to Appendix 7 - Foreshore stabilisation works (Coastal Protection Works) prioritisation tool.**	1	**Council, TfNSW,** *DPE-Crown Lands*	**Operations** Planning (Ongoing)	Med 1d/w	Will vary depending on site	$100,000 /year	Staff time only	9, 13, 14
C1.6 Investigate expanding the pilot tidal gates project to other sites (Swansea urban areas, Black Neds Bay, Blacksmiths behind northern revetment)	1	**Council**	**Investigations** Operations (Ongoing)	Med 1d/w	Capital $80,000 cost of current pilot	$10,000 /yr	Staff time only	9, 11, 13
C1.7 Support LAP actions implementation relating to future inundation and/ or pilots on public land	1	**Council,** *DPE-Crown Lands*	**Planning** Operations (Ongoing)	Low 1d/m	Integrate into future drainage projects. Costs depending on project	Unknown - dependent on site and design	Design costs dependent on site conditions and scope	9, 11, 13
Issue: 2 - Address erosion along the Pelican foreshore								
C2.1 Confirm details on funding provision and management responsibilities for implementation of Pelican foreshore stabilisation works (informed by cost benefit analysis and distribution analysis)	1	**Council,** *DPE-Crown Lands, Lake Macquarie Airport, TfNSW, Marine Rescue*	**Planning** (One-off)	M	$0	$0	Staff time only	9, 11, 12, 14

Management Action	Timing (years until commencement)	Responsibility (Lead) *(Supporting Partner)*	Type of action (One-off or ongoing)	Staff Resource Required	Indicative capital cost	Indicative maintenance cost	Indicative operational Costs (excluding staff time)	SDG (Sustainable Development Goal)
C2.2 Stabilise Pelican foreshore – Precinct A (using scheme B approach identified in the Pelican Foreshore Design Project). (Coastal Protection Works) ** Detailed funding arrangements and responsibilities to be confirmed in action C2.1*	1 for securing funding 2-5 for implementation (dependant on funding)	**Council,** *DPE-Crown Lands, Lake Macquarie Airport (TBC in action C2.1)*	**Operations Planning** (One-off)	H	Estimated as $4,670,000	See F6	Approval costs included in capital cost.	9, 11, 13, 14
C2.3 Stabilise Pelican foreshore – Precinct B (using Scheme B approach identified in Pelican Foreshore Design Project). (Coastal Protection Works) ** Detailed funding arrangements and responsibilities to be confirmed in action C2.1*	1 for securing funding 2-5 for implementation (dependant on funding)	*Council, DPE-Crown Lands, Lake Macquarie Airport (TBC in action C2.1)*	**Operations Planning** (One-off)	H	Estimated as $2,100,000	See F6	Approval costs included in capital cost.	9, 11, 13, 14
C2.4 Stabilise Pelican Foreshore Precinct C (using Scheme B approach identified in Pelican Foreshore Design Project). (Coastal Protection Works) ** Detailed funding arrangements and responsibilities to be confirmed in action C2.1*	1 for securing funding 2-5 for implementation (dependant on funding)	*Council, DPE-Crown Lands (TBC in action C2.1)*	**Operations Planning** (One-off)	H	Estimated as $3,750,000	See F6	Approval costs included in capital cost.	9, 11, 13, 14
C2.5 Stabilise Pelican Foreshore Precinct D (using Scheme B approach identified in Pelican Foreshore Design Project). (Coastal Protection Works) ** Detailed funding arrangements and responsibilities to be confirmed in action C2.1*	1 for securing funding 2-5 for implementation (dependant on funding)	*Council, DPE-Crown Lands (TBC in action C2.1)*	**Planning Staff Time Capital** (One-off)	H	Estimated as $950,000	See F6	Approval costs included in capital cost.	9, 11, 13, 14

Management Action	Timing (years until commencement)	Responsibility (Lead) *(Supporting Partner)*	Type of action (One-off or ongoing)	Staff Resource Required	Indicative capital cost	Indicative maintenance cost	Indicative operational Costs (excluding staff time)	SDG (Sustainable Development Goal)
C2.6 Monitor the Pelican foreshore – foreshore position, bathymetry and stability *** Land owners/ managers responsbile for monitoiring assets under their control*	1	*DPE-Crown Lands,* **TfNSW Council,** *DPE-Science*	**Monitoring** (Ongoing)	M	$0	$0	Include in routine TfNSW channel bathymetry (supplement with DPE surveys for non-navigable areas)	9, 11, 13, 14
C2.7 Implement interim stabilisation works until funding for major works is secured. (Coastal Protection Works) ** Detailed funding arrangements and responsibilities to be confirmed in action C2.1*	1	*Council, DPE-Crown Lands, Lake Macquarie Airport, Marine Rescue*	**Operations** (Ongoing)	M	$0	$50,000/yr	Staff time only	9, 11, 13, 14
C2.8 Investigate the condition and options for future management of the existing geofabric sandbag coastal protection works located in Pelican Foreshore Precinct B.	1	**DPE-Crown Lands,** *TfNSW, Council*	**Planning**	M	$0	$0	$50-60,000	9, 11, 13, 14
C2.9 Monitor and manage the geofabric sandbag foreshore coastal protection works located in Pelican Foreshore Precinct B.	1	**DPE-Crown Lands,** *TfNSW, Council*	**Operations**	M	TBC subject to outcomes of C2.8	$5- 10,000/ year	Approval costs included in capital cost.	9, 11, 13, 14
C2.10 implement outcomes from C2.8 and C2.8. This may include works to maintain, replace or construct coastal protection works at the location of existing geofabric sandbag coastal protection works. ** Detailed funding arrangements and responsibilities to be confirmed in action C2.1*	1	Lead to be determined, *DPE-Crown Lands, TfNSW, Council*	**Operations**	M	TBC subject to the outcomes of C2.8 and C2.9.	TBC subject to the outcomes of C2.8 and C2.9.	TBC subject to the outcomes of C2.8 and C2.9.	9, 11, 13, 14

Management Action	Timing (years until commencement)	Responsibility (Lead) *(Supporting Partner)*	Type of action (One-off or ongoing)	Staff Resource Required	Indicative capital cost	Indicative maintenance cost	Indicative operational Costs (excluding staff time)	SDG (Sustainable Development Goal)
Issue: 3 - Private property is threatened by tidal inundation								
C3.1 Implement priority actions of the Eastlakes LAPs; explore resilience planning	1	**Council,** *Hunter Water*	**Planning Operations** (Ongoing)	Med 1d/w	Costs vary dependant on actions – refer to LAP and associated CBA	Costs vary dependant on actions – refer to LAP and associated CBA	Costs vary dependant on actions – refer to LAP and associated CBA	9, 11, 13
Issue: 4 - Navigability of Swansea channel needs to be balanced with environmental and resilience impacts								
C4.1 Implement dredging and sand placement in accordance with the Sustainable Framework for Navigation in Swansea Channel (SFNSC). Small episodes of navigation dredging may be required at Black Neds Bay (sand to be used to provide build dune resilience)	1	**TfNSW**	**Operations** (Ongoing)	Med 1d/w	$0	Indicatively $500,000 per campaign	Staff time	3, 14
C4.2 Conduct regular hydro-survey of Swansea Channel in accordance with SFNSC	1	**TfNSW**	**Planning** (One-off)	Low 1d/m	$0	$0	$50,000 per year (quarterly hydro-surveys)	3, 14
C4.3 Update the SFNSC to include channel evolution and impact of dredging on the natural environment.	2-5	**TfNSW,** *Council*	**Planning** (One-off)	Med 1d/w	$0	$0	$100,000 to review and update the SFNSC	3, 14
C4.4 Utilise dredged sand for nourishment at priority locations and in accordance with dune management plans and foreshore areas along the channel. *Land owners/managers responsible for areas under their management*	1	*DPE-Crown Lands,* **TfNSW, Council**	Planning **Operations** (Ongoing)	Med 1d/w	$0	$0	$50,000 per episode for sand shaping	
C4.5 Investigate the feasibility of a west channel diversion to reconfigure and train the navigation channel via the Airforce Channel, to address scour, navigation and maintenance issues	5-10	**Council, TfNSW,** *DPE-Crown Lands, NSW Fisheries, DPE Science*	**Investiga-tions** (One-off)	High 5d/w	$0	$0	Capital works to realign the channel will require major coastal engineering studies and modelling $250,000	9, 13, 14

Management Action	Timing (years until commencement)	Responsibility (Lead) *(Supporting Partner)*	Type of action (One-off or ongoing)	Staff Resource Required	Indicative capital cost	Indicative maintenance cost	Indicative operational Costs (excluding staff time)	SDG (Sustainable Development Goal)
Issue: 5 - Swansea channel is a major recreation and tourism asset								
C5.1 Support actions to enhance recreation activation along Swansea Channel, as identified in the Lake Activation Strategy	1	**Council**	**Planning** (Ongoing)	Med 1d/w	Dependent on project	Dependent on project	See LAS proposed indicative budgets	3, 9
Issue: 6 - Estuary wetlands are vulnerable to sea level rise and climate change								
C6.1 Research best practice approach for enabling landward movement of saltmarsh in the estuary	2-5	**Council,** *DPI Fisheries, DPE Science, Universities*	**Investigations** (One-off)	Low 1d/m	$0	$0	TBA	9, 13 14, 15
C6.2 Undertake pilot projects for re-establishing estuarine wetland communities such as saltmarsh and seagrass, which will be affected by higher lake levels. (Refer to Appendix 8 – Environmental Protection Works in coastal wetlands and littoral rainforests for locations).	2-5	**Council**	Investigations **Operations** (One-off)	Med 1d/w	$0	$0	$30,000 per project	9, 13 14, 15
C6.3 Monitor wetlands to evaluate the performance of protection activities and/or pilot projects for re-establishing estuarine wetland communities	5-10	**Council**	**Monitoring** (One-off)	Low 1d/m	$0	$0	$10,000 per monitoring project	13, 14, 15
C6.4 Conduct wetland rehabilitation works. (Refer to Appendix 8 – Environmental Protection Works in coastal wetlands and littoral rainforests for locations).	1	**Council,** *Landcare Bahtabah LALC*	**Operations** (Ongoing)	Med 1d/w	$0	$0	$30,000/ yr wetland rehab program (citywide)	14, 15
C6.5 Work with existing or establish a formal Landcare program to undertake rehabilitation in priority channel locations	2-5	**Council, (Landcare)**	**Operations** (Ongoing)	Med 1d/w	$0	$0	Included in $1.3 million annual Landcare allocation for the whole Lake Macquarie LGA	15
C6.6 Protect roosting, feeding and nesting habitat for migratory shorebirds. Strategies include sand placement and fencing	2-5	**Council,** *DPE-Crown Lands, TfNSW NPWS*	**Operations** (Ongoing)	Low 1d/m	$0	$0	$10,000 /yr	15

Management Action	Timing (years until commencement)	Responsibility (Lead) *(Supporting Partner)*	Type of action (One-off or ongoing)	Staff Resource Required	Indicative capital cost	Indicative maintenance cost	Indicative operational Costs (excluding staff time)	SDG (Sustainable Development Goal)
Issue: 7 - Strengthen evidence of tidal inundation patterns and levels								
C7.1 Monitor frequency, depth and spatial extent of storm inundation, tidal inundation and lake flooding events. Monitor and analyse data from tidal gauges to assess local trends in sea and lake levels.	1	**Council,** *DPE Science*	**Monitoring** Investigations (Ongoing)	Low 1d/m	$0	Operation and maintenance of tidal gauges funded by DPE	Operation and maintenance of tidal gauges funded by DPE	9, 13
Issue: 8 - Clarity about land tenure is needed to enable effective management								
C8.1 Formalise ownership arrangements and responsibilities for public assets in Swansea Channel.	1	**Council,** *DPE-Crown Lands, TfNSW*	**Planning** (One-off)	Med 1d/w	$0	$0	Staff time	17

Part D – Whole-of-coast governance actions (8 actions)

Issue: 1 - Governance arrangements for coordinated management need to be strengthened								
D1.1 Establish and implement an interdepartmental coastal management working group to support CMP implementation	1	**Council,** *Multiple public authorities*	**Planning** (Ongoing)	Low 1d/m	$0	$0	Staff time	17
D1.2 Maintain close liaison with State and Commonwealth agencies about Lake Macquarie issues and initiatives, drive innovative management, planning, monitoring and reporting processes	1	**All Coordination by Council**	**Planning Engagement** (Ongoing)	Low 1d/m	$0	$0	Staff time	17
D1.3 Conduct an annual review of CMP action status	1	**Council**	**Planning** (Ongoing)	Low 1d/m	$0	$0	Staff time	16
Issue: 2 - Council updates the community on coastal and lake management performance and share knowledge								
D2.1 Continue the Lake Macquarie environmental attitudes survey (every 4 years)	2-5	**Council**	**Monitoring** (One-off projects undertaken every 4 yrs)	Med 1d/w	$0	$0	$20,000 Staff time	11
D2.2 Share the findings of coastal management (including research) projects more widely with the community	1	**Council,** *Universities*	**Engagement** (Ongoing)	Low 1d/m	$0	$0	Staff time	17

Management Action	Timing (years until commencement)	Responsibility (Lead) *(Supporting Partner)*	Type of action (One-off or ongoing)	Staff Resource Required	Indicative capital cost	Indicative maintenance cost	Indicative operational Costs (excluding staff time)	SDG (Sustainable Development Goal)
Issue: 3 - Providing more secure funding for coastal zone management into the future								
D3.1 Implement 'Actions to enhance the security of coastal zone management funding' as per Business Plan	2-5	**Council**	**Planning** (One-off)	Med 1d/w	$0	$0	Staff time	16
D3.2 Increase understanding of the economic value of qualitative actions and services to aid in future viability analysis. (eg. ecosystem services of wetlands, wellbeing benefits)	2-5	**Council**	**Planning** (One-off)	Med 1d/w	$0	$0	Staff time	3, 9, 11, 14, 15, 16
Issue: 4 - Enhancing cultural involvement in coastal zone management								
D4.1 Collaborate with Aboriginal groups (including traditional owners and land councils) when planning works in, or developing plans for, the coastal zone	1	All	**Engagement** Planning (Ongoing)	Med 1d/w	$0	$0	Staff time only	17

Note: Where management actions are proposed on Crown land (including Crown waterways), authorisations and approvals may need to be obtained under the Crown Land Management Act 2016. With respect to works and activities that are proposed in the CMP, if they are to occur on Crown land and Council is the appointed Crown land manager, and the proposed works are consistent with the reserve purpose and a Plan of Management, then in most circumstances no other form of authorisation under the CLM Act will be required.

Management actions undertaken on Crown land will also need to consider Aboriginal Land Claims lodged under the Aboriginal Land Rights Act 1983. All activities relating to the use of Crown land must be consistent with the Commonwealth Native Title Act 1993 (NT Act).

4.4.2 Detailed Business Plan overview

A detailed Business Plan to support the CMP has been prepared by Umwelt, and is provided as Appendix 4.

Summary

The Business Plan shows how the CMP provides value to the community and the environment.

The CMP is a strategic program of actions to maintain and enhance the health and resilience of the natural systems of the city's coastal zone, while also recognising the strengthening social, cultural and economic value of the coastal zone to the people of Lake Macquarie.

Lake Macquarie is a city of more than 210,000 people. Investing in a healthy coastal environment within a major regional city and within easy reach of other large population centres sets up very significant social and economic values, based on the essential link between protecting healthy coastal systems and community lifestyle and wellbeing.

The community supports Council's approach to managing the lake, foreshores and the coast. Results of Council's community satisfaction surveys in 2020 and 2021 demonstrate very high community value placed on the natural landscape of the coastal zone and provide clear evidence of this nexus between a healthy coast and community wellbeing.

The value of implementing the CMP draws on 10 lines of evidence. The benefits accrue to the local environment, the local community and to the State of NSW, consistent with the objects of the CM Act.

The benefits and assurance of the certainty of benefits are linked to:

- **A demonstrated track record** of enhancing community lifestyle values by protecting and restoring natural systems, including restoring estuary water quality through effective catchment management
- **Value for the community**. A healthy lake underpins recreational amenity for diverse water-based activities and events, and enables economic development opportunities. Council explored this relationship in its 2021 Lake Activation Strategy
- **Value for the people of NSW**. The Lake Macquarie CMP is strongly aligned with NSW government priorities and rationale for protecting and restoring a healthy coastal zone. This includes land tenure and land use planning controls which support ongoing risk avoidance for development in the coastal zone
- **Community commitment and involvement.** One of the most expensive budget items supports Landcare projects which engage community volunteers to protect the health of lake side ecological communities. The CMP also fosters value through collaborative engagement with the people who live and work in the city, supporting an evidence-based, deliberative approach to complex coastal and land use planning issues where there is a high level of uncertainty and different perspectives.
- **Public investment in public land and for public benefit**. Almost the entire open coastline and 100km of 174km of lake foreshore are in public land management. Public benefits dominate the outcomes of CMP implementation.
- **Efficient use of Council resources**, targeted to real priorities for a coastal city with high lifestyle values and expectation of Council's environmental performance.
- **The CMP addresses high risks affecting the coastal zone as a priority** and provides an efficient pathway for mitigating risks to values
- **A program based and adaptive approach**. Right investment at the right time, across a spectrum of baseline data collection, technical and socioeconomic investigations, communications, detailed planning, on-ground works to protect coastal processes and to strengthen safe and sustainable public access and the monitoring and reporting that delivers accountability. Adaptive planning that recognises ongoing coastal change and is linked to thresholds of impact. Council has tested a range of natural defences for coastal hazards, on the lake foreshore and coastal dunes, and is continuing to develop natural options for estuarine creek banks.
- **Flexible and innovative longer-term funding mechanisms** are available to extend current resources. This includes investment inputs from public authorities when an action is their responsibility. Costs will be met by the right organisation. It may also include direct community contributions via reintroducing a version of the coastal environmental management levy, to offset the direct benefits to Lake Macquarie residents.
- **The value of partnerships**. Achieving more together.

These natural system, social and economic benefits are clear but qualitative. There is currently limited quantitative data which would enable dollar values to be placed on these benefits in a meaningful way. The CMP includes an action to work with the NSW Government to strengthen quantitative valuation of the environmental and community benefits of effective coastal management programs.

The capital, maintenance and operational (including staff resources) costs of implementing the Lake Macquarie CMP have been estimated over the one-year, four-year and 10-year time frames of Council's Integrated Planning and Reporting (IP&R) framework.

Twenty five per cent of the actions identified in the Implementation Plan will be the direct responsibility of Council, and a further group of actions will be led by Council but involve partnership with a public authority.

Approximately 75 per cent of the actions included in the CMP are non-capital items. Three significant capital items are staged protection works on the Redhead surf club building, asset upgrades and replacement of stormwater treatment devices (SQIDs), which are a key element of water quality management for the city's urban area, and coastal protection works to stabilise the Pelican foreshore alongside Swansea Channel. A separate cost benefit analysis was prepared for these engineering works in 2021.

Only 25 per cent of actions are associated with ongoing maintenance costs. Two key maintenance costs are supporting the function and efficiency of the network of SQIDs around the lake, and the cost of maintenance dredging to enable safe navigation of deep keel and larger cruising vessels through Swansea Channel.

Council's operational expenditure for coastal zone management is estimated to be around $3-4 million a year for the next four-year period, i.e. the period of the current Implementation Strategy under IP&R. This figure includes staffing and delivery of projects such as lake health monitoring, dune and wetland rehabilitation works, community engagement activities, planning activities and research. Approximately 55 per cent of the actions in the CMP are ongoing actions where a continuing management commitment is required.

While the indicative cost of most operational activities is low to moderate (generally less than $20,000 a year for individual actions) or is primarily staff time, a key implementation strategy for the CMP, with a high annual budget, is Council's support for Landcare. Council has allocated $1.3 million a year to support Landcare activities across the city. This budget is for an integrated program across the entire city, not just within the coastal zone.

Other significant operational commitments include ongoing lake water quality/estuary health monitoring, including mapping and monitoring of sea grass (currently funded by the Marine Estate Management Strategy). This will be enhanced to provide good data about specific potential impact areas, such as around boat ramps, jetties and popular foreshore reserves. The CMP includes the update of some lake management framework documents such as the mooring management plan and the sustainable navigation dredging framework for Swansea Channel. These are key to balancing the natural and recreational values of the estuary.

Overall, the cost of Council staff to provide the services identified in the CMP, over the full life of the program is a significant part of the cost of sustainable management of the coastal zone and of the city's environment. Individually, more than 80 per cent of the actions in the CMP are anticipated to require low or moderate staff resource commitments, with staff being involved in investigations, communication, monitoring, stakeholder engagement, data analysis and project management.

Individual projects within the CMP that require more intensive staff resources include resilience and adaptive management planning for high-risk communities and the staff costs involved in maintaining beach accessways, dune protection and lake foreshore facilities.

Council's resourcing commitment is consistent with its responsibility for managing a large and complex coastal lake, multiple beaches and headlands, and the dynamic environment of Swansea Channel. All parts of the city's coastal zone are highly valued by the community, and there are high community expectations for effective management of the city's natural assets. Council's reputation for effective coastal management is linked to investment in resources for strong project management, adaptation, collaboration, communication and transparency.

Actions to enhance the security of coastal zone management funding

The following actions have been identified as potential means of increasing the availability and security of funding for Council's coastal zone management activities into the future.

- Investigate the introduction of Special Rate Variation to provide additional income for coastal zone management activities
- Investigate the introduction of a Stormwater Charge
- Continue to seek grant funds where appropriate
- Advocate for the Coast and Estuary Program funding (and other relevant funding programs) to be modified so grant guidelines provide for program level funding over longer terms, rather than short-term project level funding
- Where appropriate, include relevant coastal zone management actions in the review of Developer Contribution Plans to increase access to developer contribution funding
- Investigate a Coastal Protection Service Charge for funding of the maintenance of specific large-scale foreshore projects, particularly those in Swansea Channel
- Advocate for an expanded Coastal Protection Charge to fund new coastal and foreshore protection works (not just maintenance)
- Investigate and advocate for Crown Reserve Model to be utilised for lake and boating related programs
- Apply 'beneficiary pays' principles for foreshore and coastal protection projects that have a private benefit
- Continue to investigate emerging opportunities for additional income

4.5 Monitoring, evaluation and reporting program

The Lake Macquarie CMP is a program of on-ground works, monitoring, research and planning and engagement initiatives that targets the threats to the ecological and socio-economic values of the coastal zone. The CMP also includes actions directly aimed at improving recreational opportunities for the public, and targets coastal hazards within the coastal zone areas: coastline, estuary and Swansea Channel.

The Lake Macquarie CMP contains priority actions set out within the three coastal zone areas aimed at addressing the key threats to the coastal zone. Many of the actions are targeted towards improving ecological health, as this is the key to supporting the recreational, cultural and economic values of the coastal zone. Funding will be required for many of the actions, and will be vital for the success of the CMP.

There are action triggers relating to coastal hazards along the coastline (Table 8) and within the Local Adaptation Plan area (Table 7 and Figure 7) and the Coastal Zone Emergency Action Subplan (Appendix 5).

This subplan details locations vulnerable to beach erosion, coastal inundation and cliff instability hazards along the open coastline, and details actions during four phases of the emergency management cycle: prevention, preparation, response and recovery.

The Coastal Zone Emergency Action Subplan is to be reviewed within five years of adoption. Earlier review may be required:

- Following a coastal emergency and critical review of the CZEAS, as outlined in final action in recovery phase of the emergency management cycle (Figure 12 of appendix 5)
- After a review of the local, regional or State EMPLANs or relevant sub-plans that identify changes impacting the CZEAS
- If new/updated scientific hazard information becomes available

Annual review and reporting

Council currently implements a large number of environmental and sustainability initiatives reported in the annual Sustainability Report (previously known as the State of the Environment Report). This report describes progress on implementation of the various environmental and sustainability strategies and plans delivered by Council. including coastal zone management, and details the trends and conditions of key environmental condition indicators and progress towards meeting Council's adopted sustainability targets. This report also details Council's contribution to meeting relevant United Nations Sustainable Development Goals.

To ensure strong links with the local government integrated planning and reporting framework, key information from the Sustainability Report are incorporated into Council's Annual Report, adopted and published in accordance with provisions of the Local Government Act 1993.

The status of CMP implementation will be monitored and evaluated annually, and reported on by integrating into the existing reporting systems described above.

Five-year review

A review will be conducted after five years to measure the performance of the CMP managing and reducing threats to the ecological, social and economic values of the coastal zone area.

The main mechanism for determining whether the CMP has been successful is to re-evaluate the threats through a repeat of the threat assessment process.

10-year review

The Lake Macquarie CMP, and the need for additional supporting studies, will be reviewed every 10 years.

Internal monitoring and evaluation

An internal Coastal Management Working Group is recommended (Implementation Plan Action D1.1). This working group is to carry out a review of action status every quarter, aligning with other organisational quarterly reporting.

Results from the working group review are to be reported to the Coastal Zone Management Committee.

External review

An annual workshop in partnership with DPE, other agencies and community members will be conducted to review the implementation status of the CMP, identifying any barriers or challenges. Outcomes from this workshop are to be reported to the Coastal Zone Management Committee.

NSW Government and the NSW Coastal Council have a role to play in auditing CMPs. Details of this auditing framework are being developed.

Actions from the CMP Implementation Plan will be incorporated into Lake Macquarie City's Delivery Program and Operational Plans.

Council delivers an Annual Report to document progress with implementing Council's Delivery Program and Operational Plan activities over each financial year.

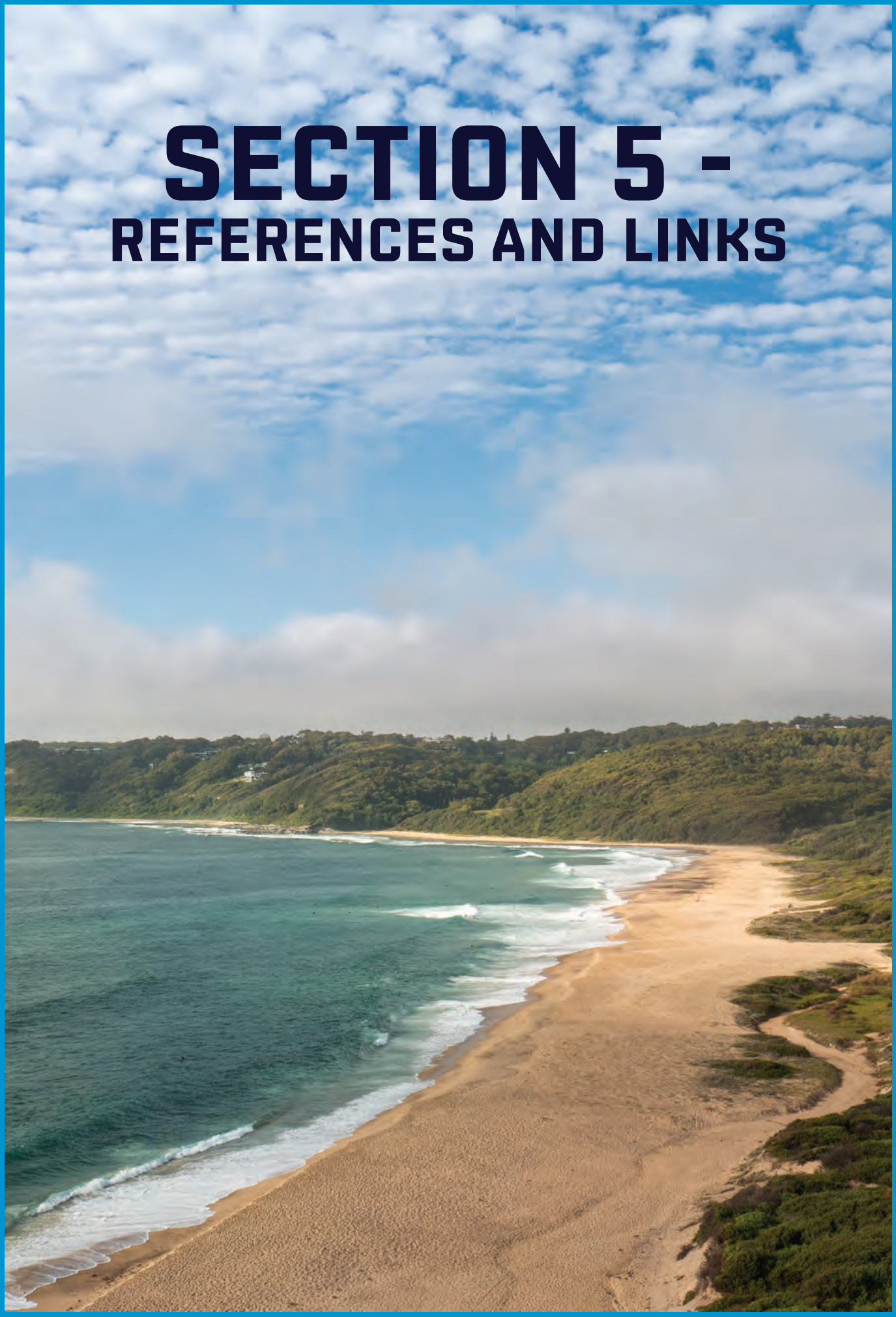
Business Plan and Finance review

The Implementation Plan and Business Plan reflects the expected cost of the CMP over the coming financial year and details the resourcing and financing arrangements to meet these costs. It also demonstrates the contribution from successful grant funding applications for specific actions, and the additional contribution required from Council.

The plan provides an avenue for bringing delayed actions into play. Through the Business Plan, the financial, resourcing or timing requirements for delayed actions can be modified, and forecasts adjusted to account for implementation of these actions over the coming or a future financial year. The Business Plan will be a key document for tracking success in grant funding applications and part or full contributions from Council. It is this financial success that will guarantee the implementation of the CMP.

As implementation of the CMP progresses, relevant sections of Council's business plans will be updated annually to reflect the budget for the CMP for each upcoming year, allowing relevant actions to be fed into the implementation process, and accounting for external grant funding awarded to implement CMP actions.

SECTION 5 -
REFERENCES AND LINKS



Reference List

Australian Government, Nd. Data.gov.au, Available at: https://search.data.gov.au/dataset/ds-dga-851571e7- 85b2-48dd-bf38-f0659a9f6b46/details?q=water, Accessed on 21 May 2020.

Australian Government, Department of Climate Change 2009, 'Climate Change Risks to Australia's Coast', A First Pass National Assessment. Australian Government, Directory of Important Wetlands in Australia, Information sheet Available at: https://www.environment.gov.au/cgi-bin/wetlands/report.pl. Accessed on 9 June 2020.

BMT 2020, Lake Illawarra Coastal Management Program 2020-2030

BMT WBM 2015, Lake Macquarie Coastal Zone Management Plan – Part C for Swansea Channel.

BMT WBM 2015, Lake Macquarie Coastal Zone Hazards and Risk Assessment Final Report.

Central Coast Council, Policies. Available at: https://www.centralcoast.nsw.gov.au/council/forms-and-publications/policies. Accessed on 9 May 2020.

City of Newcastle Coastal Management Program Scoping Study 2019. Available at: https://newcastle.nsw. gov.au/Newcastle/media/Documents/environment/Our%20Coastline%20-%20Documents/Coastal%20 Planning%20-%20Documents/CMP-Scoping-Study.pdf. Accessed March-July 2020, various dates.

Dantia, Lake Macquarie City Economic Development Strategy 2018-2038.

Department of Planning, Industry and Environment (DPIE) 2019, Coastal Management Manual and Guidelines

Department of Planning, Industry and Environment (DPIE) 2021, State of the Estuary Report, Lake Macquarie 2020.

ecological Australia (2010) Lake Macquarie Wetlands Climate Change Assessment.

Hawkesbury Shelf Marine Bioregion Threat and Risk Assessment Report 2016, The Hawkesbury Shelf TARA.

HCCREMS https://www.hccrems.com.au/ Accessed on 14 April 2020.

Lake Macquarie City Council 2018, Destination Management Plan 2018-2022. https://www.visitlakemac.com. au/contact/industry/destination-management-plan

Lake Macquarie City Council 2015, Lake Macquarie Coastal Management Plan

Lake Macquarie City Council 2016, Planning for Future Flood Risks – Marks Point and Belmont South Local Adaptation Plan Volume 1, Available at: https://shape.lakemac.com.au/adapting-marks-point-belmont-south

Lake Macquarie City Council 2016, Planning for Future Flood Risks – Marks Point and Belmont South Local Adaptation Plan Volume 2, Available at: https://shape.lakemac.com.au/adapting-marks-point-belmont-south

Lake Macquarie City Council 2017, Lake Macquarie City Community Strategic Plan – Our Future in Focus 2017-2027Lake Macquarie City Council, 2020. Local Strategic Planning Statement. Available at: https://www.lakemac.com.au/Our-Council/City-planning-and-direction.Accessed on 3 August 2020

Lake Macquarie City Council 2019, State of the Environment Report 2018-2019, https://www.google.com

Links to supporting studies

CZMP **CZMP**

Coastline Hazard and Risk Assessment - **Coastline Hazard and Risk Assessment**

Local Adaptation Plans (LAPs)
Marks Point & Belmont South LAP

Swansea and surrounds LAP

Lake Activation Strategy **Lake Activation Strategy**

Surf amenity assessment
Blacksmiths surf amenity assessment

State of Estuary State of the Estuary Report

Wave Overtopping **Wave Overtopping Assessment**

Water level analysis **Water Level Analysis**

Pelican Foreshore
Pelican Foreshore Stabilisation Project

GLOSSARY

Accretion: Growth of coastal shorelines by steady addition of sediments.

Adaptation: Adjustments in natural or human systems in response to climate stimuli or their effects, which moderate harm or exploit beneficial opportunities.

Adaptive capacity: Ability of a system to adjust to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities or to cope with the consequences.

Average Recurrence Interval (ARI) and Annual Exceedance Probability (AEP): Both terms are a measure of the rarity of a rainfall event, but can also be used to refer to the rarity of a storm event. The ARI is the average, or expected, value of the periods between exceedances of a given rainfall total accumulated over a given duration. The AEP is the probability that a given rainfall total accumulated over a given duration will be exceeded in any one year.

Bathymetry: Refers to the depth of the ocean. A bathymetric chart will show the depths to the sea floor (and therefore the shape of the sea floor) at different locations.

Biodiversity: The numbers and relative abundances of different genes, species and ecological communities in a particular area.

Bluff or cliff: Coastal cliffs (especially steep and precipitous cliffs), steep rock and weathered rock slopes, headlands, hardened and cemented sand coastal slopes.

Breakwater(s): A constructed structure built offshore to protect coastal areas such as harbours from offshore waves.

Climate change: The long-term change (decades or longer) in pattern of weather, and related changes in oceans, sea level, land surfaces and ice sheets.

Climate projection: A projection of future climate based on simulation by climate models.

Coast: Generally used, with 'coastline', to refer to the actual shoreline where the sea meets the land.

Coastal hazard zone: The shoreline and hinterland areas determined to be at risk from coastal erosion or inundation. The zone is divided up as the Zone of Wave Impact and Slope Adjustment and Zone of Reduced Foundation Capacity for a given time period.

Coastal inundation: Flooding that occurs when waves overtop the frontal dune system, so that on or landward of low dunes is inundated by sea water. Some of these areas can also be flooded by rising lake waters. High lake water levels are influenced by catchment rainfall, accommodation capacity on local floodplains and the size/capacity of the lake entrance.

Coastal risk area: Any coastal area subject to coastal erosion, inundation or geotechnical hazard that has potential to negatively impact people or property. Coastal risk areas are generally identified in NSW for immediate, 2050 and 2100 planning periods.

Coastal zone: Extends from the continental shelf to as far inland as coastal processes (tides, wind-blown coast dunes) dominate. The NSW Coastal Policy defines this as including three nautical miles seaward of the mainland, one kilometre landward of the open coast high water mark, one kilometre around the shores of all bays, estuaries, lakes and lagoons and all tidal waters upstream to the limit of mangroves.

GLOSSARY

Coastal geomorphology: The physical structures, processes and patterns associated with the coast, including landforms, soil and geology and the factors that influence them.

Dredging: An underwater excavation activity intended to remove sediments and debris. Often used to keep navigable pathways within waterways.

East coast lows: Intense low-pressure systems that usually occur several times each year off the east coast of Australia. Severe east coast lows generate extreme water levels and high waves which drive coastal erosion.

Ecosystem services: Ecological processes or functions having monetary or non-monetary value to individuals or society at large.

Entrance management: Includes artificial opening of entrances, managing the configuration, height or location of the beach to enable entrance opening at a level lower than the natural range.

Erosion: The removal of land by natural forces such as waves, tidal currents and/or littoral currents.

Estuary: The section of a river affected by tidal activity where fresh water from the river mixes with salt water from the ocean.

Foreshore: The section of the shore between the low and high tidal limits.

Geomorphology: A branch of physical geography encompassing the formation of the earth's surface, distribution of land, water and other elements.

Native title: Native title or native title rights and interests means the communal, group or individual rights and interests of Aboriginal or Torres Strait Islander people in relation to land or waters, where the rights and interests are possessed under the traditional laws and customs observed by the Aboriginal or Torres Strait Islander people, and the Aboriginal or Torres Strait Islander people, by those laws and customs, have a connection with the land or waters; and the rights and interests are recognised by the Native Title Act 1993.

Ocean waves: Waves occurring in the ocean that have been generated from wind blowing over the ocean surface over long distances (known as the fetch of a wave, length of the fetch area is measured in the direction of the wind). Swell or incident waves on the coast typically have a wave period of eight to 10 seconds, with large storm waves having periods of 12 seconds or greater.

Riparian vegetation: Vegetation located along the banks of a body of water, usually rivers.

Scour: Localised loss of soil, often present around a foundation element.

Sea level rise: A long-term increase in mean sea level, usually associated with climate change and increase in temperature in particular.

Sedimentation: The settling of particles (e.g. sand or mud) out of the water column onto the bed of a water body.

Shoaling: The deformation of incident waves on the lower shoreface that starts when the water depth becomes less than about half of the wavelength, causing the waves to become steeper.

Tidal currents: Currents caused by the incoming (flood) or outgoing (ebb) tide. Tidal currents are typically the main current within estuaries, particularly in the entrance area where tidal currents transport marine sediments (sand).

Tide: The alternate rising and falling of the sea, usually twice in each day at a particular place, due to the attraction of the moon and sun.

Wetland: Areas of land that are partly saturated by water, including marshes and swamps.

Abbreviations

CMP	Coastal Management Program
CZEAS	Coastal Zone Emergency Action Sub-plan
DPE	Department of Planning and Environment
DCP	Development Control Plan
HWC	Hunter Water Corporation
IPCC	Intergovernmental Panel for Climate Change
IP&R	Integrated Planning and Reporting
LAP	Local Adaptation Plan
LEP	Local Environmental Plan
LGA	Local Government Area
LLS	NSW Local Land Services
LSPS	Local Strategic Planning Statement
MEMS	The Marine Estate Management Strategy
NPWS	National Parks and Wildlife Service
PHA	Probabilistic Hazard and Damages Assessment
SEPP	State Environmental Planning Policy
SQID	Stormwater Quality Improvement Device
SLR	Sea Level Rise
TfNSW	Transport for New South Wales
TARA	Threat and Risk Assessment Final Report (Marine Estate Management Authority)

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COASTAL MANAGEMENT PROGRAM APPENDICES

Appendices

Appendix 1 Checklist – mandatory requirements & response details

Appendix 2 Scoping study

Appendix 3 Community engagement plan

Appendix 4 Detailed business plan

Appendix 5 Coastal zone emergency action sub plan

Appendix 6 Coastal planning lines

Appendix 7 Foreshore stabilisation works (coastal protection works) prioritisation tool

Appendix 8 Environmental protection works in coastal wetlands and littoral rainforests

Appendix 9 Actions feasibility/viability assessment

Appendix 1 – Mandatory Requirements Checklist

Table 1: Section 1 - Statutory requirements set out in the Coastal Management Act 2016

CM Act 2016	Issue	Requirements met	Reference
s13(2)	A coastal management program may be made in relation to the whole, or any part, of the area included within the coastal zone.	Yes	Addressed in: - Section 2 – Figure 8 shows the coastal zone area for Lake Macquarie.
s14(3)(a)	In preparing a coastal management program, a local council must: consider and promote the objects of this Act.	Yes	Throughout, with specific reference to: - Section 1.4 Governance Context - Appendix 1 Table 3 (Objects of the Coastal Management Act 2016) and Table 4 (Management Objectives of the *Coastal Management Act 2016*) - Appendix 9 Actions feasibility/viability assessment
s14(3)(b)	In preparing a coastal management program, a local council must: give effect to the management objectives for the coastal management areas covered by the program.	Yes	Throughout, with specific reference to: - Section 1.4 Governance Context - Appendix 1 Table 3 (Objects of the Coastal Management Act 2016) and Table 4 (Management Objectives of the *Coastal Management Act 2016*) - Appendix 9 Actions feasibility/viability assessment
s14(3)(c)	In preparing a coastal management program, a local council must: consider the State and regional policies and plans prescribed by the regulations for the purposes of this section.	Yes	Considered and specified in sections: - Section 1.5 Planning Context - Appendix 2 Scoping Study (Section 5.4)

s15(1)(a)	A coastal management program must: identify the coastal management issues affecting the areas to which the program is to apply.	Yes	Addressed in: - Section 2.1 Snapshot of Issues - Section 4.4 Implementation Plan - Appendix 2 Scoping Study - Appendix 4 Detailed Business Plan - Appendix 8 Actions feasibility/viability assessment
s15(1)(b)	A coastal management program must: identify the actions required to address those coastal management issues in an integrated and strategic manner.	Yes	Addressed in: - Section 4.4 Implementation Plan - Appendix 4 Detailed Business Plan - Appendix 9 Actions feasibility/viability assessment
s15(1)(c)	A coastal management program must: identify how and when those actions are to be implemented, including those to be implemented by local councils under Chapter 13 of the *Local Government Act 1993*, those to be implemented under the environmental planning instruments and development control plans under the *Environmental Planning and Assessment Act 1979* and those to be implemented by public authorities (other than the local council).	Yes	Addressed in: - Section 4.4 Implementation Plan - Appendix 4 Business Plan - Appendix 9 Actions feasibility/viability assessment
s15(1)(d)	A coastal management program must: identify the costs of those actions and proposed cost-sharing arrangements and other viable funding mechanisms for those actions to ensure the delivery of those actions is consistent with the timing for their implementation under the coastal management program.	Yes	Addressed in: - Section 4.4 Implementation Plan - Appendix 4 Detailed Business Plan - Appendix 9 Actions feasibility/viability assessment

s15(1)(e)	A coastal management program must: if the local council's local government area contains land within the coastal vulnerability area and beach erosion, coastal inundation or cliff instability is occurring on that land, include a coastal zone emergency action subplan.	Yes	Addressed in: - Section 1.5 Planning Context (CVA) - Section 3 Coastal Hazards
s15(4)	A coastal management program must not include the following: (a) matters dealt with in any plan made under the State Emergency and Rescue Management Act 1989 in relation to the response to emergencies, (b) proposed actions or activities to be carried out by any public authority or relating to any land or other assets owned or managed by a public authority, unless the public authority has agreed to the inclusion of those proposed actions or activities in the program.	Yes	Addressed in: - Section 4.4 Implementation Plan - Appendix 5 Coastal Zone Emergency Action Sub-plan - Appendix 10 Supporting letters from agencies
S16(1)	Before adopting a coastal management program, a local council must consult on the draft program with: (a) the community, and (b) if the council's local government area contains: i. land within the coastal vulnerability area, any local council whose local government area contains land within the same coastal sediment compartment (as specified in Schedule 1), and ii. an estuary that is within 2 or more local government areas (as specified in Schedule 1), the other local councils, and (c) Other public authorities if the coastal management program; i. proposes actions or activities to be carried out by that public authority, or	Yes	The CMP was exhibited from 29 November 2022 till 3 February 2023. Refer to: - Section 4.1 Community and Stakeholder Engagement - Appendix 3 Communications and Engagement Plan

	ii. proposes specific emergency actions or activities to be carried out by a public authority under coastal zone emergency action subplan, or iii. relates to, affects or impacts on any land or assets owned or managed by that public authority.		

Table 2: Section 2 - Mandatory Requirements set out in NSW Coastal Management Manual (2018) – Part A

CM Act 2016	Issue	Requirements met	Reference
MR2	A CMP is to consider a range of timeframes and planning horizons including immediate, 20 years, 50 years, 100 years and (if council considers it relevant based on expert advice) beyond.	Yes	Addressed in: - Section 3.1 Risk Assessment - Section 3.2 Coastal Hazards - Appendix 6 Coastal Planning Lines
MR3	A CMP is to consider a broad range of coastal management issues and management actions with a focus on achieving the objects and objectives of the *Coastal Management Act 2016.*	Yes	Addressed in: - Section 2.1 Snapshot of Issues - Section 4.4 Implementation Plan - Appendix 2 Scoping Study - Appendix 4 Detailed Business Plan - Appendix 9 Actions feasibility/viability assessment
MR4	A CMP must include the rationale for selecting the area to be covered by a CMP and identify whether it applies to: i. all or part of the coastal zone of one local government area; or ii. all or part of the coastal zone of adjoining local government areas that share a coastal sediment compartment or estuary (where adjoining local government areas share a coastal sediment compartment or estuary – refer to Schedule 1 of the Coastal Management Act 2016 – a CMP that addresses an area comprising that coastal sediment compartment or estuary must reflect this regional context).	Yes	Addressed in: - Section 2 The A, B and C of Lake Macquarie's Coastal Management Program - Appendix 2 Scoping Study
MR5i	A CMP must identify:	Yes	No amendments proposed Refer to Section 1.5 Planning Context

	any proposed amendments to mapping of relevant coastal management areas.		
MR5ii	A CMP must identify: evidence to support any proposed amendments or additions to the area of the four coastal management areas in the relevant area.	N/A	No amendments proposed Refer to Section 1.5 Planning Context
MR5iii	A CMP must identify: information about these proposed amendments that can support the preparation of a planning proposal and, in particular, that could be forwarded along with a planning proposal to the Greater Sydney Commission (if the planning proposal relates to the Greater Sydney Region) or the Minister (for elsewhere) to inform a Gateway Determination under section 3.34 of the *Environmental Planning and Assessment Act 1979*.	Yes	No amendments proposed Refer to Section 1.5 Planning Context
MR6i	During preparation of a CMP, a council is to: identify the scope of the CMP.	Yes	Addressed in: - Appendix 2 Scoping Study
MR6ii	During preparation of a CMP, a council is to: determine and assess coastal risks, vulnerabilities and opportunities (including without limitation risks to environmental social and economic values and benefits).	Yes	Addressed in: - Section 3.1 Risk Assessment - 4.3 Stage 2 Studies Supporting studies links CZMP Local Adaptation Plans (LAPs) Marks Point & Belmont South LAP Swansea and surrounds LAP

			Surf amenity assessment Blacksmiths surf amenity assessment State of Estuary State of the Estuary Report Wave Overtopping Wave Overtopping Assessment Water level analysis Water Level Analysis
MR6iii	During preparation of a CMP, a council is to: evaluate and select coastal management options.	Yes	Addressed in: - Appendix 9 Actions feasibility/viability assessment
MR7i	A council may choose not to repeat steps (or parts of steps) in subparagraphs (ii) or (iii) of mandatory requirement 6 for the area the subject of the proposed CMP (or parts of that area) if those tasks have already been undertaken for the coastal management of that area, provided that council first considers: whether the existing assessment of coastal risks, vulnerabilities and opportunities, or the existing evaluation of coastal management options, that council proposes to rely on enables council to prepare the CMP in accordance with mandatory requirement 8 below and sections 14 and 15 of the *Coastal Management Act 2016*.	Yes	Addressed in: - Appendix 9 Actions feasibility/viability assessment

MR7ii	A council may choose not to repeat steps (of part of steps) in subparagraphs (ii) or (iii) of mandatory requirement 6 for the area the subject of the proposed CMP (or parts of that area) if those tasks have already been undertaken for the coastal management of that area, provided that council first considers: the effectiveness of the existing coastal management of that area.	Yes	Addressed in: - Appendix 9 Actions feasibility/viability assessment
MR7iii	A council may choose not to repeat steps (of part of steps) in subparagraphs (ii) or (iii) of mandatory requirement 6 for the area the subject of the proposed CMP (or parts of that area) if those tasks have already been undertaken for the coastal management of that area, provided that council first considers: whether any circumstances concerning the coastal management of that area have changed.	Yes	Addressed in: - Appendix 9 Actions feasibility/viability assessment
MR8i	A CMP must: provide a description of how the objects of the *Coastal Management Act 2016* have been considered and promoted in preparing the CMP	Yes	Addressed in: - Section 1.4 Governance Context - Appendix 1 Table 3 (Objects of the Coastal Management Act 2016) and Table 4 (Management Objectives of the *Coastal Management Act 2016*) - Appendix 9 Actions feasibility/viability assessment
MR8ii	A CMP must: provide a description of how the objectives of the coastal management areas covered by the CMP have been given effect to in preparing the CMP	Yes	Addressed in: - Section 1.4 Governance Context - Appendix 1 - table 3 (Objects of the Coastal Management Act 2016) and table 4 (Management Objectives of the *Coastal Management Act 2016*).

			- Appendix 9 Actions feasibility/viability assessment
MR8iii	A CMP must: identify the key coastal management issues affecting the areas to which the CMP is to apply and how these have been considered	Yes	Addressed in: - Section 2.1 - Snapshot of Issues for the Lake Macquarie's coastal zone - Appendix 2 Scoping Study - Appendix 4 Detailed Business Plan - Appendix 9 Actions feasibility/viability assessment
MR8iv	A CMP must: identify any coastal management actions required to address those key coastal management issues in an integrated and strategic manner	Yes	Addressed in: - Section 4.4 Implementation Plan - Appendix 2 Scoping Study - Appendix 4 Detailed Business Plan - Appendix 9 Actions feasibility/viability assessment
MR8v	A CMP must: identify how the coastal management actions in (iv) have been considered and evaluated (including, without limitation, how council has evaluated the coastal management actions in light of the functions and responsibilities council has under legislation other than the *Coastal Management Act 2016*)	Yes	Addressed in: - Appendix 9 Actions feasibility/viability assessment
MR8vi	A CMP must: identify any environmental protection works, on land identified as 'coastal wetlands' or 'littoral rainforests' on the Coastal Wetlands and Littoral Rainforests Area Map under the State Environmental Planning Policy (Coastal Management) 2018, that are	Yes	Addressed in: - Section 4.4 Implementation Plan - Appendix 8 Environmental Protection Works in coastal wetlands and littoral rainforests

	proposed to be carried out by or on behalf of a public authority.		
MR8vii	A CMP must: identify any coastal protection works that are proposed to be carried out by or on behalf of a public authority.	Yes	Addressed in: - Section 4.4 Implementation Plan - Appendix 7 Foreshore Stabilisation Works (Coastal Protection Works) Prioritisation Tool
MR8viii	A CMP must: Set out the recommended timing for the proposed coastal management actions.	Yes	Addressed in: - Section 4.4 Implementation Plan - Appendix 2 Scoping Study - Appendix 4 Business Plan - Appendix 8 Actions feasibility/viability assessment
MR8ix	A CMP must: identify a proposed monitoring, evaluation and reporting program in relation to the CMP, including by identifying key indicators, trigger points and thresholds relevant to the CMP.	Yes	Addressed in: - Section 4.6 Monitoring, Evaluation and Reporting - Section 4.4 Implementation Plan
MR8x	A CMP must: include a business plan.	Yes	Addressed in: - Section 4.5 Business Plan - Appendix 4 Detailed Business Plan
MR9i	The business plan included in the CMP must identify: all proposed coastal management actions identified elsewhere in the CMP.	Yes	Addressed in: - Section 4.4 Implementation Plan - Section 4.5 Business Plan - Appendix 4 Detailed Business Plan
MR9ii	The business plan included in the CMP must identify:	Yes	Addressed in: - Section 4.4 Implementation Plan

	the full proposed capital, operational and maintenance costs, and recommended timing, of proposed coastal management actions.		- Section 4.5 Business Plan - Appendix 4 Detailed Business Plan
MR9iii	The business plan included in the CMP must identify: any proposed cost-sharing arrangements and any other viable funding mechanisms for the proposed coastal management actions to ensure delivery of those actions is consistent with the timing for their implementation under the CMP.	Yes	Addressed in: - Section 4.4 Implementation Plan - Section 4.5 Business Plan - Appendix 4 Detailed Business Plan
MR9iv	The business plan included in the CMP must identify: The distribution of costs and benefits of all proposed coastal management actions.	Yes	Addressed in: - Section 4.4 Implementation Plan - Section 4.5 Business Plan - Appendix 4 Detailed Business Plan
MR10	Where coastal hazards have been identified in a coastal management area, a CMP must identify proposed coastal management actions for those hazards.	Yes	Addressed in: - Section 3.2 Coastal Hazards - Section 4.4 Implementation Plan
MR11	If the *Coastal Management Act 2016* requires that a coastal zone emergency action subplan be prepared, it must identify any requirements for how emergency coastal protection works, within the meaning of the *State Environmental Planning Policy (Coastal Management) 2018*, are to be carried out.	Yes	Addressed in: - Appendix 5 Coastal Zone Emergency Action Sub-plan
MR12i	A CMP must demonstrate how a council has considered: projected population growth and demographic changes.	Yes	Addressed in: - Section 1.2 Cultural and Social Context

MR12ii	A CMP must demonstrate how a council has considered: projected use of coastal land for infrastructure, housing, commercial, recreational and conservation purposes.	Yes	Addressed in: - 1.4 Planning Context - 4.3 Stage 2 Studies - Appendix 4 Detailed Business Plan
MR13i	A CMP must demonstrate how a council has considered: current and future risks, at timeframes of immediate, 20 years, 50 years, 100 years and (if council considers it relevant based on expert advice) beyond.	Yes	Addressed in: - Section 3.1 Risk Assessment - Section 3.2 Coastal Hazards - Section 4.3 Stage 2 studies - Appendix 6 Coastal Planning Lines
MR13ii	A CMP must demonstrate how a council has considered: (if council considers it relevant) current and future risks of potentially high consequence, low probability events that may affect the relevant areas.	Yes	Addressed in: - Section 3.1 Risk Assessment - Section 3.2 Coastal Hazards - Section 4.3 Stage 2 Studies - Appendix 6 Coastal Planning Lines
MR13iii	A CMP must demonstrate how a council has considered: the effects of projected climate change and how it may affect the relevant area.	Yes	Considered throughout the documents, including: - Section 2.1 Snapshot of Issues - Section 3.1 Risk Assessment - Section 3.2 Coastal Hazards - Section 4.2 Principles for Coastal Zone Management - Section 4.3 Stage 2 Studies - Appendix 6 Coastal Planning Lines
MR13iv	A CMP must demonstrate how a council has considered: the local and regional scale effects of coastal processes.	Yes	Considered in: - Section 1.1 Environmental Context - Section 3.1 Risk Assessment - Section 3.2 Coastal Hazards - Section 4.3 Stage 2 studies - Appendix 6 Coastal Planning Lines
MR13v	A CMP must demonstrate how a council has considered: the ambulatory and dynamic nature of	Yes	Addressed in: - Section 3.2 Coastal Hazards - Section 4.3 Stage 2 studies

	the shoreline and how it may affect the relevant area.		- Appendix 6 Coastal Planning Lines - Appendix 7 Foreshore stabilisation works (Coastal Protection Works) prioritisation tool
MR14	A CMP is to include the following sections: i. Executive summary; ii. Introduction; iii. A snapshot of issues; iv. Actions to be implemented by the council or by public authorities; v. Whether the CMP identifies recommended changes to the relevant planning controls, including any proposed maps; vi. A business plan; vii. Coastal zone emergency action subplan, if the Coastal Management Act 2016 requires that subplan to be prepared; viii. Monitoring, evaluation and reporting program; ix. Maps x. References list	Yes	Throughout the document
MR15	A draft CMP must be exhibited for public inspection at the main offices of the councils of all local government areas within the area to which the CMP applies, during the ordinary hours of those offices, for a period of not less than 28 calendar days before it is adopted. This mandatory requirement does not prevent community consultation, or other consultation, in other ways.	Yes	The CMP was exhibited from 29 November 2022 till 3 February 2023.
MR16	When implementing a CMP, a council must: i. carry out the monitoring, evaluation and reporting program in the CMP (MER); and ii. monitor key indicators, trigger points and thresholds identified in the MER	Yes	Addressed in: - Section 4.6 Monitoring, Evaluation and Reporting

MR17	Councils must report on the implementation of a CMP through the IP&R framework on an annual, four yearly and ten-yearly basis.	Yes	Implementation Plan (section 4.4) actions priorities allocated as 1,4 or 10 years Links with IP&R framework included in: - Section 1.5 Planning Context - Section 4.6 Monitoring, Evaluation and Reporting
MR18	When an adjoining council or a public authority is affected, or is likely to be affected, by implementation of some aspect of a CMP, a council must liaise with that authority when implementing that aspect of the CMP.	Yes	Addressed in - Appendix 10 Supporting letters from agencies
MR19	Council must maintain sufficient information and records about its management of the relevant parts of the coastal zone that will enable it to demonstrate: i. how the CMP has been implemented; and ii. what has been achieved in connection with the CMP, including whether coastal management actions have been carried out within the timeframes identified in the CMP.	Yes	Addressed in: - Section 4.4 Implementation Plan - Section 4.6 Monitoring, Evaluation and Reporting

Table 3 Objects of the Coastal Management Act 2016

CM Act Section 3	Objects of the CM Act	Addressed in this of CMP	How the CMP considers and promotes these objects
(a)	to protect and enhance natural coastal processes and coastal environmental values including natural character, scenic value,	1.1 Environmental context 2.1 Snapshot of issues 3.2 Coastal Hazards	Protection and enhancement of natural coastal processes and values is a prominent theme throughout the CMP and includes a large number

	biological diversity and ecosystem integrity and resilience.	4.4 Implementation Plan	of actions focussing environmental protection and restoration.
(b)	to support the social and cultural values of the coastal zone and maintain public access, amenity, use and safety.	1.2 Cultural & Social Context 2.1 Snapshot of issues 3.2 Coastal Hazards 4.4 Implementation Plan	Supporting social and cultural values are inherently considered throughout the CMP, which contains a large number of actions to maintain access and use of key coastal areas into the future.
(c)	to acknowledge Aboriginal peoples spiritual, social, customary and economic use of the coastal zone.	1.2 Cultural & Social Context 2.1 Snapshot of issues 3.2 Coastal Hazards 4.4 Implementation Plan	The CMP acknowledges Aboriginal people who have cared for our coastal zone for thousands of years, and contains actions to enhance involvement into the future.
(d)	to recognise the coastal zone as a vital economic zone and to support sustainable coastal economies.	1.3 Economic Context 2.1 Snapshot of issues 4.4 Implementation Plan 4.5 Business Plan	Our lake and beaches are well recognised as being vital to the local economy. The CMP builds upon this and contains actions to build and support sustainable coastal economies into the future.
(e)	to facilitate ecologically sustainable development in the coastal zone and promote sustainable land use planning decision-making.	1.1 Environmental Context 1.3 Economic Context 2.1 Snapshot of issues 4.4 Implementation Plan 4.5 Business Plan	Ecologically Sustainable Development (ESD) is a prominent feature of our land-use planning system. The CMP builds upon this and aligns our ESD contributions to the United Nations Sustainable Development Goals framework.
(f)	to mitigate current and future risks from coastal hazards, taking into account the effect of climate change	3.2 Coastal Hazards 4.3 Stage 2 Studies Appendix 6 Planning Lines	The mitigation of current and future climate change hazards is a major theme of the CMP, and it contains a large number of actions relating to coastal hazard mitigation.

(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.	3.2 Coastal Hazards 4.3 Stage 2 Studies 4.4 Implementation Plan Appendix 6 Planning Lines Appendix 7 Foreshore stabilisation prioritisation tool	The consideration of local and regional scale coastal processes is an inherent component of the processes studies that informed the CMP. The CMP contains actions that reflect the dynamic nature of shorelines, especially within Swansea Channel.
(h)	to promote integrated and co-ordinated coastal planning, management and reporting.	1.4 Governance Context 4.4 Implementation Plan 4.5 Business Plan	The CMP is founded on providing an integrated and coordinated approach to the management of the whole of the city's coastal zone. It contains a large number of actions to enhance coordination into the future.
(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.	3.2 Coastal Hazards 4.3 Stage 2 Studies 4.4 Implementation Plan Appendix 5 CZEAS Appendix 6 Planning Lines Appendix 7 Foreshore stabilisation prioritisation tool	Improving the resilience of coastal assets and coastal communities to the impacts of a changing climate is a key feature of the CMP (and our Local Adaptation Planning). Improving our ability to preparing for, and responding to extreme storms is the purpose of the CZEAS.
(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.	1.4 Governance Context 4.4 Implementation Plan 4.5 Business Plan	The CMP is founded on providing an integrated and coordinated approach to the management of the whole of the city's coastal zone. It contains a large number of actions to enhance coordination into the future focusing on government and public authorities.
(k)	to support public participation in coastal management and planning and greater public awareness,	1.1 Cultural and social context 4.4 Implementation Plan	Lake Macquarie already benefits for a high level of community understanding and participation in coastal management, especially related to lake

	education and understanding of coastal processes and management actions.	4.5 Business Plan Appendix 3 Community Engagement Plan	health, climate change and Landcare. The CMP contains actions to build upon and support this into the future.
(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.	4.4 Implementation Plan	The CMP contains actions to progress the acquisition of strategically important coastal land, focussing on beach areas below the MHWM within the immediate hazard area.
(m)	to support the objects of the *Marine Estate Management Act 2014*	1.5 Planning context 4.4 Implementation Plan 4.5 Business Plan	The CMP supports the objects of the *Marine Estate Management Act 2014* and works to integrate these at a local scale.

Table 4 Management objectives for each coastal management area - Coastal Management Act 2016

CM Act Section 6(2)	Management Objectives of the Coastal Wetlands and Littoral Rainforests Area	Action section in this CMP	How the CMP considers and promotes these objectives
a	to protect coastal wetlands and littoral rainforests in their natural state, including their biological diversity and ecosystem integrity.	1.2 Planning context 4.4 Implementation Plan 4.5 Business Plan Appendix 8	The CMP considers and promotes the protection of wetlands and littoral rainforests including their biological diversity and ecosystem integrity, and including wetlands and rainforests located along the coastline (part A), estuary (part B) and channel (part C).
b	to promote the rehabilitation and restoration of degraded coastal wetlands and littoral rainforests.	1. Environmental context 1.5 Planning context 4.4 Implementation Plan 4.5 Business Plan Appendix 8	The CMP includes specific actions regarding the rehabilitation of degraded coastal wetlands and littoral rainforests. These coastal wetlands and littoral rainforests areas requiring rehabilitation are identified and prioritised in Appendix 8.
c	to improve the resilience of coastal wetlands and littoral rainforests to the impacts of climate change, including opportunities for migration.	1.1 Environmental context 1.5 Planning context 3.2 Coastal Hazards 4.4 Implementation Plan 4.5 Business Plan Appendix 8	The CMP includes consideration of climate change impacts on coastal wetlands and littoral rainforests. Migration of these areas is addressed in figures 13 and 14 of Section 3.2. Specific actions are also included in the implementation plan regarding wetland migration.
d	to support the social and cultural values of coastal wetlands and littoral rainforests.	1.1 Environmental context 1.5 Planning context	The CMP acknowledges the importance of Sensitive Aboriginal Cultural Landscapes (as identified in the Aboriginal Heritage Management

		4.4 Implementation Plan 4.5 Business Plan Appendix 8	Strategy) including coastal wetlands and littoral rainforests.
e	to promote the objectives of State policies and programs for wetlands or littoral rainforest management.	1.1 Environmental context 1.5 Planning context 4.4 Implementation Plan 4.5 Business Plan Appendix 8	The CMP considers and promotes the objectives of State policies and programs for wetlands or littoral rainforest management including *SEPP Resilience and Hazards 2021*, as detailed in Section 1.2 and Figure 3.
CM Act Section 7(2)	**Management Objectives of the Coastal Vulnerability Area**	**Action section in this CMP**	**How the CMP considers and promotes these objectives**
a	to ensure public safety and prevent risks to human life.	1.5 Planning context 3.2 Coastal Hazards 4.3 Stage 2 studies 4.4 Implementation Plan 4.5 Business Plan Appendix 5 CZEAS Appendix 6 Planning lines	Whilst the CMP doesn't identify a coastal vulnerability area (CVA), it includes detailed assessment of risk to public safety/human life and includes actions to reduce these risks.
b	to mitigate current and future risk from coastal hazards by taking into account the effects of coastal processes and climate change.	1.5 Planning context 3.2 Coastal Hazards 4.3 Stage 2 studies 4.4 Implementation Plan 4.5 Business Plan	Whilst the CMP doesn't identify a CVA, it includes detailed assessment of current and future risk from coastal hazards and includes numerous actions to reduce these risks.

		Appendix 5 CZEAS Appendix 6 Planning lines	
c	to maintain the presence of beaches, dunes and the natural features of foreshores, taking into account the beach system operating at the relevant place.	1.5 Planning context 3.2 Coastal Hazards 4.3 Stage 2 studies 4.4 Implementation Plan 4.5 Business Plan Appendix 5 CZEAS Appendix 6 Planning lines	Whilst the CMP doesn't identify a CVA, it includes actions on maintaining the presence of beaches, dunes and the natural features of foreshores.
d	to maintain public access, amenity and use of beaches and foreshores.	1.5 Planning context 3.2 Coastal Hazards 4.3 Stage 2 studies 4.4 Implementation Plan 4.5 Business Plan Appendix 5 CZEAS Appendix 6 Planning lines	Whilst the CMP doesn't identify a CVA, it includes actions on maintaining public access, amenity and use of beaches and foreshores.
e	to encourage land use that reduces exposure to risks from coastal hazards, including through siting, design, construction and operational decisions.	1.5 Planning context 3.2 Coastal Hazards 4.3 Stage 2 studies 4.4 Implementation Plan 4.5 Business Plan Appendix 5 CZEAS	Whilst the CMP doesn't identify a CVA, it includes actions to encourage land use that reduces exposure to risks from coastal hazards, including through siting, design, construction and operational decisions (eg, planning lines and assets life consideration in development controls).

		Appendix 6 Planning lines	
f	to adopt coastal management strategies that reduce exposure to coastal hazards: (i) in the first instance and wherever possible, by restoring or enhancing natural defences including coastal dunes, vegetation and wetlands, and if that is not sufficient, by taking other action to reduce exposure to those coastal hazards.	1.5 Planning context 3.2 Coastal Hazards 4.3 Stage 2 studies 4.4 Implementation Plan 4.5 Business Plan Appendix 5 CZEAS Appendix 6 Planning lines	Whilst the CMP doesn't identify a CVA, it promotes management strategies that reduce exposure to coastal hazards, including restoring/enhancing natural defences including coastal dunes, vegetation and wetlands.
g	if taking that other action to reduce exposure to coastal hazards: (i) to avoid significant degradation of biological diversity and ecosystem integrity, and (ii) to avoid significant degradation of or disruption to ecological, biophysical, geological and geomorphological coastal processes, and (iii) to avoid significant degradation of or disruption to beach and foreshore amenity and social and cultural values, and (iv) to avoid adverse impacts on adjoining land, resources or assets, and (v) to provide for the restoration of a beach, or land	1.5 Planning context 3.2 Coastal Hazards 4.3 Stage 2 studies 4.4 Implementation Plan 4.5 Business Plan Appendix 5 CZEAS Appendix 6 Planning lines	Whilst the CMP doesn't identify a CVA, it promotes management strategies that reduce exposure to coastal hazards. Options and actions identified in the CMP consider: - avoiding significant degradation of biological diversity and ecosystem integrity, - avoiding significant degradation of or disruption to ecological, biophysical, geological and geomorphological coastal processes - avoiding significant degradation of or disruption to beach and foreshore amenity and social and cultural values, - avoiding adverse impacts on adjoining land, resources or assets - providing for the restoration of a beach, or land adjacent to the beach, if any increased erosion of the beach or adjacent land is caused by actions to reduce exposure to coastal hazards

	adjacent to the beach, if any increased erosion of the beach or adjacent land is caused by actions to reduce exposure to coastal hazards.		
h	to prioritise actions that support the continued functionality of essential infrastructure during and immediately after a coastal hazard emergency.	1.5 Planning context 3.2 Coastal Hazards 4.3 Stage 2 studies 4.4 Implementation Plan 4.5 Business Plan Appendix 5 CZEAS Appendix 6 Planning lines	Whilst the CMP doesn't identify a CVA, it identifies and prioritises actions to support the continued functionality of essential infrastructure during and immediately after a coastal hazard emergency – refer to Appendix 5 CZEAS.
i	to improve the resilience of coastal development and communities by improving adaptive capacity and reducing reliance on emergency responses.	1.5 Planning context 3.2 Coastal Hazards 4.3 Stage 2 studies 4.4 Implementation Plan 4.5 Business Plan Appendix 5 CZEAS Appendix 6 Planning lines	Whilst the CMP doesn't identify a CVA, it includes strategies and actions to improve the resilience of coastal development and communities by improving adaptive capacity and reducing reliance on emergency responses. This is a key feature of Council's Local Adaptation Planning processes, which are supported by the CMP, with an increased focus on resilience planning.
CM Act Section 8(2)	**Management Objectives of the Coastal Environment Area**	**Action section in this CMP**	**How the CMP considers and promotes these objectives**
a	to protect and enhance the coastal environmental values and natural processes of coastal waters, estuaries, coastal lakes and coastal	1.1 Environmental context 2.1 Snapshot of issues	The protection and enhancement the coastal environmental values and natural processes of coastal waters, estuaries, coastal lakes/lagoons, and enhance natural character, scenic value,

	lagoons, and enhance natural character, scenic value, biological diversity and ecosystem integrity.	4.3 Stage 2 studies 4.4 Implementation Plan 4.5 Business Plan	biological diversity and ecosystem integrity is a key focus in the CMP. It contains numerous actions to protect and enhance these values and processes.
b	to reduce threats to and improve the resilience of coastal waters, estuaries, coastal lakes and coastal lagoons, including in response to climate change.	1.1 Environmental context 2.1 Snapshot of issues 4.3 Stage 2 studies 4.4 Implementation Plan 4.5 Business Plan	The CMP includes numerous strategies and actions to reduce threats to and improve the resilience of coastal waters, estuaries, coastal lakes/coastal lagoons, including in response to climate change.
c	to maintain and improve water quality and estuary health.	1.1 Environmental context 2.1 Snapshot of issues 4.3 Stage 2 studies 4.4 Implementation Plan 4.5 Business Plan	Maintaining and improving water quality and estuary health is a major focus of the CMP, which includes multiple actions on estuarine aquatic ecosystem health and water quality.
d	to support the social and cultural values of coastal waters, estuaries, coastal lakes and coastal lagoons.	1.2. Cultural & Social context 2.1 Snapshot of issues 4.3 Stage 2 studies 4.4 Implementation Plan 4.5 Business Plan	The CMP contains strategies and actions to promote social and cultural values of coastal waters, estuaries, coastal lakes and coastal lagoons. The Lake Macquarie estuary is central to the cultural identify of the City of Lake Macquarie, and the CMP reflects this cultural significance.
e	to maintain the presence of beaches, dunes and the natural features of foreshores, taking into account the beach system operating at the relevant place.	1.5 Planning context 3.2 Coastal Hazards 4.3 Stage 2 studies 4.4 Implementation Plan	The CMP contains strategies and actions to maintain the presence of beaches, dunes and the natural features of foreshores. This includes open coast beaches (part A) as well foreshores around the estuary (part B) and channel (part C).

		4.5 Business Plan Appendix 5 CZEAS Appendix 6 Planning lines Appendix 7 Foreshore stabilisation works prioritisation tool	
f	to maintain and, where practicable, improve public access, amenity and use of beaches, foreshores, headlands and rock platforms.	1.5 Planning context 4.3 Stage 2 studies 4.4 Implementation Plan 4.5 Business Plan Appendix 6 Planning lines Appendix 7 Foreshore stabilisation works prioritisation tool	The CMP contains strategies and actions to maintain and improve public access, amenity and use of beaches, foreshores, headlands and rock platforms. This includes open coast beaches, headlands and rock platforms (part A) as well foreshores around the estuary (pat B) and channel (part C).
CM Act Section 9(2)	**Management Objectives of the Coastal Use Area**	**Action section in this CMP**	**How the CMP considers and promotes these objectives**
a	to protect and enhance the scenic, social and cultural values of the coast by ensuring that: (i) the type, bulk, scale and size of development is appropriate for the location and natural scenic quality of the coast, and (ii) adverse impacts of development on cultural and built environment heritage are avoided or mitigated, and	1.5 Planning context 3.2 Coastal Hazards 4.3 Stage 2 studies 4.4 Implementation Plan 4.5 Business Plan	The CMP recognises the importance of protecting and enhancing the scenic, social and cultural values of the coast. It supports the application of planning controls to mitigate development impacts on scenic quality, cultural values, poor urban design and the provision of open space through the implementation of *SEPP Resilience and Hazards 2021* (as detailed in Section 1.2 and Figure 5).

	(iii) urban design, including water sensitive urban design, is supported and incorporated into development activities, and (iv) adequate public open space is provided, including for recreational activities and associated infrastructure, and the use of the surf zone is considered.		
b	to accommodate both urbanised and natural stretches of coastline.	1.3 Economic context 1.5 Planning context 4.4 Implementation Plan 4.5 Business Plan	The CMP addresses both urbanised and natural stretches of coastline and contains strategies and actions related to both of these areas.

LAKE MACQUARIE CITY

COASTAL MANAGEMENT PROGRAM

FINAL SCOPING STUDY

December 2020

CONTENTS

1. INTRODUCTION

The sustainable management of Lake Macquarie's coastline is required to ensure the intrinsic environmental, social, economic and recreational qualities of the coast are maintained and enhanced for the use and enjoyment of the community. However, the management of the coastal zone presents various and significant challenges. These challenges include development pressure and use of the coastal zone, impacts from urban pollution on coastal and oceanic environments and the effects of a changing climate on our lake and beach areas.

1.1 VISION

A healthy, resilient coastal zone.

The study provides:

- an overview of the coastal zone of Lake Macquarie
- insights into the values and shared responsibilities of coastal zone stakeholders
- strategic and planning context
- details of monitoring programs
- an indication of how our coastal zone is likely to be impacted by, and how we are responding to, climate change
- maps and information regarding the four coastal management areas
- details about how the preliminary risk assessment was conducted
- a preliminary business case which identifies actions for Stages 2-5 and items for potential fast-tracking.

1.2 PURPOSE OF THE SCOPING STUDY

The primary purpose of Stage 1 is to obtain a preliminary understanding of the current and potential future threats and management issues within the coastal zone of Lake Macquarie to inform and guide further investigation for the Coastal Management Program (CMP).

1.3 THE COASTAL MANAGEMENT FRAMEWORK

In 2016, the NSW Government established a new framework to manage the coastal environment in an ecologically sustainable way for the social, cultural and economic wellbeing of the people of NSW (Figure 1). The cornerstone of this framework, the *Coastal Management Act 2016*, requires Lake Macquarie City Council to develop a long-term strategy for the management of our coastal zone.

Figure 1: NSW Coastal Management Framework
(Department of Planning, Industry and Environment (DPIE) – Office of Environment and Heritage (OEH), 2018)

There are five stages in the preparation of a CMP (refer to Figure 2):

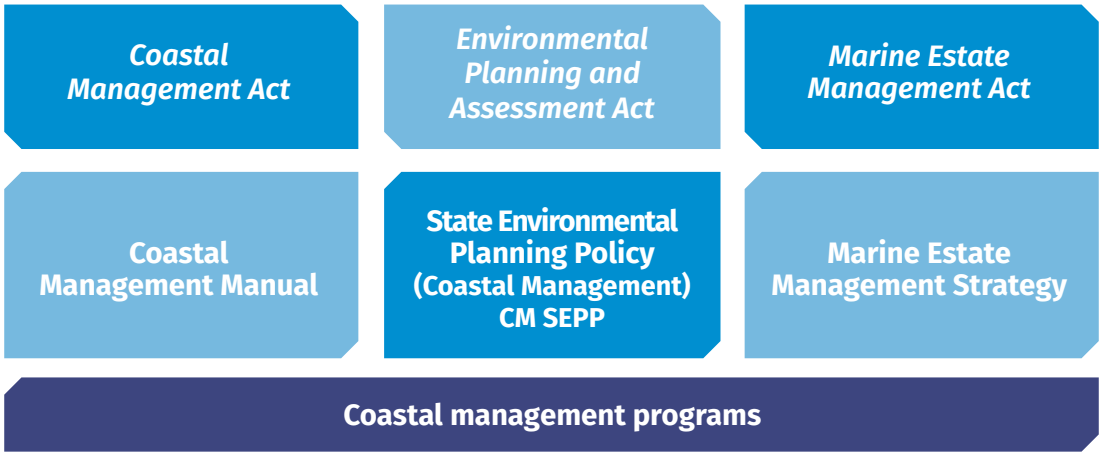
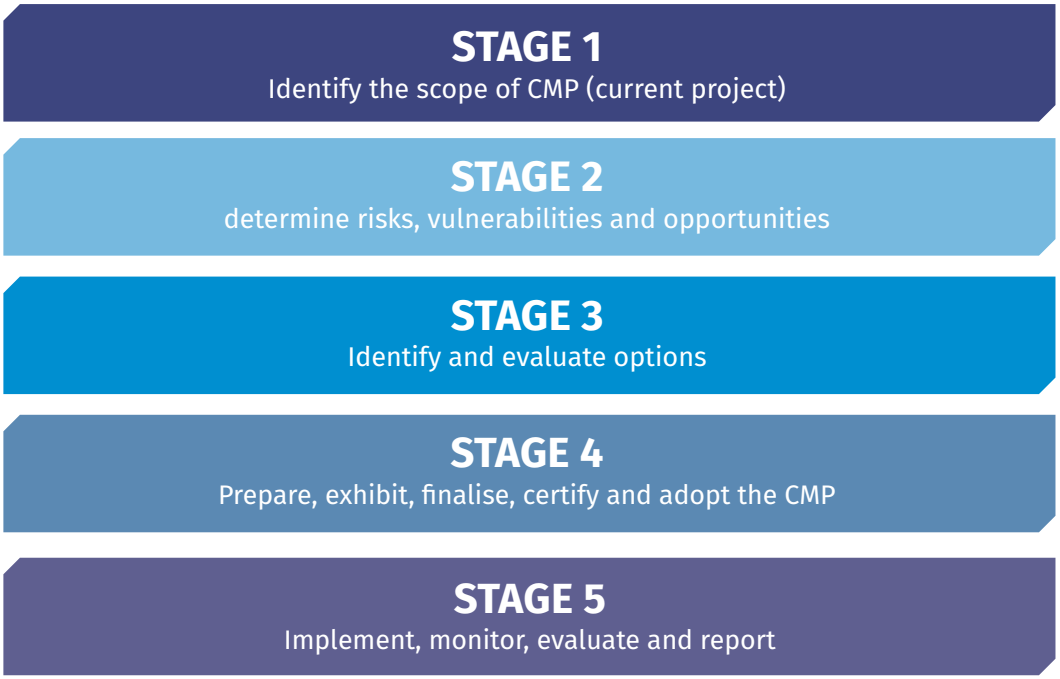


Figure 2: Stages of preparing a CMP



1.4 OBJECTIVES

In accordance with the Coastal Management Act 2016, the CMP is intended to meet the following objectives:

- analyse how currently available knowledge would change actions and priorities in the current Coastal Zone Management Plan 2015
- adopt a risk management approach
- adopt an adaptive management approach
- involve the community in preparing the CMP
- position Council to use best available technology and management approaches in future management of the coastline
- present a clear strategic direction, with a fully justified schedule of priority actions
- a plan structure for easy use by Council and the community.

1.5 PROGRAM GOVERNANCE

A key outcome of the development of a Coastal Management Program is the commitment and collaboration by stakeholders to manage coastal risk in a strategic way.

The external stakeholder groups involved in the preparation of Stage 1 of the Lake Macquarie Coastal Management Program include:

- Local Aboriginal Land Councils (Awabakal, Bahtabah and Biraban)
- local sailing clubs and yacht clubs
- Boat Owners Association
- Belmont Golf Club
- Central Coast Council
- City of Newcastle
- Hunter Water Corporation
- Community Environment Network
- Belmont Wetlands State Park
- Hunter Surf Lifesaving
- Department of Planning, Industry and Environment
  - Biodiversity and Conservation Division
  - Science, Economics and Insights Division
  - Crown Lands
- Department of Primary Industry
  - Fisheries
  - Hunter Local Lands Services
- Sustainable Neighbourhood groups
- Roads and Maritime Service
- NSW Maritime
- Transport for NSW
- Marine Infrastructure Delivery Office
- local environmental advocacy groups
- relevant private industry stakeholders.

The following Council committees have been involved in preparing the CMP Scoping Study:

- Youth Advisory Council Committee
- Aquatic Services Committee
- Coastal Zone Management Committee.

Refer to Appendix 1 for Communications and Engagement Plan.

2. LAKE MACQUARIE COASTAL ZONE

Lake Macquarie City is located in the Hunter Region of New South Wales (NSW) approximately 120 kilometres north of Sydney. The defining feature of the City is Lake Macquarie, one of the largest coastal estuaries in eastern Australia.

The Lake Macquarie coastal area is ecologically rich, physically dynamic and an attractive place to visit and live. The natural environment includes the lake, beaches and open coast to the east, and the Watagan mountain range to the west. These natural assets provide a lifestyle that is highly valued by the Lake Macquarie community.

The Coastal Management (CM) Act 2016 outlines the coastal zones, consisting of four distinct coastal management areas:

i) coastal wetlands and littoral rainforest areas – areas which display the characteristics of coastal wetlands or littoral rainforests that were previously protected by SEPP 14 and SEPP 26

ii) coastal vulnerability areas – areas subject to coastal hazards such as coastal erosion and tidal inundation

iii) coastal environment areas – areas that are characterised by natural coastal features such as beaches, rock platforms, coastal lakes and lagoons, headlands and marine and estuarine waters

iv) coastal use areas – land adjacent to coastal waters, estuaries and coastal lakes and lagoons (DPIE, 2019).

Refer to Section 9.0 – Coastal Management Areas for maps showing these areas.

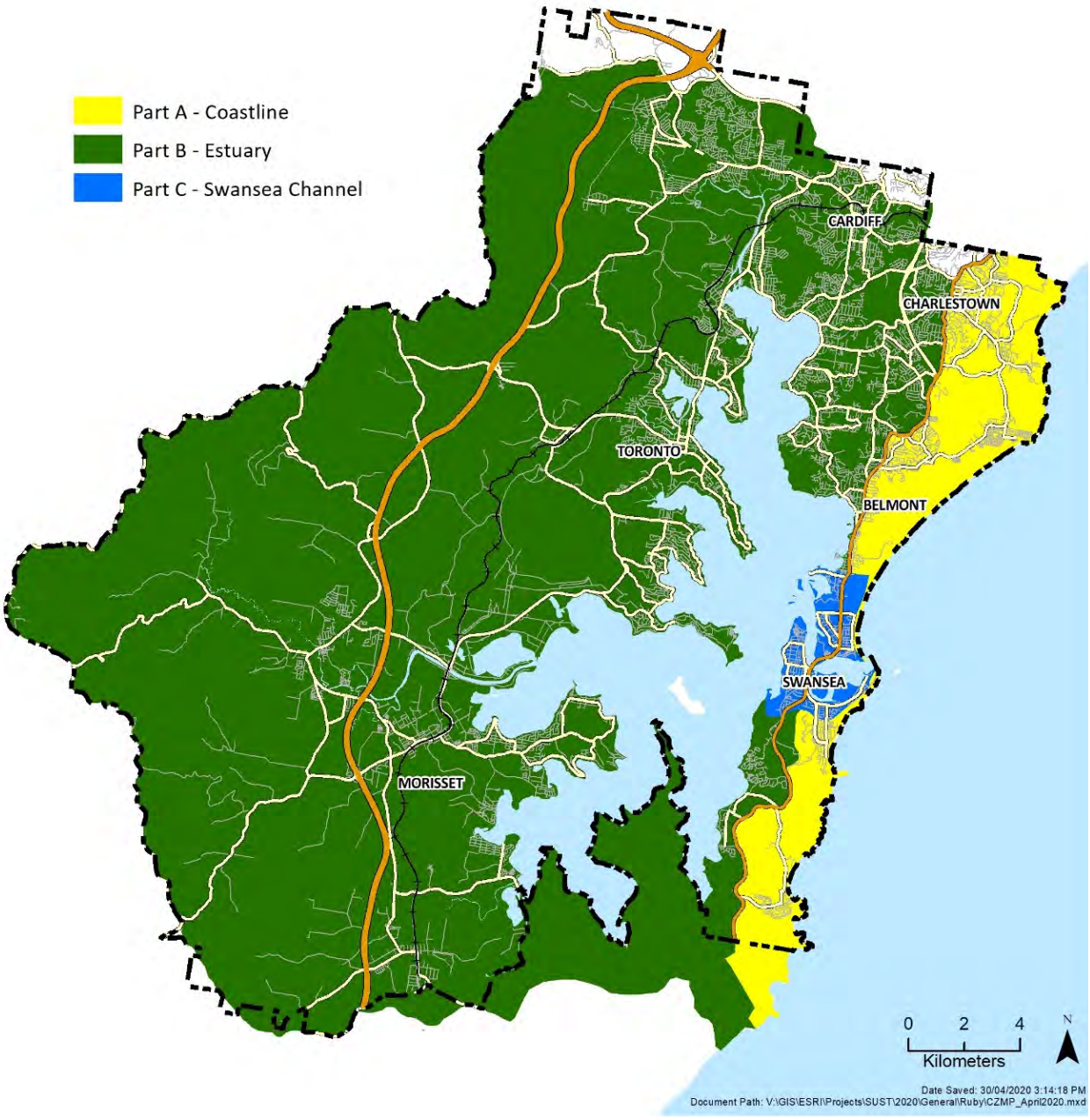
Each of these areas have their own objectives defined under the *CM Act* which take into consideration the social and environmental values placed on each area as well as the threats faced by them.

For Lake Macquarie, the CMP study area has been divided in accordance with the coastal management areas into three distinct zones:

- **Part A:** Coastline
- **Part B:** Estuary
- **Part C:** Swansea Channel.

The beaches and lake estuary are part of the coastal zone, with the lake located between the open coast and the catchments of tributary creeks. Estuary systems and estuary health are strongly influenced by catchment inputs as well as by tidal exchange with the ocean through Swansea Channel.

Figure 3: Coastal Zone Management Plan area



3. COMMUNITY VALUES AND SHARED RESPONSIBILITIES

Lake Macquarie City's community values were developed by the community to guide future planning and provide direction for how the City responds to change and growth. Our values reflect the priorities of our residents and will shape policies and plans prepared by Council, including the Coastal Management Program.

Understanding the allocation of responsibility with respect to the management of the coastal zone is important for strengthening partnerships between land managers. Greater collaboration results in improved decision-making and management outcomes.

We value our...

- Unique landscape
- Lifestyle and wellbeing
- Mobility and accessibility
- Diverse economy
- Connected communities
- Creativity
- Shared decision-making

CITY VALUES

City vision: Lake Macquarie is a city with a lake at its heart encircled by distinctive towns and villages. We balance our cherished environments with our need for great spaces to live and visit, smart transport options and a thriving economy; which adapt and strive to be fair for all.

COASTAL VALUES

The lake and coastline are important natural features of our City. Climate change and projected sea level rise are two global challenges that our City needs to consider for future planning in these areas.

Community engagement is vital to ensuring the history, values and knowledge of local areas is embedded within the decision-making of policy and plans.

Past and current planning for coastal areas and the lake have utilised community representative groups, workshops, drop-in sessions and online and postal surveys to engage local residents and key stakeholders to share their knowledge.

As part of the development of this scoping study, the community provided information about what is important to them and what they thought should be included in a vision for the coastal zone. Comments provided have been utilised to inform the vision for Lake Macquarie's CMP, and have also been translated into coastal values, along with the addition of items included in the Marine Estate Management Authority Threat and Risk Assessment (TARA) Final Report.

Table 1: Community coastal values and cumulative state-wide risk issues (highlighted)

Economic	*Social*	*Environmental*
Proactive management of coastal climate risks	Educated community	Healthy coastal zone
Strong tourism economy	Good public access	Stable and resilient channel
Accessible surf breaks	Surf amenity	Healthy, sustainable, resilient estuary
	Culturally respectful activities	Clean and healthy lake supporting natural ecosystems
	Resilient and accessible lake	Wildlife refuge
	Aboriginal cultural heritage and use	Healthy connection between lake and ocean
		Data accessibility
		Fisheries – fish assemblage management and uncertainty of impact of fishing activities
		Estuaries – role as receiving water quality environment and holistic management
		Threatened species *(Biodiversity Conservation Act)*
		Climate change – practical adaptation/ resilience building actions

3.3 CULTURAL RESPONSIBILITY

3.3.1 Aboriginal cultural heritage

Lake Macquarie, the coast and the catchment extending to the Watagan Ranges are part of the traditional country of the Awabakal people. Awabakal people have lived around Lake Macquarie and utilised its aquatic resources since the early Holocene period, more than 8000 years ago. They also occupied this landscape before it arrived at its current form, when sea levels were much lower.

Awabakal ancestors were custodians of the landscape and this tradition has passed on to Awabakal people today. Physical evidence of past Awabakal life around the estuary includes grinding groove sites, middens, campsites, scar trees and rock shelters. These sites are vulnerable to disturbance by development and recreation. The vegetation and fauna of the lake and its foreshores and catchment are also highly valued by Awabakal people are these are the resources of which they are custodians.

In June 2017, A Commitment to the Aboriginal and Torres Strait Islander people of Lake Macquarie was adopted by Council. This commitment recognises the contribution of Aboriginal culture to the City's landscape and to its social and cultural diversity. The Aboriginal Heritage Management Strategy sets out how Council and the local Aboriginal community will work as partners to implement the Statement of Commitment. The Strategy introduces the concept of Sensitive Aboriginal Cultural Landscapes (SACLs). These more sensitive landscapes are defined and mapped from known archaeological evidence, the predicted extent of archaeologically significant areas, places associated with records of traditional Awabakal stories and practices, places that conserve important traditional resources, and places that are important in the shared history of the City since European settlement. SACLs mapped include the lake and ocean shores, terraces, deltas and riparian footslopes along creek corridors and upper catchments and escarpments of Watagan and Sugarloaf Ranges.

Threats to these landscapes include:

- Historical use of the lake foreshore and lower reaches of estuarine creeks and wetlands for rail, power generation, sewerage and other infrastructure has destroyed middens and open campsites.
- Filling and formalisation of lake shorelines with sea walls, construction of slipways, boat sheds and residences. These activities have transformed the lake shore landscape, and damaged middens close to the lake shore. Some archaeological material remains in less formal foreshore reserves and where old houses or boat sheds are on piers rather than slab foundations.
- Foreshore and nearshore reserve management, including filling of low-lying areas, mowing, installation of playing fields and parkland equipment has destroyed middens and open campsites. Scarred trees have also been lost from foreshore locations. Lower reaches of major creeks and their catchments – such as Dora Creek and Cockle Creek.
- Land clearing for agricultural, industrial and urban uses has removed scarred trees and disturbed the structure and context of open sites. Stone arrangements have also been damaged or destroyed by land clearing activities.
- Land management within urban subdivisions has changed flows in creeks, increased erosion or sedimentation and encouraged invasion of culturally valued vegetation communities by weeds. Transport, water, sewerage and power infrastructure to support urban development can cause significant disturbance of long corridors across the landscape.
- Poor control of access within lake shore and bushland reserves (Crown Land, community land and private land) has contributed to erosion, rubbish dumping and damage to vegetation associated with illegal four-wheel drive and trail bike activity.
- Industrial development along major tributary creeks (for instance in the lower freshwater and estuarine reaches of Cockle Creek) has removed or damaged surfaces which would once have been associated with diverse Aboriginal community resources and archaeological evidence of past occupation.
- Coal mining (both open cut and underground) has contributed to the loss of Aboriginal sites and changes to cultural landscapes, either directly through extraction or indirectly due to subsidence impacts. It should also be noted, however, that underground mining in the western part of the City has helped to maintain some relatively natural landscapes in this area.

Many of the threats to SACLs are similar to those that impact the ecological features of the estuary and therefore estuary management actions are likely to provide enhancement of cultural, as well as natural, values.

3.3.2 European heritage

Lake Macquarie and its estuarine tributary creeks have a strong historical heritage, with European settlement dating to the early nineteenth century. The focus of European settlement was around the discovery of coal in the late eighteenth century, originating in Newcastle, then spreading to the shores of Lake Macquarie within a few years. Lake Macquarie's heritage includes coal mining, forestry, farming, boat building and fishing. The lake served as an important transport corridor for these industries, prior to the development of road transport.

The estuary also has an important history and continuing value as a yachting/dinghy sailing major training ground for national and international sailors. For the people of the Hunter Region, the lake has significant landscape heritage value, as a place to live and a place for recreation, attached to the shoreline and foreshore reserves. These heritage and cultural values are separate from but associated with the natural values and systems of the estuary.

3.4 SHARED RESPONSIBILITIES

The coastal zone is owned and/or managed by a number of different government agencies, private individuals and other organisations.

The map below indicates the land tenure and management areas for the coastal zone in Lake Macquarie.

Asset ownership has presented significant challenges for effective management of the City's coastal infrastructure and natural resources for many years, particularly in the Swansea Channel area. Implementing effective longer-term management actions and responding to emergency incidents requires ownership clarity and a coordinated partnership approach. Council is currently working on strengthening partnerships with other agencies and further defining areas of responsibility. More detailed information will be provided in the final Lake Macquarie CMP. The table below indicates ownership of some of the key coastal area assets.

Figure 4: Land tenure and management areas in Lake Macquarie

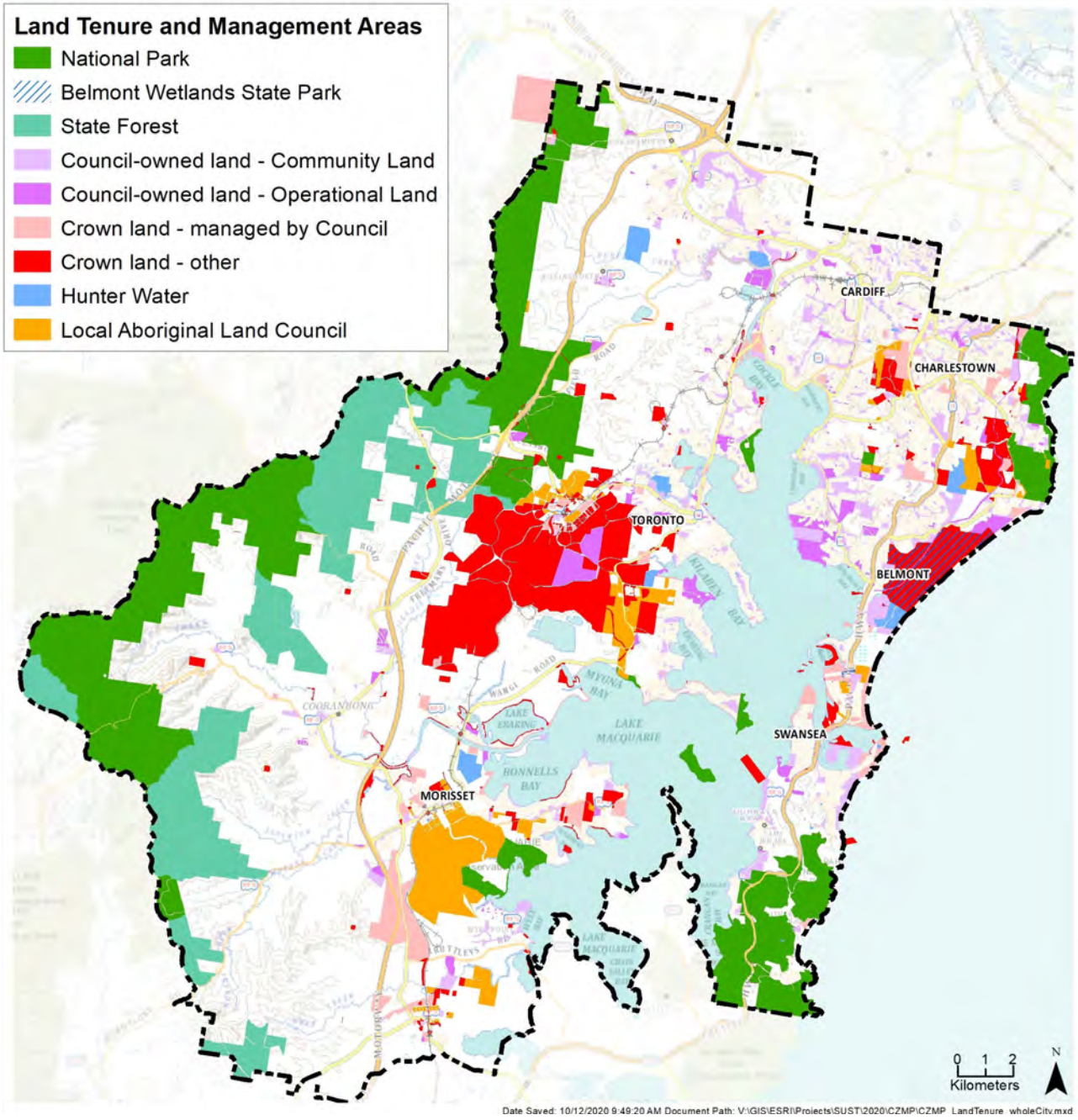


Table 2: Coastal asset ownership

ASSET	OWNERSHIP AGENCY	OTHER INFO
SWANSEA BRIDGE	ROADS AND MARITIME SERVICES	
BREAKWATERS	MARITIME INFRASTRUCTURE DELIVERY OFFICE (MIDO)	
BOAT MOORINGS	ROADS AND MARITIME SERVICES	Private individuals own the mooring apparatus and lease the location
OFFSHORE AREAS	CROWN LANDS	The Marine Estate Management Authority has a role in strategy
SWANSEA CHANNEL (DREDGING)	MIDO	As per NSW Coastal Dredging strategy

Council places great importance on working with our community and sharing in decision-making. The City's Sustainable Neighbourhoods Alliance is a key point of contact for sustainability project collaboration, as well as various other community groups. Further details, with respect to stakeholders involved in preparing this scoping study, can be found in Section 1.

4. STRATEGIC CONTEXT

The *Coastal Management Act 2016* provides the statutory framework for coastal zone management in NSW and includes the requirement for the preparation of a Coastal Management Program (CMP).

4.1 ENVIRONMENTAL CONTEXT

The coastal zone environment is dynamic. Estuary processes operate at different time scales, varying from hourly/daily to decades or more. Some processes such as tides vary in predictable ways. For others, the extent and rate of change is much more uncertain.

Estuary

Lake Macquarie is the largest coastal lake in NSW, covering an area of about 110-square-kilometres, with a catchment of about 650-square-kilometres. It is situated between Sydney and Newcastle and is bordered by residential, industrial, rural and undeveloped land. The lake is of significant ecological value, and provides for a range of aquatic and land-based recreational activities.

Lake Macquarie has about 170km of foreshore. The foreshores of the lake comprise rock-based slopes (common along the western side), rock-based slopes of lower gradient, sandy shorelines that are back-barrier deposits, creek delta deposits, creek floodplain deposits and modified shorelines with seawalls of varying designs.

Foreshore erosion in the lake is primarily driven by wind waves, allowing wave energy to impact the shoreline. Waves more than a metre high are not uncommon. Additional natural processes affecting foreshore erosion are longshore drift and incoming stream flows.

Areas affected by lake flooding occur around the entire foreshore. Inundation and flood risk are managed by Council through a separate funding and administrative program, however, there is a recognised need to align management actions and objectives with those for coastal management.

There is about 15.3-square-kilometres of seagrass coverage in Lake Macquarie. This is the third largest area of seagrass in NSW. Lake Macquarie supports a variety of seagrass species. The most abundant and widely distributed species in the lake is *Zostera capricorni*, though the threatened seagrass species, *Posidonia australis* is also present. Other species found include *Halophila ovalis* and *Ruppia megacarpa*. Seagrass is the main source of primary production for the food web within the lake and is also the focus of recycling of organic matter and nutrients by invertebrate species.

Cooling water from the Eraring and Vales Point power stations discharges into the lake. In addition, some coal mines in the Lake Macquarie catchment are licensed to discharge mine water at the surface, which then flows into the lake.

Water quality in the lake has improved significantly over the past 20 years, following significant investment in ecological health by local and state government. Expansion of reticulated sewerage, stormwater management, foreshore stabilisation and sediment control measures have systematically improved the ecological function of the lake environment, primarily by reducing excess nutrient loads.

Coastline

The Lake Macquarie City coastline is part of the Newcastle Coast sediment compartment (Schedule 1 of the *Coastal Management Act 2016*). City of Newcastle and Central Coast Council (Wyong) also share this sediment compartment.

The sandy and rocky coastline is an important part of the character of Lake Macquarie City. As a physical feature, it is the interface between the marine environment and the terrestrial environment. While the Watagan Range forms the western backdrop to the City, the ocean is its eastern landscape context.

Some of the ecological communities on the Lake Macquarie coastline are rare or endangered, including the Themeda grasslands on headlands and the littoral rainforest at Swansea Heads. In addition, many coastal habitats in the City support high biological diversity and rare species such as endangered shorebirds and animals that live off the rock platforms. Importantly, the ecological communities combine with the geomorphic structure of the coast in a scenic landscape of beaches, headlands and shore platforms highly valued for recreation by locals and visitors.

The ecological condition and value of the coast has been affected by historical mining and extractive industries (Nine Mile Beach, Caves Beach and Catherine Hill Bay). Urban development has encroached on coastal headlands at Redhead, Swansea Heads and Caves Beach, as well as behind the coastal dunes at Redhead and Blacksmiths. Old access tracks constructed for these land uses have opened pathways for walkers, cyclists and off-road vehicles. Despite this disturbance, much of the coast is in a relatively natural condition, including land managed in National Parks, State Parks, State Conservation Areas and by Council as community land.

Swansea Channel

Swansea Channel connects the main body of Lake Macquarie to the ocean. The channel is located entirely within the Lake Macquarie Local Government Area. The construction of entrance breakwaters, Swansea Bridge and revetments has modified processes in the channel. Broadly, the channel can be divided in two at Swansea Bridge, which carries the Pacific Highway across the channel and connects the suburbs of Blacksmiths to the north, and Swansea to the south. The channel downstream of Swansea Bridge is affected significantly by oceanic swell waves that penetrate the widely spaced breakwaters at the entrance. Upstream, the dominant coastal processes relate to tidal currents and the transport of sediment. The combination of waves downstream of the bridge and tidal currents throughout the channel has caused significant erosion (particularly in Salts Bay and between Mats Point and the entrance to Black Neds Bay) and the upstream transport of sand, with ultimate deposition on the ‘drop-over’ at the lake end of the channel.

Management of the channel over the past decade has involved repeated dredging campaigns and various works, such as partial closure of the southern entrance to Swan Bay, commonly to address issues with navigation and foreshore erosion. The channel has a persistent, dynamic nature that creates challenges for those tasked with its integrated management, particularly considering the competing needs of various stakeholders and finite funding. The combined impact of tides and waves with future sea level rise will further complicate those challenges.

4.2 SOCIAL CONTEXT

4.2.1 Population

In 2019, 205,901 people called Lake Macquarie home, making our City the third largest regional city in NSW by population. The population is expected to grow by 28,000 people by 2036, creating demand for 13,500 new dwellings and 12,000 new jobs.

Additionally, more detailed population data for various suburbs in the City is currently being obtained, which will allow for a greater insight into likely impacts of this projected growth on the coastal zone. Further information will be provided in later stages of this CMP.

4.2.2 Impacts on coastal zone

The interaction of people and land uses within the coastal landscape is a source of great social and economic benefit for the City, but leads to threats to the health of natural systems. The challenges to maintaining the coastline's important values include controlling and reducing well established invasive species, damage to habitats by tracks, fire and clearing, illegal dumping and managing safety concerns and conflict between users. There are also the changes to the coast that are projected to occur as sea level rises and other climate changes take effect over the next century.

Each year, Lake Macquarie City hosts a variety of events within our coastal zone that attract both local residents and visitors. 2019 attendance data for some of these key events is provided below:

Maximum Adventure Race Series – Lake Macquarie **500**	Lakefest **2,650**
Raffertys Coastal Run **1,100**	Lake Macquarie Super Boats **20,000**
Float your Boat **20,000**	Surf lifesaving events **5,000**
Let's Fish Lake Mac **1,200**	Surfest – Juniors at Redhead **240**
Paddlefest **200**	Living Smart Festival **30,000**

In 2020, events were limited to the first two months of the year due to COVID-19 restrictions.

Our beaches are popular destinations for locals and tourists alike. During the peak summer months (beginning of December to the end of January), since 2017 about 1.2 million people have visited Lake Macquarie's four patrolled beaches: Catherine Hill Bay, Redhead, Caves Beach and Blacksmiths.

Council owns four holiday parks in the City and all of these are located within the coastal zone area; at Belmont, Blacksmiths, Swansea and Wangi Wangi. During the 2019-2020 summer months (December to February), more than 120,000 people stayed in these holiday parks. Other school holiday periods and long weekends also see a high number of visitors to these facilities.

During these vacations or leisure periods, people utilise the lake and beach environments for recreation purposes. This places increased pressure on the City's coastal ecosystems as well as the social infrastructure required to support the usage of the coastal area.

4.3 ECONOMIC CONTEXT

The Lake Macquarie City Economic Development Strategy 2018-2038 identifies the vision for Lake Macquarie's economic future as:

In 20 years, Lake Macquarie will be one of the top 10 most liveable cities in Australia.

It includes the strategic objectives: identity, investment, infrastructure and innovation.

The elements of the this strategy most relevant to the coastal zone include:

- 'biodiversity initiatives' identified as a 'minimum success criteria' for the Lake Macquarie Investment Attraction Package
- the expansion of strategic projects to include: lake, lakeside and coastal tourism activation via wholesale buyer market
- exploring new town centre development opportunities eg. Morisset, Glendale, Warners Bay.

From a tourism perspective, Lake Macquarie's Destination Management Plan identifies as tourism assets: Lake Macquarie and its beaches, Warners Bay foreshore shared pathway, Fernleigh Track, Caves Beach sea caves and Belmont Wetlands State Park. Nature tourism is rated fourth in terms of importance for key target markets visiting the City.

Key infrastructure indicated in this Plan relevant to the coastal zone:

- Warners Bay foreshore shared pathway
- beach precincts
- walking and cycling trails
- Fernleigh Track
- Catherine Hill Bay
- lake foreshore areas and facilities.

The Plan lists the lake, coastline and Belmont Wetlands State Park as strengths and opportunities for the City's tourism, with the sea caves at Caves Beach, Belmont Wetlands and the rockpools and platforms included as 'hidden treasure' locations.

4.4 SIGNIFICANT HAZARD EVENTS (SINCE 2015)

4.4.1 Wave overtopping at Blacksmiths Beach

There have been significant wave overtopping events in April 2015, June 2016 and February 2020 at the southern end of Blacksmiths Beach, resulting in breakthroughs to Grannies Pool (the dune adjacent to the northern breakwater).

At the time of these events, there has been east coast low (ECL) activity, particularly when waves are large and coming from a north-easterly direction. The breakthroughs have been observed at two locations:

1. on the northern side of the northern breakwater (southern end of Blacksmiths Beach)
2. on the southern side of the northern breakwater (from within the channel) where waves overtop the training wall and flow through to Grannies Pool.

There has also been significant recent erosion of the beach and dunes north of the surf club.

4.4.2 Stability of the Eraring Power Station ash dam

Eraring Power Station is Australia's largest coal fired power station with a generation capacity of 2922MW. Power station operations result in the generation of large volumes of fly and bottom ash, of which some is reused, but the majority is disposed of in a large ash dam facility located adjacent to Myuna Bay.

Image: Milano's on the Lake, February 2016

On 29 March 2019, following an assessment by Origin Energy of the engineering integrity and safety of its ash dam wall for the nearby Eraring Power Station, the Myuna Bay Sport and Recreation Centre was closed by NSW Office of Sport.

Following further assessment and investigation of the engineering and safety aspects of the wall, on 12 December 2019 the NSW Government decided to permanently close the Myuna Bay Sport and Recreation Centre. The buildings of the former Myuna Bay Centre will be demolished and its site will be revegetated by Origin Energy, the owner of the Eraring power station. The Myuna Bay site will be returned to community use after the remediation of the ash dam wall. Origin Energy has entered into an agreement with the NSW Office of Sport to construct a replacement sport and recreation centre at Lake Eraring on land currently owned by Origin Energy. The Office of Sport has selected a parcel of land on the northern foreshore of Lake Eraring as its preferred site, about a kilometre south-west of the former Myuna Bay Centre. The ownership of the Lake Eraring site is to be transferred to the NSW Government.

4.4.3 Pelican foreshore erosion

The Pelican foreshore contains some of NSW's most vulnerable assets at risk from coastal erosion. In 2016, erosion resulted in significant asset loss of the Pelican marina complex, including the marina buildings, a popular restaurant, a boat brokerage business and a residential apartment. Ongoing erosion is currently threatening essential emergency service facilities and recreational assets and, if left unchecked, will threaten residential housing. Assets currently at risk include several essential emergency service facilities (NSW Coastal Patrol Facility, NSW Maritime/Fisheries Facility, Northern NSW's Rescue Helicopter Facility) and recreational assets (including the Pelican aerodrome, foreshore reserves, boat-ramps etc).

The cause of this erosion (ongoing migration of Swansea Channel) is well understood, however, the largely unprotected stretch of foreshore at Pelican will continue to claim assets unless foreshore protection works are effectively designed, costed and installed. The high vulnerability of the Pelican area to sea level rise impacts necessitates that various adaptation pathways be considered, as part of the concurrent Pelican-Blacksmiths local adaptation planning process.

Since the collapse of the marina complex, a large amount of work has been undertaken to further understand the issue, including the formulation of probabilistic hazard lines for foreshore erosion in this area. Concept designs for foreshore protection schemes have been prepared and an economic assessment has commenced, including a cost benefit analysis and distribution analysis. Final designs will be selected following the completion of the economic assessment and detailed designs produced for foreshore stabilisation works.

5. PLANNING CONTEXT

Local councils and public authorities are required to manage their coastal areas and activities in accordance with relevant state legislation, policies and plans.

5.1 Integrated Planning and Reporting Framework (IP&R)

The Integrated Planning and Reporting (IP&R) Framework (Figure 5) recognises that most communities share similar aspirations: a safe, healthy and pleasant place to live, a sustainable environment, opportunities for social interaction, opportunities for education and employment, and reliable infrastructure. The difference lies in how each community responds to these aspirations. It also recognises that council plans and policies should not exist in isolation – that they are interconnected. This framework allows NSW councils to draw their various plans together, understand how they interact and get the maximum leverage from their efforts by planning holistically and sustainably for the future (NSW Office of Local Government, 2007).

Figure 5: Council's IP&R Framework

The Community Strategic Plan specifies the City Vision and Community Values for a 10-year period. There are seven key focus areas identified in Council's Community Strategic Plan: Unique landscapes, Lifestyle and wellbeing, Mobility and accessibility, Diverse economy, Connected communities, Creativity, and Shared decision-making. The Plan also identifies various strategies, performance measuers and objectives.

The CMP fits under the Local Strategic Planning Statement in the other Strategic Plans and will be delivered through the Delivery Program and the Operational Plan.

5.2 LEGISLATION

The *Coastal Management Act 2016 (CM Act)* establishes the framework and overarching objectives for coastal management in NSW, which focuses on strategic, integrated and ecological sustainable management of the NSW coastal zone.

The State Environmental Planning Policy (Coastal Management) 2018 (CM SEPP) seeks to balance social, economic and environmental interests by promoting a coordinated approach to coastal management, consistent with the objectives of the CM Act. This SEPP updates and consolidates into one integrated policy SEPP 14 (Coastal Wetlands), SEPP 26 (Littoral Rainforests) and SEPP 71 (Coastal Protection) and divides every part of the 'coastal zone' into one of four management areas.

The *Marine Estate Management Act 2014 (MEM Act)* provides for strategic and integrated management of the whole marine estate – our marine waters, coasts and estuaries.

Other NSW legislation relevant to the management of the environmental, social and economic values of the coastal zone include:

- *Crown Land Management (CLM) Act 2016*
- *National Parks and Wildlife Act 1974*
- *Fisheries Management Act 1994*
- *Local Land Services Act 2013*
- *Biodiversity Conservation Act 2016.*

5.3 MARINE ESTATE MANAGEMENT STRATEGY (MEMS)

The Marine Estate Management Strategy (MEMS) 2018-2028 is a first for NSW and is the centrepiece of the marine estate reforms. The Strategy is a requirement of the Marine Estate Management Act 2014 and sets out the vision and principles for the management of the marine estate.

The Strategy has nine interlinked management initiatives supported by detailed actions that address the priority and cumulative threats to the marine estate over the next 10 years. It outlines how these threats will be managed for the benefit of the environment and community.

The Strategy was developed by the Marine Estate Management Authority (MEMA) with input from key stakeholders and the broader community. It reaffirms the NSW Government's commitment to holistic management of the marine estate as a single continuous system.

The Strategy includes a comprehensive, evidence-based NSW Marine Estate Threat and Risk Assessment (state-wide TARA).

The state-wide TARA found that the greatest threats to the environmental assets of the marine estate were:

- urban and rural water pollution or runoff
- climate change (over a 20-year outlook)
- disturbance to habitats and species from estuarine entrance modification, harbour maintenance, foreshore development, wetland drainage and other works.

The greatest threats to social, cultural and economic benefits were primarily associated with water pollution and a general lack of social, cultural and economic information, lack of compliance with regulations and lack of access to the marine estate. Cumulative threats were also assessed.

The state-wide TARA identified five cumulative threats (in no priority order):

- multiple threats to estuarine water quality
- climate change (over a 20-year outlook)
- multiple threats to Aboriginal cultural heritage
- multiple threats to marine wildlife
- multiple threats to fish assemblages.

The threats identified in the TARA have been utilised, where applicable, in the risk assessment section of this Scoping Study. Refer to Section 10.

5.4 LOCAL AND REGIONAL PLANS

5.4.1 Local Strategic Planning Statement

Strategic plans, such as the Hunter Regional Plan 2036 (DPE, 2016) and Greater Newcastle Metropolitan Plan 2036 (DPE, 2018), are required to be supported by a Local Strategic Planning Statement (LSPS) by each local council.

The following priorities and actions within the Lake Macquarie LSPS are relevant to coastal management:

Table 3 – Priorities and actions

Planning Priority 5: ***A city of progress and play***	
Action 5.4:	Commence a City-wide Aquatic Strategy to encourage and support use of the lake, the coast and their foreshores, including for recreation and water-based tourism.
Planning Priority 6: ***A city with a vast natural environment***	
Action 6.2	Prepare Coastal Management Program for the Lake Macquarie coastal zone to provide a strategic program for coastal, estuary and waterway management
Action 6.6:	Implement priority actions in the Lake Macquarie Coastal Zone Management Plan, such as contributing to prepare adaptation plans, to develop resilient coastal landscapes and communities

5.4.2 Community Strategic Plan

Section 402 of the *Local Government Act 1993* requires local councils to develop and adopt a Community Strategic Plan that outlines the main priorities and planning for the LGA for the following 10 years. The Lake Macquarie City Community Strategic Plan 2017-2027 is a plan for our community that describes how we can achieve our City's vision.

This Plan aligns with the NSW State Plan and Hunter Regional Plan and has been prepared with regard to the social justice principles of access, equity, participation and rights, and addresses social, environmental, economic and governance matters. It includes seven key focus areas for Lake Macquarie City. The relevant focus area for the Coastal Management Program is:

- Unique landscapes
  - Measure No. 1: No net decline in catchment waterway and estuary health.

5.4.3 Hunter Regional Plan

The Hunter Regional Plan 2036 (DPE, 2016) contains land use priorities for the region, including within Lake Macquarie City and the coastal zone.

The Hunter Regional Plan 2036 (DPE, 2016) incorporates strategic directions for each key goal with actions outlined for each direction.

Appendix 2 provides an overview of the relevant goals, directions and actions within the Hunter Regional Plan 2036 (DPE, 2016) that relate to coastal zone management within Lake Macquarie City.

5.5 PLANNING INSTRUMENTS

Instruments relevant to coastal management in the City include:

- Lake Macquarie Local Environmental Plan (LEP) 2014
- SEPP Coastal Management
- SEPP Vegetation in Non-Rural Areas
- SEPP Infrastructure
- SEPP 19 Urban Bushland
- SEPP Koala Habitat Protection.

6. MONITORING

Monitoring the health of waterways and catchments provides important information to assist with maintaining the quality of coastal environments and communities. There are a number of monitoring programs carried out within the coastal zone of Lake Macquarie.

6.1 INTEGRATED COASTAL ZONE MONITORING PROGRAM

Council has received funding from the NSW Coastal and Estuary Grants Program to deliver an integrated coastal zone monitoring program (currently funded until 2022).

The monitoring program is being delivered in three component parts, assessing three key elements of coastal zone management:

6.1.1 Beach and dune morphology

Monitoring sand volumes of beaches and dunes is undertaken on a regular basis (four times a year, plus following major erosion events) using LiDAR. Collected data will be provided to Council in a format that shows change over time and highlights changes in beach and dune form.

Previous studies indicate that resilient dunes and beaches play a vital role in protecting coastal assets from future impacts of coastal erosion and wave overtopping. Hence, gaining a high level of understanding of changes in beach/dune morphology is a priority for Council, and frequent collection of LiDAR data provides an important tool to assist with managing this important issue into the future.

6.1.2 Lake aquatic health monitoring

The aims of the monitoring program are to assess the ecological health of Lake Macquarie using methods that are scientifically valid and standardised, and to report the information generated in an accessible way to a number of potential users in a report card style format.

Turbidity, chlorophyll-a and change in seagrass extent are considered to be appropriate measures of estuary ecological health as they are indicators of ecosystem performance in response to catchment pressure. These indicators are consistent with the NSW monitoring evaluation and reporting protocols. There are extensive seagrass beds in Lake Macquarie and the change in seagrass extent is a key indicator of ecological health. Water quality sampling will be carried out at 10 sites throughout the lake; eight in the main basin and two in major inflowing tributaries – Cockle Creek and Dora Creek – 12 times throughout the year. Seagrass depth range will be measured annually (in May), at five sites.

Monitoring results are reported to the Lake Macquarie community in a 'water quality report card' format linked with Council's annual State of the Environment Report, as well as feeding into the Marine Estate Management Authority's (MEMA) state-wide monitoring program of estuary water quality, which is anticipated to include the development of an interactive map for estuary webpages and an estuary water quality database project plan.

6.1.3 Estuary foreshore intertidal ecology monitoring

Foreshore intertidal areas are increasingly being recognised as playing a critical role in the ecological function of estuaries. This narrow foreshore strip is also under significant pressure with works to stabilise foreshore erosion impacting upon this important zone. While Council has been effective in preventing further construction of damaging structures, such as seawalls in favour of 'soft engineering' solutions, there is concern over the impacts of these 'soft' works, usually consisting of a cobble beach, on intertidal and near-shore sub-tidal ecology. The lack of research on the impact of foreshore stabilisation works on intertidal and nearshore sub-tidal ecology has prompted Council to consider this issue in more detail and design a suitable monitoring program to assist in quantifying potential impacts. Monitoring methodology includes monitoring of several foreshore locations, with sites including a range of foreshore stabilisation treatments such as seawalls, cobble beaches and saltmarsh. Monitoring assesses intertidal and near-shore sub-tidal faunal assemblages, water chemistry and nearshore seagrass depth range over a monitoring duration of two and a half years.

6.2 ECOLOGICAL COMMUNITY AND HABITAT MAPPING

Council currently has ecological community and habitat mapping available and Council's Community Ecosystem Monitoring Program provides some longitudinal data on the existing condition of specific sites. The six key sites in coastal ecological communities included in the Community Ecosystem Monitoring Program are saltmarsh (two wetlands in Black Neds Bay), littoral rainforest (Swansea Heads), coastal headland heath (Caves Beach) and maritime grasslands (two sites on the dunes north of Second Creek, Redhead). To date, there has been no tracking of coastal changes in ecological condition and limited site-specific data is available for Landcare project sites.

6.3 FRESHWATER CATCHMENT ECOSYSTEM HEALTH MONITORING PROGRAM

Council undertakes an annual freshwater catchment ecosystem health program and has an online scorecard that provides a snapshot of waterway health from six of Lake Macquarie City's main catchments (Winding, Flaggy, Cocked Hat, Cockle, North, Jigadee, Scrubby and Stoney Creeks). These scorecards (available at lakemac.com.au) report on three attributes: water quality; riparian assessment (an assessment of the vegetation interface between land and a river or stream); and the presence of aquatic macroinvertebrates (an indicator of stream quality).

6.4 RECREATIONAL WATER QUALITY MONITORING

Popular lake and beach swimming spots are tested weekly from November through to April as part of Council's recreational water quality monitoring program.

Council samples one beach and 13 lake sites and Hunter Water samples another five beach sites for Enterococci bacteria. The presence of Enterococci indicates that water may be polluted with stormwater or sewage, and Enterococci levels above 100 organisms/100mL indicate that water may be unsuitable for swimming. Beaches sampled as part of this monitoring include Glenrock, Dudley, Redhead, Blacksmiths, Caves and Little Beach, as well as an area adjacent to the southern breakwater of Swansea Channel.

6.5 SEAGRASS MONITORING

Lake Macquarie's State of the Environment Report 2018 details coastal monitoring around the lake, including seagrass mapping. This mapping involves identifying the different species, the varying habitats and the overall trends in seagrass coverage. As part of recent local adaptation work in Marks Point Belmont South, shoreline seagrass monitoring has also been completed.

6.6 STATE GOVERNMENT MONITORING

Extensive research has also been carried out by the Estuaries and Catchments Team (ECT) of DPIE on the water quality, catchment generation rates for pollutants, hydrodynamic processes, lake ecosystem response, seagrass health, food-web analysis, foreshore processes, and sediment processes. The preparation of a State of the Estuary Report by DPIE is underway. The aim of this report is to collate the results from monitoring and studies conducted to date and also identify trends and threats to lake water quality.

6.7 SMART BEACHES

Lake Macquarie City Council is the Smart Beaches lead organisation, in partnership with Northern Beaches Council and the University of Technology Sydney.

Currently, there is inconsistency in the nature of beach data collection along Australia's coast, with different councils collecting different information relating to crowd numbers, activity and localised conditions.

Collection and recording of beach usage information is a time-consuming and imprecise task for professional lifeguards. Smart Beaches provides reliable, uniform, objective information, allowing them to focus more on their primary role of protecting public safety.

Smart Beaches will provide immediate, constant condition reports specific to each beach covered by the project, filling in gaps left by existing surfing and weather apps, and websites. Sensors and other technology will collect and interpret data on local surf conditions and crowd numbers, helping determine what resources are required to keep our beaches safe and user-friendly.

Smart Beaches technology was trialled at Redhead Beach and Blacksmiths Beach in Lake Macquarie, and Manly Beach and Shelly Beach in the Northern Beaches Council LGA. The technology may be rolled out to other beaches nationally and internationally in the future.

6.8 ENVIRONMENTAL RESEARCH GRANTS

Each year Council provides funding for Environmental Research Grants. In 2019-2020, a grant was awarded for the investigation of aquatic recreational structures as ecologically important habitats. The primary aim of the grant is to assess the fish assemblages associated with various recreational structures in Lake Macquarie such as boat ramps, jetties and protective swimming nets. As an adjunct to this grant the University of Newcastle is currently studying seahorse populations within the lake.

6.9 BLACKSMITHS BEACH SURF AMENITY ASSESSMENT REPORT

The Water Research Laboratory (WRL) at the School of Civil and Environmental Engineering at UNSW Sydney has been engaged by Council to undertake a Surf Amenity Assessment for Blacksmiths Beach.

The following tasks have been completed:

1. a stakeholder meeting to engage with the local surfing community to discuss long-term changes to the site and possible causes
2. analysis of the best available estimates of long-term coastal change (erosion, vegetation and bathymetry) using a remote sensing data ensemblecreation of a time-lapse animation of collated aerial imagery for community consultation activities
3. installation of a short-term camera monitoring deployment for tracking beach usage.

The Report was completed in October 2020.

6.10 FORESHORE ASSET CONDITION ASSESSMENT

Council staff are completing an audit of existing lake foreshore revetment structures on land under the care of Council. This information will assist with the development of forward works programs and will also be used to inform an Asset Management Plan for foreshore revetments.

7. CLIMATE CHANGE

The Hunter and Central Coast Regional Environmental Management Strategy (HCCREMS) identifies some of the key impacts of climate change on the Hunter and Central Coast regions as sea level rise, higher average and extreme temperatures, and increased intensity and frequency of extreme events, including storms.

Given the geography of the coastal zone, with a significant portion of land adjacent to the coast, estuary and channel being relatively low-lying, a key concern is sea level rise. With the lake being connected to the open coast, the issue broadens to also include lake level rise.

In 2009, The Department of Climate Change (now the Department of Industry, Science, Energy and Resources) identified the Local Government Areas of Lake Macquarie, Wyong, Gosford, Wollongong, Shoalhaven and Rockdale as having the greatest risk of inundation from sea level rise (to 1.1 metres) collectively representing more than 50 per cent of residential buildings at risk in NSW. It was determined that between 5100 and 6800 buildings in Lake Macquarie City may be affected by sea level rise and storm tide inundation by 2100, with the upper range representing approximately 10 per cent of then current residential building stock.

7.1 FLOODING AND INUNDATION

Council currently has a Waterway Flooding and Tidal Inundation Policy that sets a planning level benchmark of 2.82m AHD for the year 2100. This factors in a 1:100-year lake flooding event with a sea level rise of 0.9m by 2100. Coastal hazard and risk studies are based on these adopted levels, which will be used during Stage 1 of the CMP. However, with the ongoing review of climate change projections, the understanding of coastal risks also varies. The CMP will be reviewed in 10 years to ensure development of the most suitable solutions, based on available advice from the Intergovernmental Panel for Climate Change (IPCC) and the Commonwealth and state governments.

The 2012 Lake Macquarie Waterway Flood Risk Management Study and Plan identified a number of areas around the lake already experiencing the effects of flooding, inundation and property damage, and highlighted the need to plan for projected sea level rise. One of the recommendations was for Local Adaptation Plans (LAPs) to be generated in priority areas/ catchments to guide future decisions by Council and the community in adapting to climate change. An LAP was developed for Marks Point and Belmont South in 2016 that outlined methods to manage the risk of current and future flooding and permanent tidal inundation resulting from rising lake levels. The LAP provided residents with increased certainty about future development in the area and included a range of measures including raising and improving the design of infrastructure such

as drains and roads, constructing new buildings with floor levels above projected flood levels and raising homes, if required.

LAPs are currently being developed for the Pelican and Blacksmiths area and another for Swansea and surrounds.

7.2 BEACH EROSION AND COASTAL RECESSION

During severe storms or a series of storms in succession, increased wave heights and elevated water levels result in wave attack of the beach berm and foredune region. Storm events generate transport of sand:

- offshore, with sand eroded from the beach face and transported to the seabed to form a sand bar roughly parallel to the shoreline
- alongshore (i.e. along the beach), either up-coast or down-coast depending on wave direction.

The result is erosion on the beach face that may pose a hazard to back beach land and assets. The short-term storm related cross-shore sand transport and longshore drift occur simultaneously. Their effects are additive, although the beach itself (above mean sea level) will erode predominantly during storm events.

Beach accretion (i.e. growing areas of deposited sand) may occur where longshore transport brings in more sand than is taken away. Shifts in transport direction can also result in a shift in sand from one end of the beach to the other and a slight change in beach alignment between the controlling headlands. During calmer weather, sand slowly moves onshore from the nearshore bars to the beach forming a wave-built berm, or bank, under the action of swell waves. From the berm, wind blows sand to form incipient dunes and foredunes.

As part of developing Lake Macquarie's Coastal Zone Management Plan (BMT WBM, 2015) assumed the average net yearly regional longshore sediment transport rate to be about 20,000-30,000-cubic-metres a year at Newcastle. The studies indicated clearly a northwards net littoral transport under the predominant south-easterly waves at beaches south of the Hunter River, and this has been assumed would also be the case at Lake Macquarie. For Lake Macquarie, a regional longshore transport rate of 21,000-cubic-metres a year was adopted as the upper limit scenario.

The severity of wave attack at the dune is dependent on wave height, elevated water level (the combination of tide, storm surge and wave setup) and preceding beach condition (i.e. if the beach is accreted or eroded prior to the storm). In addition, depending upon the orientation of the coastline relative to the direction of the incoming storm, the beach may either experience unimpeded wave power and severe erosion, or may be shadowed and protected from incoming wave energy.

Beaches can be subject to longer-term trends of erosion or accretion associated with the gradual net removal or addition of sand to the active nearshore profile. Long-term recession is frequently associated with a longshore sediment transport differential, where the supply of sediment into the system is less than the sediment losses from the system.

Recession of the shoreline is also expected to occur in response to sea level rise. In this case, there is an upward and landward translation of the entire beach and dune position as the shoreline reaches a new equilibrium with the new sea level position.

The Lake Macquarie Coastal Zone Management Plan 2015 (CZMP) also took into consideration the effects of climate change in each of the three study areas – the open coast, the estuary and the channel – with the objective to encourage and promote plans and strategies for adaptation in response to coastal climate change impacts. In evaluating the three zones in the CZMP, climate

Table 4: Adopted immediate beach erosion extents (BMT WBM, 2015)

Immediate beach erosion hazard	Almost certain	Unlikely	Rare
Catherine Hill Bay (Moonee, Pinny, Stinky Point and Dudley)	25m	40m or limit of bedrock	65m or limit of bedrock
Caves, Hams (+Crabs)	20m	50m or limit of bedrock	75m or limit of bedrock
Blacksmiths Beach	20m	65m	85m
Redhead Beach	40m	100m	140m

change considerations were made in assessing the coastal hazards with parameters such as rainfall intensity and frequency, sea level rise, change in storm waves and change in wave direction.

7.3 IMPACTS OF SEA LEVEL RISE ON WETLANDS

In 2010, an inventory of all low-lying wetlands in Lake Macquarie City was compiled from existing data and field investigation. This inventory was then used to analyse the likely impacts of sea level rise on wetlands (up to the 90cm benchmark adopted by the NSW Government at that time) and these wetlands' capacity for retreat.

The results of the sea level rise analysis indicated that about 680 hectares or 28 per cent of the current extent of low-lying wetlands will be inundated with 90cm sea level rise by 2100. However, the impact of sea level rise differs greatly between wetland types. Spatially, the areas to experience the most significant inundation of wetlands are Dora Creek, Cockle Creek, the eastern coastal areas around Swansea and low-lying lake foreshore areas, with low-lying saline wetlands likely to be the most affected. Wetlands that occur at higher elevations were predicted to experience less frequent saltwater inundation and, therefore, were at lower risk of material changes to existing status (Umwelt, 2015).

Wetland communities may have the capacity to retreat (upslope) from rising sea levels, such that some or all of their current aerial extent is preserved. For most wetland types, the potential retreat area is more than 10 times greater than the area that will be inundated with sea level rise. There is potential for wetlands to migrate upslope as sea levels rise, and some climate change impacts may be able to be mitigated. The exception to this is for mangroves.

The potential retreat areas in Lake Macquarie are concentrated in three main locations: in the coastal dune system around Belmont, along the floodplain of Cockle Creek and in the south western foreshore and floodplain of Lake Macquarie around Morisset and Wyee Point. These regions are the largest patches of vegetation at low elevation (Eco Logical Australia, 2010).

Saltmarsh is particularly vulnerable to the impacts of sea level rise due to its position in the landscape and the nature of saltmarsh as a community. Saltmarsh requires particular gradients, salt to maintain a competitive advantage, a location in the intertidal range and it is vulnerable to threats such as weed invasion, fire and fragmentation. It is also readily invaded by mangroves in dynamic estuarine situations.

8. COASTAL MANAGEMENT AREAS

The Coastal Management Program focuses on four coastal management areas, defined and mapped in the Coastal Management SEPP. The coastal management areas are:

- Coastal wetlands and littoral rainforests area
- Coastal vulnerability area
- Coastal environment area
- Coastal use area.

In many instances, the mapped coastal management areas overlap in the coastal zone. Land that falls within multiple coastal management areas may be subject to different management objectives specified in the *Coastal Management Act 2016*.

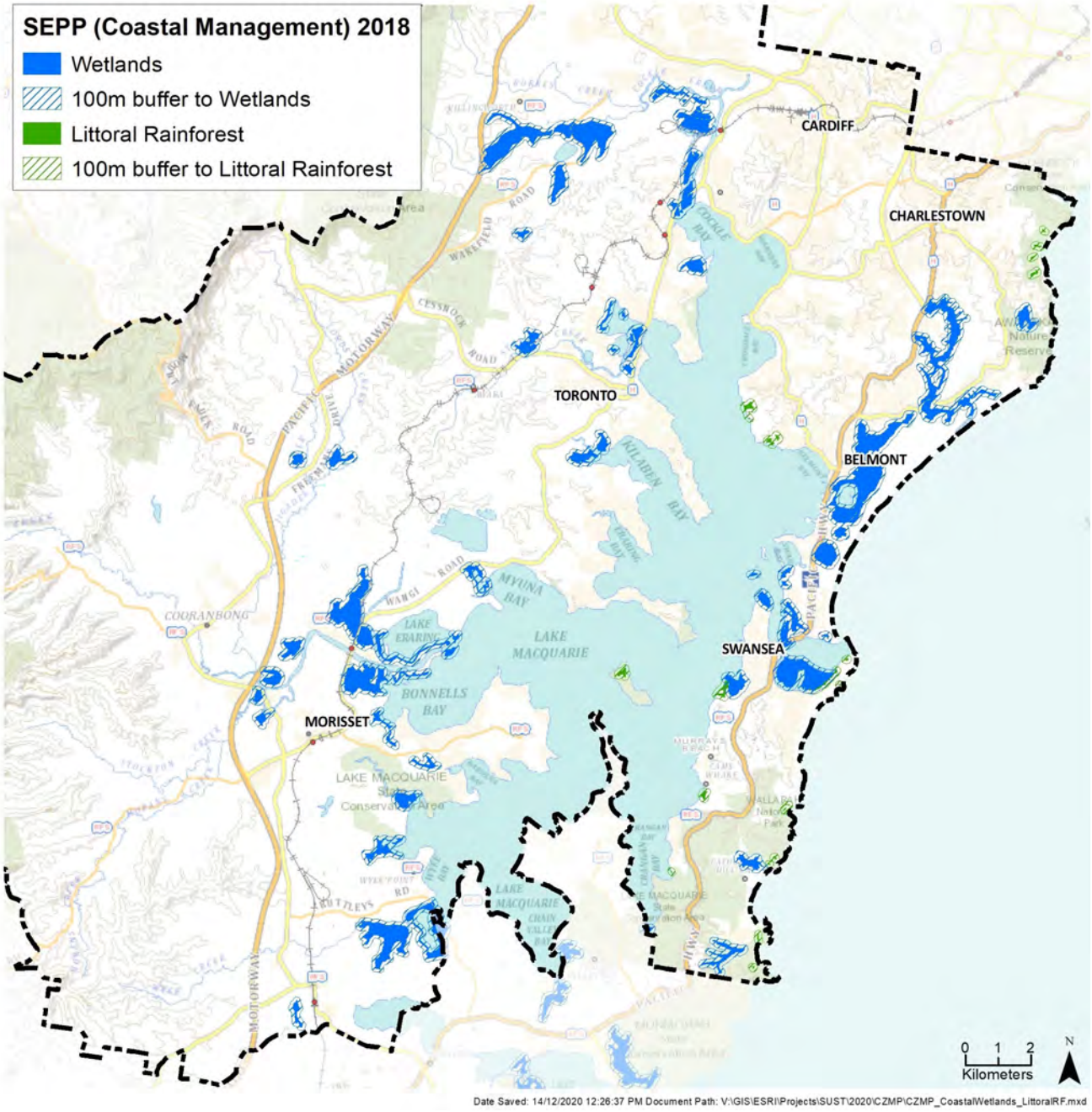
The application of management objectives is based on the hierarchy of management areas as outlined above. For example, if an area lies within a coastal environment area as well as a coastal use area, the objectives of the coastal environment area take precedence, in the event of any inconsistencies between the objectives of the two areas.

8.1 COASTAL WETLANDS AND LITTORAL RAINFORESTS AREA

Coastal wetland and littoral rainforest is land that displays the hydrological and floristic characteristics of coastal wetlands or littoral rainforests, and land adjoining those features.

Lake Macquarie contains more than 50 major natural wetland areas, occupying more than 2200 hectares. Mangrove and saltmarsh wetlands adjoin the lake or ocean, while freshwater and brackish wetlands such as Belmont Lagoon and Toronto Wetlands are dependent on a level of fresh water entering the system.

Coastal wetlands around Lake Macquarie are also recognised for their national importance, and are listed in the Directory of Important Wetlands in Australia.



About 460 hectares of wetland area around Lake Macquarie is included in the national directory, described as:

"The area is comprised of a chain of 17 permanent and semi-permanent shallow wetlands. The site lies between Jewells Wetlands, north (Directory of Important Wetlands in Australia listed NSW 183) and south, the Lake's entrance and Black Neds Bay and, further south-west, Galgabba Point, on the eastern shore of Lake Macquarie.

They lie parallel with the eastern barrier sands within the coastal hazard zone of Nine Mile Beach and the Pacific Ocean/Tasman Sea coast. To the west, they lie parallel with the hills and urban settlement along Pacific Highway and the eastern shores of Lake Macquarie and, further west, the Watagan Mountains. The site is separated from the catchment of the Hunter River by the line of hills between Mount Sugarloaf and the coast at Glenrock Lagoon"

Multiple pockets of littoral rainforest exist on the eastern side of Lake Macquarie, including the well-known Black Neds Bay at Swansea Heads. Littoral rainforests grow in areas protected from wind and salt spray, and require a unique microclimate formed by the surrounding vegetation.

The major threats to Lake Macquarie's coastal wetlands and littoral rainforests include:

- climate change and projected sea level rise – 28 per cent of wetlands affected by inundation from sea level rise
- clearing of wetlands – estimated more than 90 per cent of Lake Macquarie's wetlands have previously been cleared or filled
- alteration of natural flow regimes from development and urban rainwater runoffinvasive exotic plant species and feral animals
- disturbance from construction of roads, drainage and underground infrastructure
- fire regimes and arson
- anthropogenic activities resulting in pollution, trampling and dumping of waste.

Since the CZMP was prepared in 2015, about 88 hectares of wetland habitat improvement works have been undertaken across the City.

8.2 COASTAL VULNERABILITY AREA

The Coastal Vulnerability Area identified in the Coastal Management SEPP for the purpose of the CM Act is defined as land subject to coastal hazards. At present, no coastal vulnerability map has been adopted in the SEPP and therefore no Coastal Vulnerability Area has been formally identified.

Hazards considered in development of Lake Macquarie's CZMP in 2015 included extreme storm flooding, permanent inundation, coastal erosion and recession. For the channel and estuary, the hazard envelope is driven by the extreme storm flood hazard. For the open coast, the hazard envelope is driven by coastal erosion and recession.

Identifying and assessing land that is subject to current and future coastal hazards will help inform the mapping of the coastal vulnerability area.

Coastal hazards are defined in s4 (1) of the CM Act as:

- beach erosion
- shoreline recession
- coastal lake or watercourse entrance instability
- coastal inundation
- coastal cliff or slope instability
- tidal inundation
- erosion and inundation of foreshores caused by tidal waters and the action of waves, including the interaction of those waters with catchment floodwaters.

In Lake Macquarie, the studies indicated in Table 5 have been undertaken to provide more detailed information for some of these hazards.

Table 5: Coastal hazards and studies

Coastal process	*Coastal hazard*	*Study*	*Location*	*Prepared by*	*Year*
Weathering and slope processes on cliffs, bluffs and shore platforms	Cliff instability	Preliminary Landslide Risk Zoning of Coastline Cliffs and Slopes	Glenrock Lagoon to Little Beach	RCA Australia	2013
Weathering and slope processes on cliffs, bluffs and shore platforms	Cliff instability	Geotechnical assessment	Dudley (Debs Parade), Redhead, Swansea Heads (Reids Reserve Area), Seacliff Place (Caves Beach), Catherine Hill Bay	Cardno	2017
Weathering and slope processes on cliffs, bluffs and shore platforms	Cliff instability	Coastal Cliff Stability and Safety Assess-ment	Redhead Bluff, Swansea Heads, Caves Beach South	Cardno	2020
Weathering and slope processes on cliffs, bluffs and shore platforms	Coastal recession, inundation and wave overtopping	Lake Macquarie Coastal Zone Hazards and Risk Assessment	Coastal zone	BMT WBM	2015
Storm patterns – frequency, intensity and direction	Beach erosion	LiDAR data			Quarterly
Water levels – from tides and during storms	Waterway flooding and tidal inundation	Lake Macquarie Waterway Flood Study		WMA Water	2012
Water levels – from tides and during storms	Waterway flooding and tidal inundation	Lake Macquarie Waterway Flood Risk Management Study and Plan		WMA Water	2012
Waves and currents	Shoreline recession due to sediment deficit or accretion when there is more sand migrating on to the beach				
Changes to coastal entrances of creeks, lakes and estuaries	Coastal entrance instability as creek and lake entrances open, close and change position				
Past and future changes to sea level associated with long-term climate change	Shoreline recession due to long-term sea level rise (or potentially accretion due to sea level fall)				
Stormwater runoff	Erosion at stormwater outlets – there may also be water quality issues from stormwater runoff				
Sediment transport by wind	Sand drift, where mobile dune sand moves landward over areas of native vegetation, or open space for recreational uses, or onto roads etc.				

Council will be submitting a planning proposal for the newly developed coastal vulnerability map at the completion of the CMP.

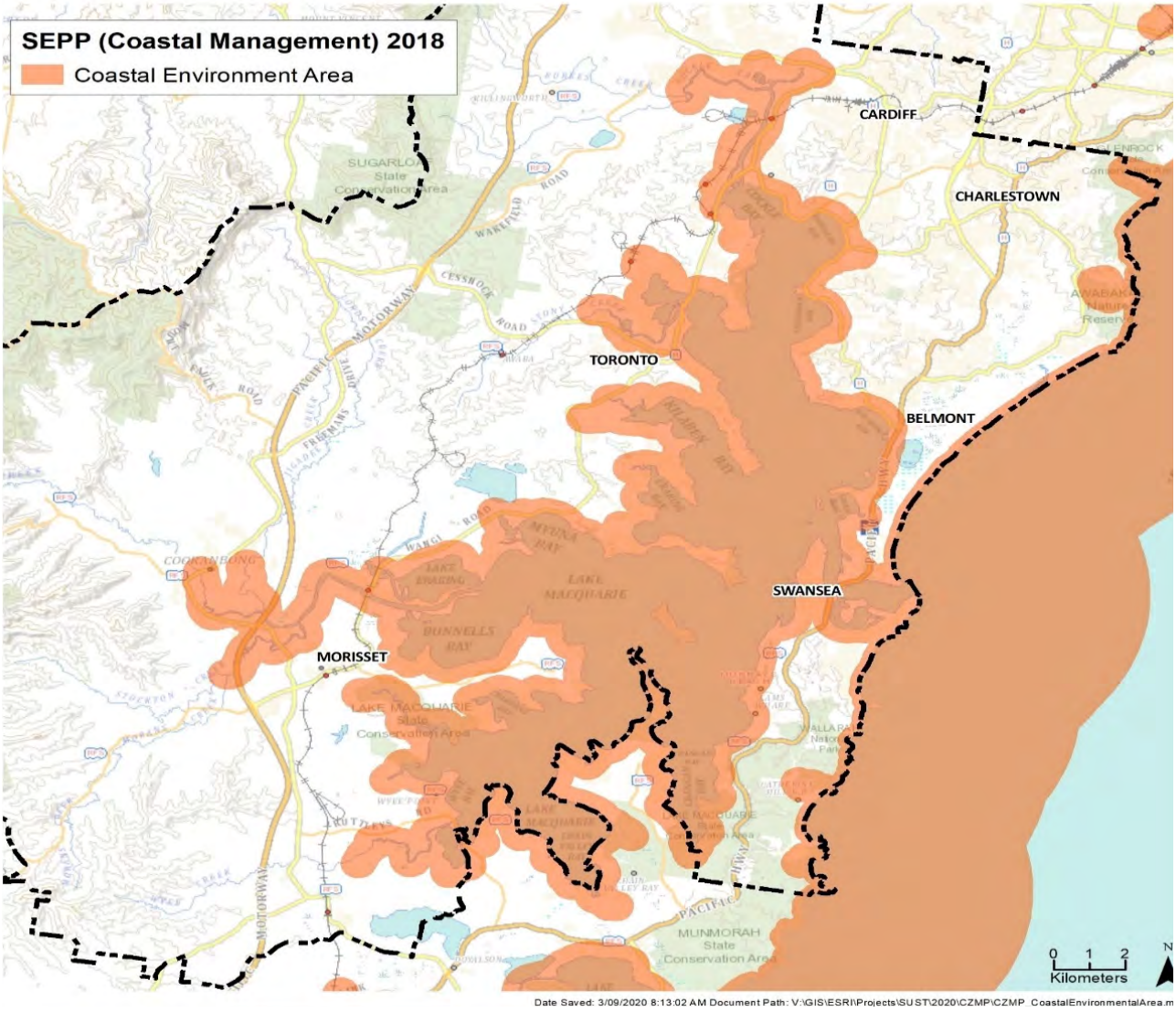
8.3 COASTAL ENVIRONMENT AREA

The Coastal Environment Area identified in the Coastal Management SEPP for the purpose of the *CM Act* is defined as land containing coastal features such as the coastal waters of the State, estuaries, coastal lakes, coastal lagoons and land adjoining those features, including headlands and rock platforms.

The Coastal Environment Area includes land adjacent to the coastal shoreline and land surrounding the lake, Swansea Channel and major tributaries. Land within a 500-metre perimeter of coastal lakes and lagoons and a 100-metre perimeter of estuaries and submerged lands falls within the Coastal Environment Area. Current Coastal Environment Area mapping does not include coastal headlands, which will be amended in further stages of the CMP.

Lake Macquarie has about 170km of foreshore. The foreshore surrounding the lake is comprised of rock-based slopes, sandy shorelines, creek deposits and modified shorelines, with a varied range of foreshore treatments. Rehabilitation of vulnerable sections of foreshore and banks are actively implemented by Council to prevent ongoing erosion and improve the health of native ecosystems.

Annual water monitoring in Lake Macquarie has shown significant improvements in ecological health since the 1980s. In addition to foreshore stabilisation works, stormwater management, sediment control, bush regeneration projects and Landcare sites have increased the resilience of the foreshore area, and limited excess nutrient loads and pollutants entering the lake.


SEPP (Coastal Management) 2018
Coastal Environment Area
CARDIFF
CHARLESTOWN
TORONTO
BELMONT
SWANSEA
MORISSET
SUGARLOAF State Conservation Area
LAKE MACQUARIE State Conservation Area
MUNMORAH State Conservation Area
0 1 2
Kilometers
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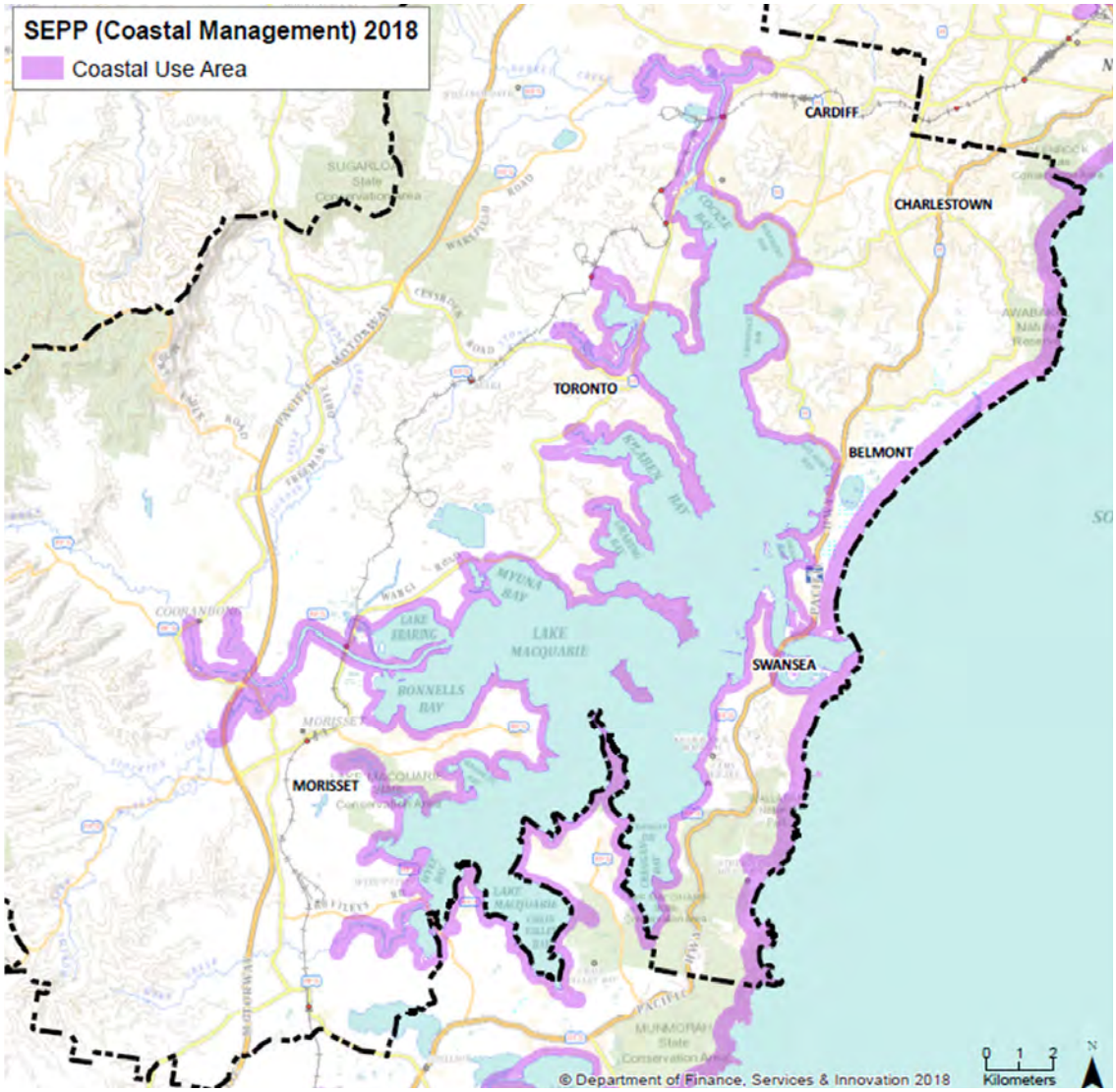
8.4 COASTAL USE AREA

The Coastal Use Area identified in the Coastal Management SEPP for the purpose of the *CM Act* is defined as land adjacent to coastal waters, estuaries, coastal lakes and lagoons where development is or may be carried out (at present or in the future).

The Coastal Use Area includes land within a kilometre of the coastline and estuary. Where the overlapping of mapped areas occurs, the management objectives and development controls for the Coastal Environment Area prevail over the Coastal Use Area.

A number of natural and structural assets exist along the lake and coastline of Lake Macquarie including:

- lake foreshore structures such as jetties, boat ramps and swimming enclosures
- channel foreshore structures such as Swansea Bridge and Blacksmiths breakwater wall
- land development such as residential properties, reserves, and marinas
- environmental assets such as ecosystem communities and beaches
- stormwater infrastructure and sewage systems
- roads and energy infrastructure.



The regional population of Lake Macquarie is projected to increase over the coming years, creating a demand for more development to accommodate the growing community. This will likely result in increased pressures within the coastal area.

8.5 REVIEW OF CURRENT COASTAL MANAGEMENT

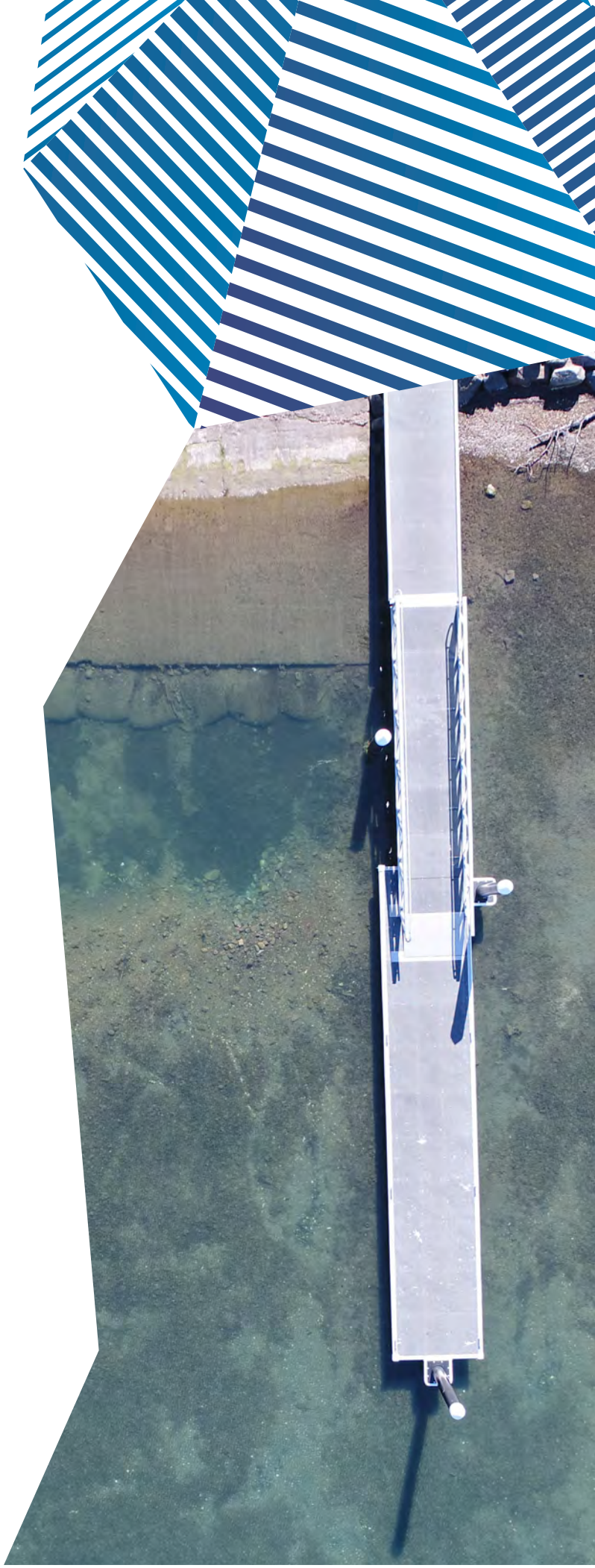
8.5.1 Managing estuary health

Managing the health of the Lake Macquarie estuary has been a high priority issue for the local community and Council for many years.

Following major community concern over the deteriorating condition of Lake Macquarie, the then State Pollution Control Commission undertook an audit of Lake Macquarie in 1983. The report found that the lake was in the early stages of eutrophication, a state in which a body of water becomes overly enriched with minerals and nutrients, which induces excessive growth of algae. The main causes were identified as excessive nutrients and sediments running in from the catchment to Lake Macquarie, combined with the destruction of natural filtration facilities such as wetlands and vegetation buffers.

The Lake Macquarie Estuary Management Plan was finalised in 1997 following several years of process and management studies. This plan highlighted that significant investment was required to address the decline in lake health. The plan also identified that lake health is inextricably linked to the health of the catchment, and that solutions which complemented natural ecological processes (known as 'soft engineering') were likely to be most applicable (as compared to traditional 'hard' engineering solutions, such as dredging and reclamation, which had been used historically in many estuaries). The plan also identified that an integrated, 'whole-of-government' approach was required in partnership with the local community.

In 1998, the then State Premier, the Hon. Bob Carr, appointed a Task Force under the chair of Ian Kiernan OA to address the problem. The report of the Task Force, known as the Integrated Estuary and Catchment Management Framework, was accepted by cabinet in February 1999. The report included several components that provided the foundation for a



successful outcome. Among these was a strong emphasis on a whole-of-government approach, which was supported by various departments and agencies during the implementation phase.

The report recommended a unique institutional arrangement for implementation through the creation of the Office of the Lake Macquarie and Catchment Coordinator. This cooperative-based arrangement was a joint initiative of Lake Macquarie City Council, Wyong Shire Council, and the State Government, with major funding provided by these partners.

To oversee the implementation process, a committee known as the Lake Macquarie Project Management Committee was appointed by the then Minister of Land and Water Conservation. The Committee consisted of representatives of both councils, community members, regional directors of relevant government departments and three ex-officio members.

The Lake Macquarie Improvement Project (1999-2009) achieved the following:

- installation of 66 stormwater treatment devices, with a focus on wetlands
- rehabilitation of about 38.6km of Lake foreshore and estuarine creek banks
- rehabilitation of 15 state significant wetlands
- planting of an additional 600,000 endemic plants through Landcare.

More than 260 Landcare groups existed in Lake Macquarie at the completion of the improvement project in 2009.

A review of the effectiveness of the Lake Macquarie Improvement Project found that the execution of the works program was well managed and overall concluded that “the Lake Macquarie Improvement Project had enabled the cost-effective implementation of a large works program that can be expected to provide substantial improvements in water quality in Lake Macquarie”. The project was awarded the prestigious Theiss River Prize for excellence in waterway improvement in 2008. In June 2009, the term of appointment by the Minister for the Lake Macquarie Project Management Committee and consequently the Office of the Lake Macquarie and Catchment Coordinator (OLM&CC) and the Lake Macquarie Improvement Project ceased. The responsibility then shifted to Lake Macquarie City Council, Wyong Shire Council and various relevant government agencies.

Since the cessation of the OLM&CC in 2009, Lake Macquarie City Council has continued to deliver lake improvement works, monitoring and engagement activities in a manner consistent with the principles developed and delivered by the OLM&CC. This approach has continued to deliver excellent results, as sustained improvement in lake health has been achieved.

Some of the challenges experienced in effectively managing the lake environment include:

- difficulties in delivering a whole-of-government approach, particularly in relation to how local priority issues/actions are addressed by relevant state agencies and inconsistent approaches to management by Lake Macquarie City and Central Coast councils
- availability and lack of certainty of funding for ongoing lake and catchment improvement works
- maintenance funding for lake and catchment improvement assets (such as stormwater treatment devices)
- consideration of climate change and sea level rise impacts on lake and catchment improvement assets (particularly foreshore stabilisation assets).

8.5.2 Coastline management

The Lake Macquarie coastline is in a fortunate position in comparison to many other parts of the NSW coast. Historic land use planning in the City has meant that there are very few assets along the open coast that are within the area identified as being potentially affected by coastal erosion. Hence, the City is relatively well placed to manage coastal erosion issues into the future, especially in relation to erosion threats to residential property. The Lake Macquarie Coastal Zone Hazards and Risk Assessment – Final Report 2015 identified that the coastline does face some future challenges, such as wave overtopping, beach recession and coastal inundation and potential loss of public assets such as beach accessways and surf club infrastructure.

Council's approach to managing these hazards has been to integrate our responses with other climate-related hazards (particularly coastal inundation exacerbated by future sea-level rise, which poses a significant threat to a number of the low-lying suburbs along the City's coastal strip) and address through the preparation of Local Adaptation Plans (LAPs) for these affected communities.

Council has adopted a co-design approach of community collaboration and partnership when preparing LAPs. This approach has proven to be a successful model for community participation and acceptance of response options.

During the term of the Lake Improvement Project, the health of the City's coastal catchments was not eligible for improvement works, as this program was focused on catchments that flow into the lake. Hence, these areas did not benefit to the same degree as lake catchments and concerns were raised over the long-term health of these areas. Since the cessation of the Lake Improvement Project in 2009, there has been effort by Lake Macquarie City Council to address this through targeted works to improve the health of coastal catchments. As a result, catchments such as Scrubby and Crokers Creeks have been targeted for improvement works in recent years and gradual improvements in catchment health of these areas are starting to be observed. While this approach has addressed some of the historical imbalance in funding and works between coastal and lake catchments, further work is required to address the health of coastal catchments into the future.

Since 2012, there has been an ongoing effort to address the degraded condition of dunal systems in the City, particularly along Nine Mile Beach, which previously suffered from poor dune health, primarily resulting from infestations of Bitou Bush and impacts of off-road vehicle usage. Successive years of treatment of Bitou Bush infestations have resulted in a significant reduction, however, further work is required to establish native vegetation to help with stabilising the dunes. A beach vehicle permit system for off-road vehicles has been introduced by the Belmont Wetlands State Park to manage vehicle numbers. However, high usage numbers in peak periods and ongoing compliance issues have resulted in impacts from off-road vehicles being observed. This issue will need to be addressed in the future.

The management of the City's dunal environment has experienced some challenges due to the land tenure of the coastline, particularly Nine Mile Beach, (which has sections managed by Council, Crown Lands, Belmont Wetlands State Park, Hunter Water Corporation and Belmont Golf Course. While a collaborative approach to the management of these areas has been in place, ongoing challenges are anticipated into the future resulting from these dispersed management responsibilities.

Table 6: Management purposes of land management tools along the Lake Macquarie coastline

Source: Coastal Zone Management Plan, 2015, Part A

Land Management Tool	Management Purpose
Belmont Wetlands State Park Plan of Management	Gazetted for Access and Public Requirements, Tourism Purposes and Environmental and Heritage Conservation. Provide the community with sustainable world class, family orientated facility featuring passive and active recreational and educational activities within a rehabilitated and well managed coastal and wetlands park environment.
Wallarah National Park Plan of Management	Conserve significant cultural features, biodiversity (plants, animals and their habitats) and scenic landscape elements, and to provide public access for enjoyment and education.
Glenrock State Conservation Area	Primary purpose is for recreation and conservation. The SCA conserves over 500 ha of natural coastline and supports the last surviving pocket of coastal rainforest in the region.
Awabakal Nature Reserve Plan of Management	Recreation and conservation of cultural and natural heritage
Munmorah State Conservation Area	Recreation and conservation of cultural and natural heritage
Hunter Water Corporation - Belmont WWTP	Maintain an asset to treat wastewater and discharge to ocean in accordance with EPA licence conditions.
Council managed coastal reserves - Plans of Management	Conserve natural resources, promote public use and enjoyment, promote multiple appropriate and sustainable uses.

8.5.3 Entrance channel management

The management of Swansea Channel has been historically dominated by a number of key issues, being:

- management responsibility for dredging, foreshore works and maintenance of coastal protection assets
- the dynamic nature of the channel form, particularly foreshore erosion (which can lead to loss of foreshore infrastructure) and shoaling (which can impact on navigation)
- an ongoing process of 'channel evolution' as the channel gradually adjusts over time to breakwater configuration at the channel entrance
- the low-lying landforms surrounding the channel and vulnerability of the surrounding suburbs to inundation impacts.

The Coastal Zone Management Plan for Swansea Channel contained numerous actions focused on addressing these issues, and progress has been made in a number of areas, particularly through Local Adaptation Planning which has occurred for Swansea and Pelican. However, most of the historic management issues identified above remain problematic and are unlikely to be effectively addressed without significant expenditure, and a management structure that adopts a whole-of-government approach.

These management issues will be considered as part of Stage 3 of this CMP.

8.5.4 Implementation of Coastal Zone Management Plan 2015

Council maintains a detailed record for reporting on implementation of actions developed from the Coastal Zone Management Plan in 2015. This information is reviewed and updated annually.

Refer to Appendix 3 for action overview tables for the CZMP.

9. PRELIMINARY RISK ASSESSMENT

9.1 APPROACH

The risk assessment process utilised for this study is adapted from the Australian Standard Risk Management Principles and Guidelines ISO 31000:2009. It is consistent with the Marine Estate Threat and Risk Assessment (TARA) (Section 5) and where possible, consistent terminology has been applied.

The risk assessment has been conducted for three planning horizons: present-day, 2050 and 2100. The trajectory for future planning horizons assumes no management action taken beyond current practices.

Analyse the risks – this involves considering both the likelihood and consequence to determine the overall level of risk (Extreme, High, Medium, Low or Very Low).

ESTABLISH THE CONTEXT

the requirements of a coastal management program (CMP) are set by NSW Legislation and guideline documents. These provide the context for the risk assessment and intended outcomes.

IDENTIFY THE RISKS

the risks arise from the threats, as defined in the state-wide TARA.

ANALYSE THE RISKS

this involves considering both the likelihood and consequence to determine the overall level of risk (Extreme, High, Medium, Low or Very Low).

Further details with respect to the likelihood and consequences assessment are provided in Appendix 3.

Table 7: Risk ranking matrix (based on Lake Macquarie City Council's Enterprise Risk Management Framework)

		Consequence rating			
		Catastrophic 1	Major 2	Moderate 3	Minor 4
Likelihood rating	Almost Certain A	Extreme E	Extreme E	High H	Meduim M
	Likely B	Extreme E	High H	Meduim M	Meduim M
	Possible C	High H	High H	Meduim M	Meduim M
	Unlikely D	High H	Meduim M	Meduim M	Low L
	Rare E	High H	Meduim M	Low L	Very low VL

9.2 PRIORITY ISSUES

The risk assessment for this scoping study was undertaken on the impact of the threat across the following risk categories:

ENVIRONMENTAL

impact resulting in harm to ecosystems, loss of biodiversity and unsustainable use of natural resources

SOCIO-ECONOMIC

impacts to community services, liveability, culture and well-being, businesses, employment, property values and visitor economy.

Documented information was used in conjunction with local knowledge to assign a risk level. Risk assessment results were reviewed by Council's Coastal Zone Management Committee, interdepartmental Council staff as well as government agencies and community members who are part of the project stakeholder group.

Refer to Appendix 3 for a summary of risk ratings for the environmental and socio-economic threats applicable to the coastal zone in Lake Macquarie.

Table 8: Highest priority issues for the Lake Macquarie Coastal Zone (until 2050)

Threat	Estuary	Coastline	Channel
ENVIRONMENT			
Ecosystem impacts from climate change and coastal hazards	High	Extreme	High
Water quality impacts	High	n/a	n/a
Catchment vegetation modifications	High	n/a	n/a
Waterway modifications	High	n/a	High
SOCIAL AND ECONOMIC			
Social and economic impacts from climate change and coastal hazards	High	High	Extreme
Water quality impacts	High	High	n/a
Access to marine estate	High	High	High

9.3 NSW MARINE ESTATE STATE-WIDE THREAT AND RISK ASSESSMENT (TARA)

The NSW Government established the Marine Estate Authority in 2013 and tasked the Authority with developing an overarching Strategy and to undertake specific projects on the way to developing it, including the state-wide TARA.

The state-wide TARA involved a thorough risk assessment process that considered and prioritised the social, economic and environmental threats to the community benefits or values of the marine estate (Section 5.3). Threats and their associated risks were assessed at a state and regional scale. The region applicable to Lake Macquarie is the Central Region; from Newcastle to Shellharbour, including the Hawkesbury Shelf Bioregion Hawkesbury Shelf Marine Bioregion (NSW Marine Estate Management Strategy 2018-2028).

Highest priority threats – environment:

- climate change (next 20 years)
- urban stormwater discharge
- clearing foreshore vegetation
- dredging and excavation activities
- shipping (boating for Lake Macquarie).

Highest priority threats – social, cultural and economic

- governance issues associated with government regulations
- access to the marine estate
- climate change
- a range of activities (some conflicting).

10. PRELIMINARY BUSINESS CASE

Lake Macquarie is located on the mid-north coast of NSW, about 120km north of Sydney. The open coastal zone within Lake Macquarie City extends from Little Beach in the south to Glenrock Lagoon (Burwood Beach) in the north. The Lake Macquarie open coastline includes numerous beaches and rocky headlands, the entrance to Lake Macquarie (Swansea Channel) to Swansea Bridge and various smaller creek outlets. The beaches and coastal foreshore areas are key focal points for a wide range of recreational and social activities. These activities, in conjunction with the increasing population that utilises the area has resulted in growing pressures on the natural environment.

The sustainable management of Lake Macquarie's coastline is required to ensure the intrinsic environmental, social, economic and recreational qualities of the coast are maintained and enhanced in the present and retained for the use and enjoyment of the community into the future.

The Coastal Zone Management Plan 2015 involved the preparation of a detailed risk assessment and options study. This Plan will be replaced by the Coastal Management Program upon completion in December 2021.

10.1 JUSTIFICATION FOR PREPARATION

Some of the benefits of developing a CMP include:

- clear guidance on current and future actions and cost-sharing arrangements
- preservation of key community coastal values
- standardized processes/documentation and fewer activities or projects that duplicate one another
- collaboration with adjacent councils and other agencies which provides better knowledge transfer and delivery of outcomes
- identification of risks and management responses for adaptation to coastal processes, both now and into the future. Development of actions for adapting to coastal hazard risks over time

- identification of improvements in land-use and infrastructure planning
- improved grant funding opportunities, resource sharing and streamlined procurement processes
- collaboration with emergency agencies to develop emergency action sub-plans specific to coastal hazard management
- identification of recipients of proposed works in order to explore potential cost-share arrangements including private owners and investor sector financiers
- compliance with the planning process outlined within the NSW Coastal Management Manual and fulfillment of the good faith provisions of the Local Government Act 1993 i.e. Council does not incur any liability in terms of the advice provided as a result of the Coastal Management Program
- a strong, defendable strategic basis for management decisions affecting the coastal zone
- a consistent and transparent process for identifying coastal management issues that is underpinned by a risk-based framework.

If Council did not proceed with converting its CZMP to a CMP, some of the identified risks include:

- limited understanding of the true long-term risk exposure to coastal hazards
- inadequate representation in management tools and guiding documents, such as Local Environmental Plan and Development Control Plan, increasing the community's current and future risk exposure and creating future management problems, financial burden and public safety risks
- reactionary ad hoc protection works that could result in negative impacts on public safety, loss of beach access and amenity and other environmental and tourism related impacts
- frustration within community and agencies regarding a lack of guidance for appropriate coastal management works
- poor understanding of future risk leading to possible loss of the 'good faith' legal protection in managing coastal assets afforded to councils who show due diligence
- reduced access to funding sources for future capital works
- limitations to future government and external funding opportunities.

10.2 GEOGRAPHIC SCOPE OF THE LAKE MACQUARIE COASTAL MANAGEMENT PROGRAM

Council intends to develop a Coastal Management Program for the entire coastal zone to include the coastline, the estuary and Swansea Channel (see Section 2, Figure 3) bounded by the Lake Macquarie City Local Government Area.

The stages applied to the CMP will be the five stages as specified in the NSW Coastal Management Manual and identified in Section 1 of this study.

10.3 COMMUNITY AND STAKEHOLDER ENGAGEMENT

A Community Stakeholder Engagement Plan was prepared for Stage 1 of the CMP (refer to Appendix 1). This includes provisions for a stakeholder awareness campaign, as well as consultation with internal Council staff and key external stakeholders, including the Coastal Zone Management Committee, Youth Advisory Council and other key community groups, including Aboriginal Land Councils.

Further engagement planning will occur in subsequent stages of the program, with the external stakeholder group established during Stage 1 being the primary point of contact with the community.

10.4 GAPS ANALYSIS

A gap analysis was undertaken during preparation of this scoping study. This involved engagement with key internal and external stakeholders to identify any knowledge gaps for the three study areas: coastline, estuary and Swansea Channel. These gaps were then prioritised and the ones required for inclusion in the scope of works program (see below) identified. The remaining gaps will be revisited during Stage 3 when management actions are determined.

10.5 COST ESTIMATE

Council will be eligible for funding support through the NSW Government. Major reforms have been undertaken recently in order to support coastal management and management of the marine estate. Council will apply for funding packages to support the preparation of our Coastal Management Program.

Funding is currently available from the Department of Planning, Industry and Environment (DPIE) Coast and Estuary Grants program.

Lake Macquarie City Council received grant funding of $27,750 for the preparation of Stage 1 of the Coastal Management Program. Council has provided matched funding for this Stage, in accordance with the funding agreement, with a total estimated cost of $55,500 for this Stage. A grant application for delivery of Stage 2 of the CMP has been submitted to DPIE and an application for Stages 3 and 4, under the planning stream, will be submitted in early 2021.

Total project cost for delivery of the CMP is estimated to be $300,000.

Table 9: Coastal Management Program cost arrangements

Stage	Activity	Council funds	State Government funding	Total cost
Stage 1	Scoping study preparation	$27,750	$27,750	$55,500
Stage 2	Determine risks, vulnerabilities and opportunities	$28,000	$56,000	$84,000
Stage 3	Identify and evaluate options	$34,000	$68,000	$102,000
Stage 4	Prepare, exhibit, finalise and certify	$19,500	$39,000	$58,500
TOTAL COST				**$300,000**

10.6 ONGOING COSTS

The CMP will result in management actions being identified for the coastal zone. Lake Macquarie City Council has budgeted for a number of high priority coastal zone management actions within its Delivery Plan, but ongoing costs for the CMP are currently unknown and will be dependent on the outcomes of development of management actions in Stage 3.

10.7 GOVERNANCE

Lake Macquarie City Council is the lead organisation for the development of the CMP for the LGA, as outlined in the *Coastal Management Act 2016*. Lake Macquarie City Council will continue to partner with CMP external and internal stakeholders throughout the stages of the program.

The Lake Macquarie stakeholder working group includes relevant representatives from various sections of Lake Macquarie City Council, as well as external organisations. Refer to Section 1 (1.5 Program governance) for a list of external stakeholder groups involved.

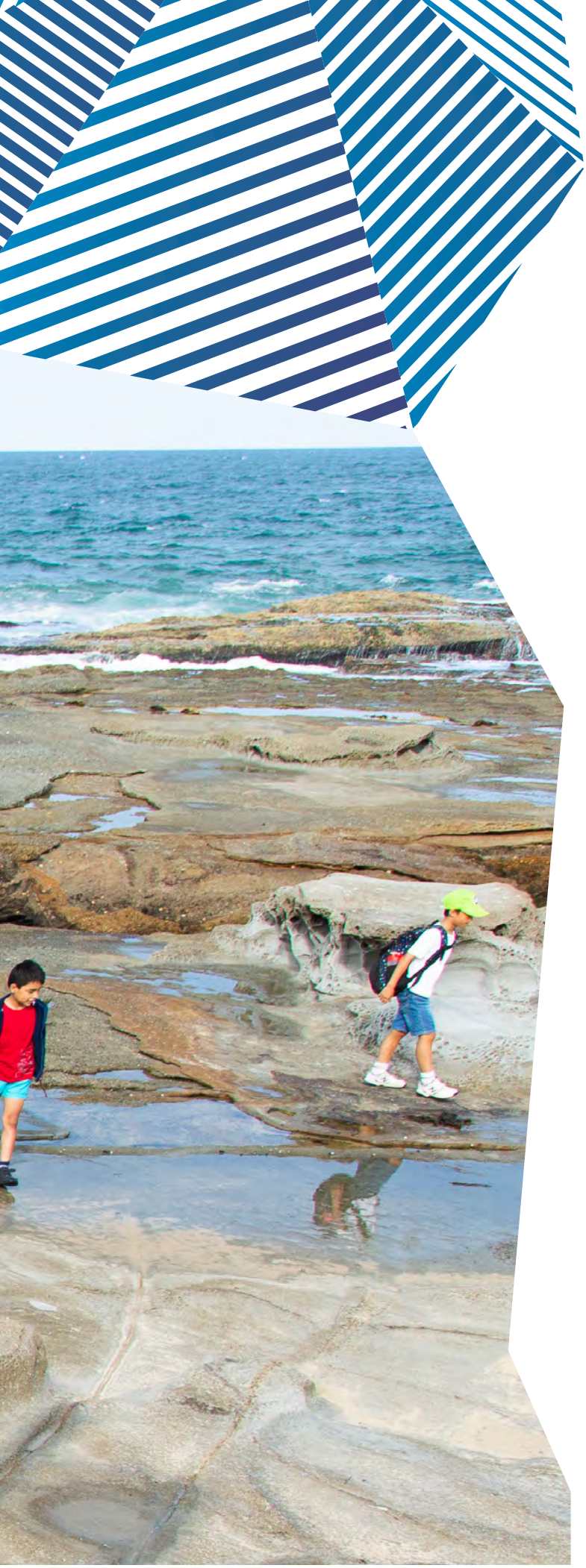
10.7.1 Current studies

Council has a number of studies currently underway that relate to gaps identified prior to the preparation of this scoping study. Refer to Table 10.

Table 10: Current studies to address pre-identified gaps

Gap	*Area*	*Current study*	*Completion date*
Lack of flooding and inundation information for 'residual' catchments not previously covered by previous flood studies/plans	Lake	Flood Study Assessment for residual Lake Macquarie waterway tributary catchments. **Covers:** 1. Plains Gully Creek, Swansea and Caves Beach 2. Sheppards Creek, Croudace Bay and Valentine 3. Muraban Creek, Floraville and Belmont North 4. Mills Gully Creek, Belmont and Valentine 5. Fullers Creek and Freshwater Creek, Bonnells Bay 6. Mannering Creek, Swampy Creek and Wyee Creek, Wyee 7. Postmistress Creek, Sunshine and Morisset East 8. Puntei Creek, Carey Bay Project undertaken by: WmaWater	June 2021
Probabilistic Hazard Lines for Pelican foreshore and Swansea Channel	Channel	Pelican foreshore stabilisation project – Concept design, options analysis and economic analysis Project undertaken by: Salients	May 2021
Cost benefit analysis and distribution analysis for Pelican foreshore stabilisation options	Channel	Pelican foreshore stabilisation project – Concept design, options analysis and economic analysis	December 2020
Examine current waterbody levels and trends in mean sea level over time	Lake Channel	Lake Macquarie water level and tidal analysis project Project undertaken by: Manly Hydraulics Laboratory	February 2021

Gap	Area	Current study	Completion date
Changes in tidal behaviour thought to be associated with entrance channel scour	Lake Channel	Lake Macquarie water level and tidal analysis project Project undertaken by: Manly Hydraulics Laboratory	February 2021
Determining the true current level of the MHWM for Lake Macquarie	Lake Channel	Lake Macquarie water level and tidal analysis project Project undertaken by: Manly Hydraulics Laboratory	February 2021
Examine variance in water levels around the lake, particularly in north and south areas of the lake as a result of seiching during wind events and/or other factors	Lake Channel	Lake Macquarie water level and tidal analysis project Project undertaken by: Manly Hydraulics Laboratory	February 2021
Economic analysis of selected adaptation options for Pelican, Blacksmiths and Swansea adaptation plans	Coast Channel	Feasibility, cost benefit and distribution analysis of Adaptation Planning options Project undertaken by: The Centre for International Economics, Umwelt and Salients.	December 2020
Foreshore revetment structures condition information	Lake	Audit of existing lake foreshore revetment structures on land under Council's care and control. Project undertaken by: Lake Macquarie City Council.	November 2020
Assessment of surf amenity for Blacksmiths Beach	Coast	Blacksmiths Beach Surf Amenity Assessment Project undertaken by: UNSW Water Research Laboratory	September 2020



10.7.2 Fast-tracking proposal

A detailed risk assessment has been completed for this scoping study. Information with respect to this assessment is in Section 10 and Appendix 2. Council is applying to fast-track the risk assessment required in Stage 2 of the Coastal Management Program.

A number of studies have been completed relating to coastal hazards in Lake Macquarie. Details of these studies can be found in Section 9. As these studies are relatively recent, it is not considered necessary to undertake further hazard analysis work for the Coastal Management Program, aside from the addition of dune heights to a previous study on wave overtopping. Council does, however, propose to prepare a coastal vulnerability map (refer to Scope of Works table below).

10.7.3 Scope of works – Stages 2-5

The following table provides an overview of the key tasks that will be undertaken during Stages 2-5 of the Coastal Management Program. For Stage 2, these tasks are focused on the priority gaps identified during Stage 1, which are essential for providing information needed for completion of further stages.

Table 11: Scope of works – Stage 2

STAGE 2
determine risks, vulnerabilities & opportunities

TASK/STUDY NEEDED	FUNDING OPTIONS	TIMEFRAME
Dune height – missing from current coastal hazard study	Stage 2 funding application (DPIE)	Three months
Vulnerability assessment	Part of Stage 2 funding (DPIE – TBA)	Four weeks
Blacksmiths Surf Amenity Assessment Report – completion and results shared with stakeholders	Funded by Council	Two months
Socio-economic assessment – desktop study of existing information	Stage 2 funding application (DPIE)	Four weeks
Desktop review of benefits of ecosystem services (e.g. saltmarsh, wetland)	Stage 2 funding application (DPIE)	Three weeks
Surf safety – first pass assessment of key issues	Stage 2 funding application (DPIE)	One week
Emergency management (extreme events) Review of CZMP Emergency Management Sub-plan	Stage 2 funding application (DPIE)	Two weeks
Power station closures – dates and planning confirmation	Stage 2 funding application (DPIE)	One week
Heavy metals in the lake – completion of State of the Estuary Report	Funded by Council	Two months
Foreshore erosion –develop prioritisation matrix (extreme events: reassess)	Council staff time	Two months
Identify foreshore erosion sites and apply prioritisation matrix	Council staff time	Three months
Foreshore revetments (land owned by other agencies) – clarify ownership	Council staff time	Two weeks

Table 12: Scope of works – Stage 3

STAGE 3
Identify and evaluate options

TASK/STUDY NEEDED	FUNDING OPTIONS	TIMEFRAME
Inclusion of all future foreshore works	Council staff time	Two weeks
Unauthorised foreshore development on private land – identifying barriers	Council staff time	One week
Boat usage (channel) – desktop review of existing information	Stage 3 and 4 funding application (DPIE)	Three weeks

Table 13: Scope of works – Stage 4

STAGE 4
Prepare, exhibit, finalise and certify

TASK/STUDY NEEDED	FUNDING OPTIONS	TIMEFRAME
Collate information into draft program	Stage 3 and 4 funding application (DPIE)	Two months
Report to Council, exhibition (including engagement) and reporting post-exhibition	Stage 3 and 4 funding application (DPIE)	Four months

Table 14: Scope of works – Stage 5

STAGE 5
Implement, monitor, evaluate and report

TASK/STUDY NEEDED	FUNDING OPTIONS	TIMEFRAME
Implementation and reporting through IP&R Framework, EP&A Framework (LEP and DCP) and CM SEPP if necessary	Funded by Council	January 2022 onwards

REFERENCES

AECOM 2020, *Baseline Thermal Assessment. Thermal Performance of the Lake Macquarie Local Government Area.*

Australian Government, Nd. *Data.gov.au*, Available at: https://search.data.gov.au/dataset/ds-dga-851571e7-85b2-48dd-bf38-f0659a9f6b46/details?q=water, Accessed on 21 May 2020.

Australian Government, Department of Climate Change 2009, *'Climate Change Risks to Australia's Coast', A First Pass National Assessment.* Australian Government, *Directory of Important Wetlands in Australia*, Information sheet Available at: https://www.environment.gov.au/cgi-bin/wetlands/report.pl. Accessed on 9 June 2020.

BMT WBM 2015, *Lake Macquarie Coastal Zone Management Plan – Part C for Swansea Channel.*

BMT WBM 2015, *Lake Macquarie Coastal Zone Hazards and Risk Assessment Final Report.*

Central Coast Council, *Policies*. Available at: https://www.centralcoast.nsw.gov.au/council/forms-and-publications/policies. Accessed on 9 May 2020.

City of Newcastle Coastal Management Program Scoping Study 2019. Available at: https://newcastle.nsw.gov.au/Newcastle/media/Documents/environment/Our%20Coastline%20-%20Documents/Coastal%20Planning%20-%20Documents/CMP-Scoping-Study.pdf. Accessed March-July 2020, various dates.

Dantia, *Lake Macquarie City Economic Development Strategy 2018-2038.*

Department of Planning, Industry and Environment (DPIE) 2019, Coastal Management. Available at: https://www.planning.nsw.gov.au/Policy-and-Legislation/Coastal-management, Accessed on 7 May 2020.

ecological Australia (2010) Lake Macquarie Wetlands Climate Change Assessment.

Hawkesbury Shelf Marine Bioregion Threat and Risk Assessment Report 2016, *The Hawkesbury Shelf TARA.*

HCCREMS https://www.hccrems.com.au/ Accessed on 14 April 2020.

Lake Macquarie City Council 2018, Destination Management Plan 2018-2022. https://www.visitlakemac.com.au/contact/industry/destination-management-plan

Lake Macquarie City Council 2015, *Lake Macquarie Coastal Management Plan- Part D- Four Year Action Plan 2015-2019.*

Lake Macquarie City Council 2016, *Planning for Future Flood Risks – Marks Point and Belmont South Local Adaptation Plan Volume 1,* Available at: https://shape.lakemac.com.au/adapting-marks-point-belmont-south

Lake Macquarie City Council 2016, *Planning for Future Flood Risks – Marks Point and Belmont South Local Adaptation Plan Volume 2,* Available at: https://shape.lakemac.com.au/adapting-marks-point-belmont-south

Lake Macquarie City Council 2017, *Lake Macquarie City Community Strategic Plan – Our Future in Focus 2017-2027.*

Lake Macquarie City Council, 2020. *Local Strategic Planning Statement*. Available at: https://www.lakemac.com.au/Our-Council/City-planning-and-direction.Accessed on 3 August 2020

Lake Macquarie City Council 2019, *State of the Environment Report 2018-2019*, https://www.google.com url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjEkofOm5TqAhUjyzgGHQRqA1gQFjAAegQIAhAB &url=https%3A%2F%2Fwww.lakemac.com.au%2Ffiles%2Fassets%2Fpublic%2Fhptrim%2Fenvironmental-management-reporting-state-of-the-environment-reports-state-of-the-environment-2018-2019%2Ffinal-state-of-the-environment-report-2018-2019.pdf&usg=AOvVaw2qcgWr_ixxg7XfehhlKpyp

Lake Macquarie City Council 2018, *State of the Environment Report 2017/18.*

Lake Macquarie City Council 2017, *State of the Environment Report 2016/17.*

Lake Macquarie City Council, Policies, Available at: https://www.lakemac.com.au/Our-Council/Policies-register Accessed on 9 May 2020.

Lake Macquarie City Council, *Lake Macquarie Waterway Flooding and Tidal Inundation - Council Policy,* Available at: https://www.lakemac.com.au/files/assets/public/hptrim/environmental-management-policy-protection-of-the-environment-policies-pep-climate-change-adaptation-lake-macquarie-sea-level-rise-preparedness-and-adaptation-policy/lake-macquarie-waterway-flooding-and-tidal-inundation-council-policy-version-3.pdf. Accessed on 9 May 2020

Lake Macquarie Landcare. N.d, *Wetlands in The Lake Macquarie Region*

Lake Macquarie Landcare. N.d, *Coastal Vegetation in Lake Macquarie*

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

Marine Estate Management Authority (MEMA) 2017, *NSW Marine Estate Statewide Threat and Risk Assessment.*

Available at: https://www.marine.nsw.gov.au/__data/assets/pdf_file/0010/736921/NSW-Marine-Estate-Threat-and-Risk-Assessment-Final-Report.pdf Accessed on 23 March 2020.

New South Wales and Office of Environment and Heritage (OEH) 2018, *Our future on the coast. NSW Coastal Management Manual Part A: Introduction and mandatory requirements for a coastal management program.*

NSW Office of Local Government. Integrated Planning and Reporting Framework. C2007, Available at: http://122.102.106.44/councils/integrated-planning-and-reporting/framework Accessed on 11 May 2020.

Port Stephens Council 2019, *Port Stephens Council Coastal Management Program Scoping Study.*

Umwelt 2014, *Coastal Zone Management Plan – Part A for the Lake Macquarie Coastline*

Umwelt 2014, *Coastal Zone Management Plan – Part B for the Lake Macquarie Estuary*

APPENDIX 1 - COMMUNICATIONS AND ENGAGEMENT PLAN

1. ABOUT THE PROJECT

1.1 Project background

In 2015, Council adopted a Coastal Zone Management Plan (CZMP) The CZMP comprised four parts: Coastline; Estuary; Swansea Channel; and a four-year action plan. This CZMP will be superceded by a Coastal Management Program (CMP) from December 2021. The CMP is an updated version of the CZMP, including requirements from the NSW Government – Department of Planning, Industry and Environment.

"The purpose of a coastal management program is to set the long-term strategy for the co-ordinated management of land within the coastal zone with a focus on achieving the objectives of this *[Coastal Management] Act [2016].*"

The scope of the CMP aims to cover local issues, challenges and opportunities in coastal management ranging from immediate, 20 years, 50 years to 100 years and beyond, as relevant. The first engagement activities of the project are during Stage 1 – the scoping study. This stage evaluates the previous CZMP plan and outcomes of the action plan to ensure the issues, challenges, opportunities and actions are still applicable and will focus on identifying any gaps for meeting the new requirements of the CMP.

The entire CMP project has five stages:

STAGE 1
Identify the scope of CMP (current project)

STAGE 2
determine risks, vulnerabilities and opportunities

STAGE 3
Identify and evaluate options

STAGE 4
Prepare, exhibit, finalise, certify and adopt the CMP

STAGE 5
Implement, monitor, evaluate and report

The project will run for approximately two years.

Information gathered during the scoping study will not only achieve Stage 1 of the Program but also provide key information to guide preparation of Stages 2 and 3.

Stage 1 includes the following milestones:

- Prepare a Stakeholder Engagement Strategy
- Identify data gaps
- Prepare a scoping study.

We are committed to providing best practice engagement based on our principles of engagement and guided by the International Association of Public Participation (IAP2). As this project moves through the different stages, we will utilise the IAP2 spectrum to guide how we engage with the community and key stakeholders.

Evaluation and review will be conducted by survey to stakeholders at the conclusion of Stages 2 and 3.

1.2 Communication objectives

- To raise public awareness about the project and the importance of coastal and waterway management.
- To interest and encourage community and industry members to participate in engagement opportunities for greater stakeholder involvement in the project.
- To increase understanding of the CZMP and the new requirements of the CMP.
- To encourage community feedback/response to assist in identifying key data gaps, new issues or challenges, and new opportunities for coastal management options, and to evaluate the relevance of existing CZMP issues and actions.

CONSULTATION ON THE COASTAL MANAGEMENT PROGRAM

Statutory provisions

16 Consultation

(1) Before sdopting a coastal management program, a local council must consult on the draft program with:

(a) the community, and

(b) if the local council's local government area contains:

(i) land within the coastal vulnerability area, any local council whose local government area contains land within the same coastal sediment compartment (as specified in Schedule 1), and

(ii) an estuary that is within 2 or more local government areas (as specified in Schedule 1), the other local councils, and

c) other public authorities if the coastal management program:

(i) proposes actions or activities to be carried out by that public authority, or

(ii) proposes specific emergency actions or activities to be carried out by a public authority under the coastal zone emergency action subplan, or

(iii) relates to, affects or impacts on any land or assets owned or managed by that public authority.

(2) Consultation under this section is to be undertaken in accordance with the relevant provisions of the coastal management manual

(3) A failure to comply with this section does not invalidate a coastal management program.

(4) The regulations may amend Schedule 1.

Mandatory requirements

15. A draft CMP must be exhibited for public inspection at the main offices of councils of all local government areas within the area to which the CMP applies, during the ordinary hours of those offices, for a period of not less than 28 calendar days before it is adopted. This mandatory requirement does not prevent community consultation, or other consultation, in other ways.

1.3 Project timeline

Date	*Details*
December 2019 – September 2020	**Stage 1** - Awareness raising and gaps analysis
December 2020 – May 2021	**Stage 2** - studies and information for identified gaps
April – October 2021	**Stage 3** – prepare the CMP, develop management actions
November 2021- July 2022	**Stage 4** – Exhibition and adoption of the CMP

2. STAKEHOLDER AND ISSUES IDENTIFICATION

Stakeholders for the project can be categorised into the following groups:

COUNCIL

STAKEHOLDER CATEGORY	INDIVIDUAL/ORGANISATION
Mayor	Kay Fraser
Councillors	
East Ward	Adam Shultz (ALP), Nick Jones (LIB), Christine Buckley (ALP), John Gilbert (LMIND)
West Ward	David Belcher (ALP), Jason Pauling (LIB), Wendy Harrison (IND), Luke Cubis (LMIND)
North Ward	Brian Adamthwaite (ALP), Kevin Barker (LIB), Barney Langford (ALP), Colin Grigg (LMIND)
Council staff	Executive, Environmental Systems, Assets, Integrated Planning, Communications, Development Assessment and Compliance and Community Partnerships.

STATE AND FEDERAL MEMBERS

STAKEHOLDER CATEGORY	INDIVIDUAL/ORGANISATION
Member for Charlestown	Ms Jodie Harrison MP
Member for Shortland	Mr Pat Conroy MP
Member for Cessnock	Mr Clayton Barr MP
Member for Lake Macquarie	Mr Greg Piper MP
Member for Swansea	Ms Yasmin Catley MP
Member for Wallsend	Ms Sonia Hornery MP
Member for Hunter	Mr Joel Fitzgibbon MP
Member for Newcastle	Ms Sharon Claydon MP

INDUSTRY, COMMUNITY AND LOCAL GOVERNMENT

Refer to stakeholder spreadsheet D09532304

MEDIA

STAKEHOLDER CATEGORY	INDIVIDUAL/ORGANISATION
TV	NBN (Newcastle office)
Radio	Triple M Newcastle/Hit1069, 2NURFM, ABC (1233 Newcastle), NEWFM/2HD
Print	Newcastle Herald, Newcastle Weekly

ONLINE

STAKEHOLDER CATEGORY	INDIVIDUAL/ORGANISATION
Facebook	@lakemaccity
Twitter	@lakemac
Blogs/websites	lakemac.com.au
Instagram	@ourlakemac
LinkedIn	

2. STAKEHOLDER AND ISSUES IDENTIFICATION

2.1 Key issues and responses

Stakeholders' key issues of concern for the project are outlined below, along with strategic communications responses and actions.

Stakeholder issue	*Stakeholder*	*Risk*	*Response/mitigation*
Surf amenity	Bring Blacksmiths Back	High	Surf assessment project underway (UNSW). Possible development of surf amenity plan. Moderation of workshop discussions to ensure balanced input.

3. FAQS

The agreed key messages for this project are:

- Coastal management involves the integrated management of the coastal environment, consistent with the principles of ecologically sustainable development, for the social, cultural and economic wellbeing of the community. Coastal legislation and policy in NSW has changed, with significant reforms over the last five years. The CMP will outline priorities and actions that will see community and government working together to achieve the best outcomes for a healthy coastline, estuary and channel.
- The health of the Lake is integral to the City's identity and prosperity. Whilst lake health has been improving over the last 20 years, it is important to maintain this focus, as it could quickly deteriorate if not considered a priority
- Balancing the desire for recreational use of waterways and foreshores with the need to protect these landscapes is a key consideration in the development of the CMP.
- 30km open ocean coastline, from Glenrock Lagoon to Moonee Beach.
- The coast is used for so many enjoyable activities, such as swimming surfing, beach walking, diving, snorkelling and wildlife watching, it's worth protecting.
- Many more people now live in our region – so more demand on coastal resources. Community recreation preferences are changing.
- Climate change has significant consequences for coastal asset management. New climate change projections based on quality science are available.

By collaborating with the community to review the CZMP we can identify new opportunities for coastal management and improve the health of our lake, waterways and coastline while maintaining community access and recreation in these areas.

4. COMMUNICATION ACTIVITIES ACTION PLAN SUMMARY

ENGAGEMENT STAGE 1
– Awareness raising and scoping study preparation (gaps and risks) (16 December 2019 – 30 September 2020)

Activity	*Stakeholders*	*Timeframe*	*Details*	*Responsibility*	*IAP2 Status*	*Status /comments*
Online						
Shape Lake Mac website	All stakeholders	January 2020	Shape Lake Mac project page to include: ■ discussion forum as main feedback mechanism ■ frequently Asked Questions ■ key dates ■ document library	Communications, Environmental Systems	Inform, Consult, Involve	complete
e-Newsletters: ■ Shape Lake Mac ■ Your City Online ■ Planning ■ Eco Advocate	Subscribers	February 2020	Share relevant updates and opportunities for consultation through eNewsletters	Communications, Environmental Systems	Inform	complete
Email notification	Identifies stakeholder email list	January 2020	Promote awareness of the project, what it is trying to achieve, how people can contribute and what information we are seeking to identified stakeholders on email.	Communications	Inform	complete
Social media posts via: ■ Facebook ■ Twitter ■ Instagram ■ LinkedIn	Followers	February 2020	Post regular updates on Council's social media platforms to keep the community informed and provide details of consultation opportunities	Communications	Inform	complete
Print						
Footpath stickers	Beach goers/lake users	January 2020	Place the footpath stickers at the four beach locations and at key locations around the lake. Promote awareness of the project and encourage use of the SLM site.	Communications	Inform	complete

Activity	*Stakeholders*	*Timeframe*	*Details*	*Responsibility*	*IAP2 Status*	*Status /comments*
Media						
Media release	Media	February 2020	Issue media release promoting opportunity for community to share their feedback	Communications	Inform	complete
Other						
Attend Community Events	Community event attendees	20 February 7,8 March	Toronto Markets Surfest, Newcastle Beach	Communications, Environmental Systems	Inform, Consult and Involve	complete
Portfolio Committees, as appropriate	Councils and key staff	Reconsider for later stage when CMP going to Council	Brief the committee members and provide an opportunity for members to contribute to the scoping study.	Environmental Systems	Inform, Consult and Involve	No further action for Stage 1
Attend Coastal Zone Management Committee meetings	Coastal Zone Management Committee members	Next meeting date: 6 February 2020	Attend Committee meetings and provide an update on progress with the CMP	Environmental Systems	Inform, Consult and Involve	
Attend Youth Advisory Council (YAC) meeting	YAC members	Next Meeting date: 12 February. Endless Summer Youth Event (23 Feb)	Attend YAC meeting and promote awareness of the project. Record discussion and any outcomes/ actions. Encourage participation through SLM and sharing on YAC social media channels, discuss ways to engage young people.	Environmental Systems	Inform, Consult and Involve	complete
Internal briefing	Identified internal stakeholders	TBC	Hold a meeting to brief identified internal stakeholders about the project. Share information and work through the project aims, stages and timeframes. Highlight opportunities for their participation and why it is important.	Environmental Systems	Inform, Consult and Involve	complete

ENGAGEMENT STAGE 1
– Awareness raising and scoping study preparation (gaps and risks) (16 December 2019 – 30 September 2020)

Activity	*Stakeholders*	*Timeframe*	*Details*	*Responsibility*	*IAP2 Status*	*Status /comments*
Other						
Focus group	Selected groups of industry and community members	June 2020	Conduct a short online forum to analyse any gaps between the CZMP and CMP and to review the risk ratings. Opportunities for new information to be gathered and included.	Communications, Environmental Systems	Consult and Involve	complete
Coastal Zone Management Committee	Committee members	June 2020	Workshop session as part of monthly committee meeting to review risk ratings, identify any additional gaps and to prioritise these gaps.	Environmental Systems	Consult and Involve	complete
Consultation summary	All stakeholders	June/July 2020	Feedback regarding risk assessment changes and gaps collated. Report on community forum provided by Deliberately Engaging.	Environmental Systems	Inform	complete

ENGAGEMENT STAGE 2
– Studies, information for identified gaps (December 2020 – May 2021)

Activity	*Stakeholders*	*Timeframe*	*Details*	*Responsibility*	*IAP2 Status*	*Status /comments*
Online						
Shape Lake Mac website	All stakeholders	February / March 2021	Shape Lake Mac project page to include: ■ discussion forum as main feedback mechanism ■ frequently Asked Questions ■ key dates ■ document library	Communications, Environmental Systems	Inform, Consult, Involve	
e-Newsletters: ■ Shape Lake Mac ■ Your City Online ■ Planning ■ Eco Advocate	Subscribers	February / March 2021	Share relevant updates and opportunities for consultation through eNewsletters	Communications	Inform	
Email notification	Identifies stakeholder email list	January 2021	Promote awareness of the project, what it is trying to achieve, how people can contribute and what information we are seeking to identified stakeholders on email.	Communications, Environmental Systems	Inform	
Social media posts via: ■ Facebook ■ Twitter ■ Instagram ■ LinkedIn	Followers	February 2021	Post regular updates on Council's social media platforms to keep the community informed and provide details of consultation opportunities	Communications	Inform	

ENGAGEMENT STAGE 2
– Studies, information for identified gaps (December 2020 – May 2021)

Activity	*Stakeholders*	*Timeframe*	*Details*	*Responsibility*	*IAP2 Status*	*Status /comments*
Other						
Presentation to Unique Landscapes Portfolio Committee Meeting	External Coastal Management Plan Group and Coastal Zone Management Committee	February 2021	Brief the committee members and provide an opportunity for members to contribute	Environmental Systems	Inform, Consult, Involve	
Councillor Briefing	Councillors	March and July 2021	Presentation to Councillors	Environmental Systems		
Wave overtopping workshop	Council staff, Coastal Management Program Group and Coastal Zone Management Committee	February / March 2021	Consultant to facilitate.	Consultant Environmental Systems	Inform, Consult, Involve	
Attend Coastal Zone Management Committee meetings	Coastal Zone Management Committee members	February and April 2021	Attend Committee meetings and provide an update on progress with the CMP	Environmental Systems	Inform, Consult and Involve	
Government agencies	Stakeholders as identified	January 2021 onwards	Regular meetings to discuss key issues and barriers to management options development	Environmental Systems	Inform, Consult and Involve	
Evaluation survey (online)	Identified stakeholders and CZM committee members	June/July 2021	Evaluation of Stage 2 consultation (short online survey)	Communications, Environmental Systems	Consult, Involve	

ENGAGEMENT STAGE 3
– Prepare the CMP, developing management actions in partnership with stakeholders
(April 2021 – October 2021)

Activity	*Stakeholders*	*Timeframe*	*Details*	*Responsibility*	*IAP2 Status*	*Status /comments*
Online						
Shape Lake Mac website	All stakeholders	February / March 2021	Shape Lake Mac project page to include: ■ discussion forum as main feedback mechanism ■ frequently Asked Questions ■ key dates ■ document library	Communications, Environmental Systems	Inform, Consult, Involve	
e-Newsletters: ■ Shape Lake Mac ■ Your City Online ■ Planning ■ Eco Advocate	Subscribers	February / March 2021	Share relevant updates and opportunities for consultation through eNewsletters	Communications	Inform	
Email notification	Identifies stakeholder email list	January 2021	Promote awareness of the project, what it is trying to achieve, how people can contribute and what information we are seeking to identified stakeholders on email.	Communications, Environmental Systems	Inform	
Social media posts via: ■ Facebook ■ Twitter ■ Instagram ■ LinkedIn	Followers	February 2021	Post regular updates on Council's social media platforms to keep the community informed and provide details of consultation opportunities	Communications	Inform	

ENGAGEMENT STAGE 3
– Prepare the CMP, developing management actions in partnership with stakeholders
(April 2021 – October 2021)

Activity	*Stakeholders*	*Timeframe*	*Details*	*Responsibility*	*IAP2 Status*	*Status /comments*
Other						
Presentation to Unique Landscapes Portfolio Committee Meeting	External Coastal Management Plan Group and Coastal Zone Management Committee	February 2021	Brief the committee members and provide an opportunity for members to contribute	Environmental Systems	Inform, Consult, Involve	
Wave overtopping assessment workshop	Council staff, Coastal Management Plan Group and Coastal Zone Management Committee	February/ March 2021	Facilitated by consultant. Internal and external stakeholders and Coastal Zone Management Committee members invited.	Environmental Systems	Inform, Consult, Involve	
Attend Community Events	Community event attendees	December 2021 – February 2022	Assess face-to-face options	Communications, Environmental Systems	Inform, Consult and Involve	
Attend Coastal Zone Management Committee meetings	Coastal Zone Management Committee members	Bimonthly, commencing February 2021	Attend Committee meetings and provide an update on progress with the CMP	Environmental Systems	Inform, Consult and Involve	
Attend Youth Advisory Council (YAC) meeting	YAC members	June-October 2021	Provide an opportunity for YAC members to contribute to management options development	Environmental Systems	Inform, Consult and Involve	
Evaluation survey (online)	Identified stakeholders and CZM committee members	November 2021	Short online survey	Communications, Environmental Systems	Consult, Involve	

ENGAGEMENT STAGE 4
– Finalise, exhibit, adopt and certify the CMP
(November 2021 – June 2022)

Activity	*Stakeholders*	*Timeframe*	*Details*	*Responsibility*	*IAP2 Status*	*Status /comments*
Online						
Shape Lake Mac website	All stakeholders	December 2021 – January 2022	Shape Lake Mac project page to include: ■ discussion forum as main feedback mechanism ■ frequently Asked Questions ■ key dates ■ document library	Communications, Environmental Systems	Inform, Consult, Involve	
e-Newsletters: ■ Shape Lake Mac ■ Your City Online ■ Planning ■ Eco Advocate	Subscribers	December 2021	Share relevant updates and opportunities for consultation through eNewsletters	Communications	Inform	
Email notification	Identifies stakeholder email list	December 2021	Promote awareness of the project, what it is trying to achieve, how people can contribute and what information we are seeking to identified stakeholders on email.	Communications, Environmental Systems	Inform	
Social media posts via: ■ Facebook ■ Twitter ■ Instagram ■ LinkedIn	Followers	October 2021 – April 2022	Post regular updates on Council's social media platforms to keep the community informed and provide details of consultation opportunities	Communications	Inform	

ENGAGEMENT STAGE 4
– Finalise, exhibit, adopt and certify the CMP
(November 2021 – June 2022)

Activity	*Stakeholders*	*Timeframe*	*Details*	*Responsibility*	*IAP2 Status*	*Status /comments*
Media						
Media release	Media	December 2021	Issue media release promoting opportunity for community to share their feedback	Communications	Inform	
Other						
Councillor Briefing	External Coastal Management Plan Group and Coastal Zone Management Committee	February 2022	Presentation to Councillors	Environmental Systems	Inform, Consult, Involve	
Attend Community Events	Community event attendees	December 2021 – February 2022	Assess face-to-face options prior to October 2021	Communications, Environmental Systems	Inform, Consult and Involve	

APPENDIX 2 - HUNTER REGIONAL PLAN - 2036

ACTIONS RELATING TO CMP

Sustain water quality and security

15.4 Implement catchment-based plans for the ongoing sustainable management and health of estuaries.

15.5 Apply the neutral or beneficial water quality objectives to land use planning in surface and groundwater drinking water catchment areas to minimise the effects of development on waterways, including watercourses, wetlands, groundwater dependent ecosystems, riparian lands, estuaries, lakes, beaches and marine waters.

15.6 Reduce the risk of introduction or spread of aquatic pests and diseases from new development that may affect fisheries and aquaculture industry practices.

15.7 Incorporate water-sensitive design into development that is likely to have an adverse impact on coastal water catchments, water quality and flows.

Increase resilience to hazards and climate change

16.2 Review and consistently update floodplain risk and coastal zone management plans, particularly where urban growth is being investigated.

Enhance access to recreational facilities and connect open spaces

18.3 Enhance public access to natural areas, including coastal and lake foreshores.

18.4 Assist councils to develop open space and recreation strategies that identify a range of accessible open space and recreation opportunities; integrate open space, active transport and recreation networks; and improve public foreshore access.

18.5 Implement actions and invest in boating infrastructure priorities identified in regional boating plans to improve boating safety, boat storage and waterway access.

Identify and protect the region's heritage

19.1 Consult with the local Aboriginal communities to identify and protect heritage values to minimise the impact of urban growth and development, and to recognise their contribution to the character and landscape of the region.

APPENDIX 3 -
RISK ASSESSMENT

Table 1 – Risk assessment summary – environment, social and economic threats

	Threat	CURRENT RISK			FUTURE RISK 2040			FUTURE RISK 2070			FUTURE RISK 2120		
		Estuary	Coastline	Swansea Channel	Estuary	Coastline	Swansea Channel	Estuary	Coastline	Swansea Channel	Estuary	Coastline	Swansea Channel
		Risk L,M,H,E	Risk L,M,H,E	Risk L,M,H,E	Risk L,M,H,E	Risk L,M,H,E	Risk L,M,H,E	Risk L,M,H,E	Risk L,M,H,E	Risk L,M,H,E	Risk L,M,H,E	Risk L,M,H,E	Risk L,M,H,E
	ENVIRONMENT												
1	Ecosystem impacts from climate change and coastal hazards	Medium	Medium	High	High	*Extreme	High	Extreme	Extreme	Extreme	Extreme	Extreme	Extreme
2	Water quality impacts	High	Low	Low	High	Low	Low	High	Low	Low	High	Low	Low
3	Catchment vegetation modifications	High	Medium	Medium	High	Medium	Medium	High	High	Medium	High	High	Medium
4	Waterway modifications	High	Medium	High	High	Medium	High	High	Medium	High	High	High	High
	SOCIAL AND ECONOMIC									High	High		
5	Social and economic impacts from climate change and coastal hazards	High	High	Extreme	High	High	Extreme	High	High	Extreme	Extreme	High	Extreme
6	Water quality impacts	High	High	Medium	High	High	Medium	*High	High	Medium	High	High	Medium
7	Access to marine estate	Medium	Medium	Medium	High	*High	*High	High	High	High	High	High	*High
8	Governance	Medium	Medium	Medium	Medium	*Medium	*Medium	Medium	Medium	Medium	Medium	Medium	Medium

APPENDIX 4 - COASTAL ZONE MANAGEMENT PLAN (2015) – OVERVIEW OF MANAGEMENT ACTIONS

COASTLINE

* Lake Macquarie City Council
** Department of Planning, Industry and Environment

Management Action	*Responsibility/ Partners*	*Focus*	*Status*
Approach - Risk Assessment			
Conduct an audit of the foundations of all surf clubs, as well as the Redhead SLSC seawall when conditions allow	LMCC*	Catherine Hill Bay, Caves Beach, Blacksmiths and Redhead SLSCs	complete
Conduct further analysis of the interactions of lake sourced inundation, coastal recession and marine inundation from overtopping, to clarify likely constraints to land use and potential for retreat	LMCC	Whole coast, but priority for Swansea/ Blacksmiths and Pelican area	commenced
Conduct detailed cliff line stability study to confirm hazard and planning lines for headland areas	LMCC	Coastal headlands including Dudley, Redhead, Swansea and Caves Beach to Catherine Hill Bay	complete
Formalise cliff top lookouts, install safety fencing more formal stairs and rails on access tracks down the cliff or bluff to rock platform fishing sites, and also to provide emergency exit points for people on rock platforms in popular locations	LMCC	Redhead to Dudley, Swansea Heads, south of Caves Beach and south of Catherine Hill Bay	complete
Conduct a safety audit of Redhead, above the surf club and beach, to clarify the risk of rock fall risks to beach users	LMCC	Coastal cliffs, headlands and rocky sea borders	complete

COASTLINE

Management Action	*Responsibility/ Partners*	*Focus*	*Status*
Approach - Planning and development controls			
Use a 'coastal landuse zone' should it become available in the LEP standard template environment protection zoning (E2) or E3) for all public land along the Lake Macquarie coastline, as far landward as the extent of coastal recession Planning Line by 2100, plus a buffer. Wherever possible on coastal dunes, maintain a buffer, zoned environment protection (beyond 2100), to allow for ecological transition as dunes roll landward.	LMCC	Whole coast - public land	not commenced
Ensure planting provides a suitable mix of native species selected from the coastal planting guide and that are relevant to site conditions. Optimise natural assets by selecting plants that provide higher biodiversity value above low maintenance plants such as Lomandra and Casuarina species	LMCC	Whole coast – public land	complete
Incorporate preparation for coastal recession into local community adaptation plans developed with the community at Blacksmiths Beach, Redhead Beach and Catherine Hill Bay Beach	LMCC	All suburbs linked to beaches and likely to be affected by coastal process/risks	commenced/ ongoing
Regulate the prohibition of off-road vehicle driving on Lake Macquarie beaches and coastal headlands, other than in a specified section of Nine Mile Beach and where specifically approved by OEH	LMCC Belmont Wetlands State Park Trust Hunter Water Corporation DPIE** – Crown Lands Department	Whole coast	
Update Plan of Management for Swansea Heads Reserve to better manage the Aboriginal values of the reserve and tell the story of the Awabakal people	LMCC Bahtabah Local Aboriginal Land Council	Swansea Heads Reserve	not commenced
Review essential uses for frontal dunes and in consultation with Surf Clubs (and SLSA) determine agreed trigger points for commencing detailed planning for protecting or relocating surf club buildings	LMCC	All Surf Clubs	not commenced
Adopt a policy to encourage transfer of private land along the coast from MHW to the landward edge of the 2100 coastal hazard zone" plus a buffer) to public tenure, as opportunity arises. Investigate land swap options as necessary	LMCC DPIE – National Parks & Wildlife Service	All private land within coastal risk planning area	not commenced
Review and improve alignment of objectives of Plans of Management and other Plans (such as LEP and Master Plans) prepared by Council, (NB: DPIE Catchments & Lands Plans of Management can no longer override the LEP)	LMCC	Council managed coastal lands, Belmont Wetlands State Park, National Parks, Conservation areas and Nature Reserves	not commenced

Management Action	*Responsibility/ Partners*	*Focus*	*Status*
Approach - Onground works			
Conduct beach management works such as beach scraping to reshape dunes and increase dune volume/ recovery after storms if necessary	LMCC DPIE – Office of Environment & Heritage DPIE – Crown Lands Department	Blacksmiths Beach, Redhead Beach, Caves Beach, near Belmont WWTP & Golf Course	commenced/ ongoing
Re-instate city wide beach maintenance program and continue dune rehabilitation works. This includes dune fencing, access controls, invasive species control and replanting native colonising species. Provides stronger in house support and direction for Landcare volunteers	LMCC	Whole coastline	commenced/ ongoing
Focus on control of Bitou bush by eliminating new colonisation on dunes, headlands and around wetlands, as a priority. This may require revisiting 'cleaned up' sites to remove new seedlings	LMCC Belmont Wetlands State Park Hunter Water Corporation DPIE – Crown Lands Department Belmont Golf Course	Whole coast - public land	commenced/ ongoing
Protect little tern and pied oystercatcher breeding areas on beaches and dunes by seasonal exclusion of off-road vehicles and dogs	LMCC Bahtabah Aboriginal Land Council	Nine Mile Beach	commenced/ ongoing
Prepare a multi stakeholder strategy through the Coastal Managers working group to provide controlled and managed off road vehicle access to Nine Mile Beach. Identify locations for access ways, design safe and environmentally appropriate access structures. Close and rehabilitate other access ways, and formalise the main one(s)	LMCC Belmont Golf Club Belmont Wetlands State Park Trust Hunter Water Corporation	Nine Mile Beach	complete

COASTLINE

Management Action	*Responsibility/ Partners*	*Focus*	*Status*
Approach - Monitoring			
Establish a beach monitoring program, with cross section sites at each of the main recreational beaches. These sections would be monitored monthly to quarterly	LMCC	Catherine Hill Bay, Caves Beach, Blacksmiths Beach and Redhead Beach	complete
Support the use of remote sensing tools with targeted field survey of biodiversity and condition: themeda grasslands on headlands; coastal wetlands; and a selection of barrier beach and pocket beach locations	LMCC DPIE – Office of Environment and Heritage	Whole coast - public land	commenced/ ongoing
Encourage further research on the behaviour of coastal dunes in pocket and long barrier coastal sediment compartments, as climate changes and sea level rises. Incorporate the results of these studies into future revisions of coastal risk and ecological resilience management	LMCC DPIE – Office of Environment and Heritage University of Newcastle	Whole coast	commenced/ ongoing
Approach - Engagement			
Involve off-road vehicle users in Clean Up Australia events in the BWSP and along Nine Mile Beach, similar to the Stockton Bight Clean Up Day	LMCC	Whole coast	commenced/ ongoing
Conduct awareness raising activities for bag limits for the collection of rock platform species and enforce bag limits	LMCC DPIE - Fisheries	Swansea Heads, Redhead to Dudley rock platforms	not commenced
Review membership of the Aquatic Services Committee. Expand agenda to include environmental considerations	LMCC	Committee	complete
Investigate the potential for Surf Life Saving Clubs to be involved in coastal rehabilitation activities during the off-season	LMCC Hunter Surf Lifesaving Association	Patrolled beaches	not commenced
Promote the economic opportunities that the coast brings to the city, such as national surf carnivals, conferences etc. Additional information on the economic value of the coast will also inform decisions about priorities for investment in coastal recreational spaces and land management	LMCC	Marketing	commenced
Update and enhance Council's web site with information about coastal processes and hazards, management approach and achievements. Provide more information about coastal values and activities	LMCC	Coastal hazards	commenced/ ongoing
Confirm coastal zone monitoring program relevant to natural resource management targets. Establish systems and train staff and community monitoring personnel	LMCC Hunter Water Corporation Belmont Golf Club Belmont Wetlands State Park Trust community (Citizen Science programs)	Personnel	commenced/ ongoing

COASTAL ZONE

Management Action	*Responsibility/ Partners*	*Focus*	*Status*
Approach - Planning and development controls			
Use clauses in the LEP and other planning instruments to link new development types to coastal risk planning zones, based on lifespan and sensitivity of the development	LMCC*	all areas within 2100 coastal risk planning areas	not commenced
Investigate use of DCP clauses to establish trigger-based consents for new development in coastal risk planning areas	LMCC	all areas within 2100 coastal risk planning areas	not commenced
Investigate, document and utilise all relevant and cost-effective external funding avenues, to facilitate implementation	LMCC	whole coastal zone	commenced/ ongoing
Approach - Monitoring			
Establish monitoring programs (monitoring framework) to track the condition of the coast and the outcomes of management actions	LMCC, community DPIE** – Office of Environment & Heritage Local Land Services	whole coastal zone	
Participate in a regional scale coastal zone monitoring program, using LiDAR and other high-resolution spatial data	LMCC DPIE – Office of Environment & Heritage	whole coastal zone	complete
Establish monitoring programs (Monitoring Framework) to track the condition of the coast and the outcomes of management actions	LMCC Community DPIE – Office of Environment & Heritage Local Land Services	whole coastal zone	commenced/ ongoing
Approach - Engagement			
Conduct coast information and action days with local communities, to include beach monitoring, ecological monitoring and presentations on adaptive management of coastal risks	LMCC	whole coastal zone	ongoing
Develop signage to inform the community about coastal processes and coastal change	LMCC	whole coastal zone	complete
Review the membership of the Estuary and Coastline Management committee and reform as a Coastal Zone Management Committee, with representatives of key stakeholder groups for both the estuary and open coast. To ensure the membership is more representative of open coastal stakeholders as well as the lake. Expand agenda to include environmental considerations	LMCC Stakeholder partners	Committee	complete
Review membership of the Aquatic Services Committee Expand agenda to include environmental considerations	LMCC Stakeholder partners	Committee	complete

ESTUARY

Management Action	*Responsibility/ Partners*	*Focus*	*Status*
Approach - Risk assessment			
Identify actively eroding creek bank sites on public land	LMCC* Central Coast Council Local Land Services DPIE** – Office of Environment and Heritage	Whole catchment	commenced
Approach - Planning and development controls			
Prepare flood risk management studies and plans to enhance understanding of risks and provide for consistent management of floodplains in the Lake Macquarie catchment	LMCC DPIE - Crown Lands Department DPIE – Office of Environment & Heritage NSW Office of Water	Major estuarine Creeks	commenced/ ongoing
Develop a Foreshore Development Guideline that includes integration of environmentally friendly foreshore stabilisation techniques	LMCC Central Coast Council	DCP Guidelines	commenced
Review Council's creek bank stabilisation guidelines and incorporate recommendations relating to predicted climate change impacts	LMCC	DCP Guidelines	complete
Continue compliance activities relating to erosion and sediment controls	LMCC Central Coast Council Environment Protection Authority	Greenfield development sites; development sites in close proximity to the lake and tributaries	commenced/ ongoing
Apply WSUD to all new developments to ensure treatment of 50-80% of stormwater from each subcatchment in new subdivisions	LMCC DPIE – Office of Environment & Heritage (OEH)	Generation of hotspots within urban sub-catchments	commenced/ ongoing
Review and apply Council's DCP controls and Water Cycle Management Guidelines for all new development	LMCC Central Coast Council	Whole catchment	not commenced
Develop a riparian guideline that outlines development requirements and restoration solutions	DPIE Infrastructure providers NSW Office of Water Land development industry	Whole catchment	complete

Management Action	*Responsibility/Partners*	*Focus*	*Status*
Approach - Planning and development controls			
Develop a foreshore development guideline that includes low impact methods for recreational structures and foreshore stabilisation treatments	LMCC DPIE – Crown Lands Dept DPIE - NSW Fisheries DPIE – Office of Environment & Heritage	Development Control Plan; Absolute waterfront private property	commenced
Review DCP guidelines on best practice jetty designs suitable for installation in Lake Macquarie. Update as necessary to meet ecological and recreational objectives	LMCC DPIE – Crown Lands Dept DPIE - NSW Fisheries DPIE – Office of Environment & Heritage	DCP	commenced
Prioritise estuarine and floodplain wetland areas for protection and management	LMCC DPIE – Crown Lands Dept DPIE - NSW Fisheries DPIE – Office of Environment & Heritage	Areas sensitive to climate change impacts	complete
Prepare management guidelines for *Posidonia* in Lake Macquarie, consistent with the types of information that Council provides on other threatened species	LMCC DPIE - NSW Fisheries	DCP	not commenced
Investigate the feasibility of a catchment-based project to improve water quality and ecological condition in LT Creek and Fennell Bay	LMCC	LT Creek and Fennell Bay	not commenced
Identify and prioritise wetlands (all types of estuary wetlands) where protected buffer areas can be established to facilitate retreat	LMCC DPIE – Office of Environment & Heritage	Land zoning and identification of rehabilitation works sites	complete
Update the Mooring Management Plan for Lake Macquarie	LMCC RMS DPIE - Fisheries DPIE – Crown Lands Dept Yacht clubs and boat owners	Mooring areas over seagrass beds	commenced
Prepare public wharf, jetty and boat ramp strategies for Lake Macquarie	LMCC RMS Transport NSW	Long term recreational use	complete
Develop an integrated coastal zone management implementation strategy and funding plan for the open coast and estuarine parts of the Lake Macquarie coastal zone	LMCC DPIE – Office of Environment & Heritage	Funding plan	commenced/ ongoing
Investigate and utilise all relevant and cost-effective external funding avenues, to facilitate implementation	LMCC State and Federal Government agencies	Grant identification	commenced/ ongoing

ESTUARY

Management Action	*Responsibility/Partners*	*Focus*	*Status*
Approach - Planning and development controls			
Allocate resources to carefully monitor opportunities under all grant programs and to ensure grant applications are best positioned to deliver funding for CZMP projects	LMCC	Grant funding	commenced/ ongoing
Approach - On-ground works			
Continue Council's foreshore stabilisation program	LMCC DPIE – Office of Environment & Heritage DPIE - Crown Lands Dept	Priority sites displaying active erosion; Previously rehabilitated sites requiring maintenance	commenced/ ongoing
Continue Council's foreshore stabilisation program	LMCC DPIE - Crown Lands Department DPIE – Office of Environment & Heritage NSW Office of Water	Tributaries in catchments with highly erodible soils; priority sites displaying active erosion	commenced/ ongoing
Monitor vegetated SQID performance in relation to maintenance practice	LMCC DPIE – Office of Environment & Heritage	Whole catchment	commenced/ ongoing
Continue to implement the current riparian corridor rehabilitation program	LMCC DPIE -Office of Environment & Heritage NSW Office of Water	Priority estuarine creek systems such as LT Creek, Mannering Creek, and Wyee Creek	commenced/ ongoing
Retrofit existing stormwater quality improvement devices.	LMCC	Whole catchment	commenced/ ongoing
Install and maintain WSUD devices to reduce sediment and nutrient load	LMCC	Whole catchment	commenced/ ongoing
Introduce dinghy storage racks as a trial at selected high profile/high risk locations (e.g. Valentine, Marmong Point). Publicise and report on the trial	LMCC RMS Transport NSW	Public foreshores adjoining mooring areas	commenced

Management Action	*Responsibility/Partners*	*Focus*	*Status*
Approach - Monitoring			
Conduct a condition assessment of existing lake foreshore erosion treatment sites (on public land) to determine their current condition and performance	LMCC DPIE – Office of Environment & Heritage Trade and Investment DPIE - Crown Lands	Public foreshores subject to high wave energy, primarily southern facing shorelines	commenced
Review a sample of creek bank stabilisation works undertaken by Council to identify any potential design improvements required for future works	LMCC DPIE – Office Environment & Heritage Crown Lands Dept NSW Office of Water	Sites previously subject to rehabilitation works	commenced
Continue sea grass mapping and health monitoring, and investigate partnership opportunities with other organisations required to monitor seagrass	LMCC Central Coast Council DPIE Fisheries Licensed industry, power stations and coal mines	Partnerships; Consistent monitoring methodology	commenced/ ongoing
Continue the lake health monitoring program (water quality and ecological indicators), consistent with NSW State- wide MER (Monitoring, Evaluation and Review) program	LMCC DPIE – Office of Environment & Heritage EPA DPIE - Fisheries	Ongoing data collection at existing monitoring sites	commenced/ ongoing
Continue to report on boat usage statistics for Lake Macquarie, including vessel size, numbers and locations of swing moorings, numbers of vessels berthed in marinas, and any incidents associated with mooring location, function or interaction with jetties	RMS Yacht clubs and Boat Owners Association Marina operators	Data collection	commenced
Implement a comprehensive estuary health and community use monitoring program, consistent with the NSW State-wide MER strategy but also tailored to provide appropriate management information for LMCC and its community. Report results annually	LMCC All agencies having responsibilities under this plan	Monitoring; Community engagement; audit	commenced/ ongoing
Conduct an annual review audit of actions implemented from the estuary CZMP to inform progress and facilitate adjustments as necessary	LMCC OEH Hunter Water Corporation (HWC) Centennial Coal Origin Energy Community (Citizen Science programs)	Monitoring; Adaptive management	commenced/ ongoing

ESTUARY

Management Action	*Responsibility/Partners*	*Focus*	*Status*
Approach - Engagement			
Establish a mooring working group, to make recommendations on reducing mooring impacts on sensitive seagrass beds	LMCC RMS Local Land Services Central Coast Council DPIE - OEH DPIE - Fisheries Boat Owners Association and Yacht Clubs	Moorings over *Posidonia australis* beds	complete
Hold a forum to discuss options for boat moorings in Lake Macquarie to minimise impacts on sensitive sea grass beds and to provide practical designs	LMCC RMS	Moorings over *Posidonia australis* beds; Mooring areas subject to high wave energy or currents	complete
Continue education programs for construction industry and residential property owners to promote best practice stormwater management	LMCC EPA	Catchment-wide	commenced/ ongoing
Establish an inter-council working group to provide consistent policy and strategy around access infrastructure for Lake Macquarie	LMCC Central Coast Council DPIE – Crown Lands Dept	Lake-wide	commenced
Continue adaptation conversations and planning with affected communities	LMCC DPIE - OEH Local residents and businesses Utility providers such as HWC, Ausgrid, Jemena, Transgrid Transport NSW	Urban areas most affected by sea level rise	commenced/ ongoing
Regularly use electronic surveys and feedback opportunities on lake management issues, via Council's web site	LMCC	Community consultation	commenced/ ongoing

Management Action	*Responsibility/Partners*	*Focus*	*Status*
Approach - Partnerships			
Maintain close liaison with State and Commonwealth agencies about Lake Macquarie issues and initiatives, to lay groundwork for investment in innovative management, planning, monitoring and reporting processes	LMCC DPIE - OEH EPA RMS DPIE - Fisheries Transport NSW	Partnerships	commenced/ ongoing
Advocate for a NSW Container Deposit System	LMCC	Advocacy	complete
Request Lake Macquarie participation in DPIE trials to reduce fishing impacts on turtles	LMCC DPIE- Fisheries	Partnerships	complete
Collaborate with University of Newcastle and other tertiary institutions to bring new research results into the community	LMCC University of Newcastle Tertiary Institutions	Community engagement; research opportunities	commenced/ ongoing
Use local media to promote estuary management activities or works	LMCC DPIE - OEH RMS EPA	Community engagement	commenced/ ongoing

SWANSEA CHANNEL

Management Action	*Responsibility/ Partners*	*Focus*	*Status*
Approach - Risk assessment			
Maintain the entrance breakwaters in accordance with defined asset management framework to provide for continued navigability, recreational use and public safety. Conduct a detailed risk assessment of the breakwaters at the entrance to Lake Macquarie. Maintain the entrance training walls to continue functionality and strengthening in the context of sea level rise and climate change.	LMCC DPIE – Crown Lands Dept (CLD)	Northern and southern breakwaters of Swansea Channel	commenced/ ongoing
Conduct audit (dilapidation survey) of existing structures and revetments to determine their ownership, current condition, effectiveness, expected functional life, and future potential to mitigate storm erosion and wave overtopping under higher sea levels. The audit should be used to guide subsequent decisions, including future replacement/retrofit or "manage to fail" (planned retreat) options	LMCC DPIE – Crown Lands Dept	Swansea Channel, revetments	commenced/ ongoing
Implement new infrastructure design process that addresses both existing and future hazards. Development of a holistic long-term strategy for the assets located in the channel.	LMCC DPIE – Crown Lands Dept	Swansea Channel, western revetment, upstream from bridge to Wallarah Street (approx. length is 1650 metres)	not commenced
Work with affected communities, infrastructure providers, and other stakeholders to develop Local Adaptation Plans (LAPs) to identify strategic pathways for adaptation to changing levels of hazard and risk as a result of rising sea levels. LAPs will include many of the management options recommended elsewhere in the Plan, but will apply them to the specific conditions of each locality, and link them into an integrated plan	LMCC	Blacksmiths Pelican Marks Point Swansea	commenced/ ongoing
Re-run risk assessment based monitoring results and revise management response if risk level changes (i.e. increase or decrease in level of risk).	LMCC	Part C Study Area	not commenced
Develop a tsunami emergency response plan for evacuation of susceptible areas within Swansea and Blacksmiths and implement plan as triggered by advice from Bureau of Meteorology and Pacific Tsunami Warning Centre	LMCC State Emergency Service	Swansea Blacksmiths	commenced/ ongoing

Management Action	*Responsibility/Partners*	*Focus*	*Status*
Approach - Planning and development controls			
Investigate and prepare new design criteria to account for changing channel conditions (notably depths). Progress implementation of the *"Towards a Sustainable Framework for Navigation in Swansea Channel"* Such design criteria would be required for any new revetments or upgrades to existing foreshore protection structures which are likely to be required to mitigate against existing and future coastal hazards, particularly rising sea levels.	LMCC	Swansea – lakeside land behind Swansea revetment foreshore. Land behind Pelican foreshore. Blacksmiths – behind northern revetment.	not commenced
Review development controls to address extreme storm flooding and increased tidal lake levels in these areas. Review and update Councils existing flood policy as required. The controls should be applicable to the type of development (e.g. high density residential, alterations/additions, public facilities) and level of risk (extreme, high, medium, low)	LMCC	Blacksmiths, Marks Point, Pelican, Swansea	commenced/ ongoing
Progress with existing asset management planning and the incorporation of revised design requirements for any new infrastructure. Work with infrastructure providers and owners to ensure existing infrastructure continues to function and provide services safely and for as long as practical	LMCC Hunter Water Jemena Telstra Ausgrid	Swansea Channel foreshore and adjoining suburbs	commenced
Use planning controls and design guidelines to minimise the use of foreshore structures that restrict ecological transition. Planning controls would seek to remove existing barriers to wetland migration wherever possible, and provide clear guidance to waterfront land owners and managers about how to design and install waterfront structures so that ecological impacts are minimised	LMCC	Foreshore areas	not commenced
Update internal checklists, procedures, guidelines and policies to facilitate the consideration of coastal hazard zones. and timeframes by Council in the preparation or revision of: • Community & Crown Land Plans of Management • Masterplans • Review of Environmental Factors (REF) for works not requiring development consent • Planning new infrastructure and conducting strategic planning (e.g. designing new road networks, sewer networks etc) (i.e. prior to preparation of development applications), and • Any other works not requiring development consent or assessment	LMCC DPIE – Crown Lands Dept DPIE – Planning Dept	Foreshore and coastal areas	commenced/ ongoing
Investigate and implement strategic planning to prevent and remove barriers to the planned retreat of low-lying public lands. Investigate and implement strategic planning to allow for the future (>50years) planned retreat of low-lying private lands if other measures such as foreshore protection and development controls prove insufficient to manage the increased risk	LMCC	Swansea – lake side. Land behind Swansea revetment foreshore. Land behind Pelican foreshore. Blacksmiths – behind northern revetment.	not commenced

SWANSEA CHANNEL

Management Action	*Responsibility/ Partners*	*Focus*	*Status*
Approach - On-ground works			
Construct/retrofit new revetment for segment of foreshore following detailed design and development approval	LMCC DPIE – Crown Lands Dept	Swansea Channel, western revetment, upstream from bridge to Wallarah Street (approx. length is 1650 metres)	not commenced
Investigate options to manage existing and future hazards. Retrofit may involve just 'topping up' groyne structure providing top width is sufficient to accommodate additional material	LMCC DPIE – Crown Lands Dept	Pelican foreshore 1 – reserve south from Soldiers Road (approx. length 300 metres)	commenced
Consider measures such as tidal flaps on drains to manage increasing tidal inundation of low-lying areas exposed to ocean tides	LMCC	Swansea urban area Black Neds Bay Blacksmiths behind northern revetment	commenced
Implement dredging and sand placement in accordance with the Sustainable Framework for Navigation in Swansea Channel. Smaller episodes of navigational dredging may be required at other locations, such as the entrances to Swan Bay or Black Neds Bay, which could supply sand for local nourishment	LMCC DPIE – Crown Lands Dept	Salts Bay Black Neds Bay foreshore Pelican foreshore Sand islands	not commenced
Maintain a sufficient amount of sand on the Salts Bay foreshore between the groynes. This would involve placement of additional sand (i.e. nourishment), on a one-off basis to rebuild a frontal dune along Salts Bay as the foreshore slowly erodes. Any sand placement areas should be planted with Spinifex runners to help stabilise the sand dune.	LMCC DPIE – Crown Lands Dept	Salts Bay	not commenced
Undertake beach scraping, re-contouring, sand transfer, and dune revegetation to increase sand volumes and height of frontal dunes	LMCC DPIE – Crown Lands Dept	Salts Bay Black Neds Bay barrier dunes	not commenced
Work with existing or establish a formal dune care program, to undertake dune rehabilitation in priority locations, which shall also incorporate weed and pest management. Note: This action would complement beach nourishment episodes to reduce loss of sand by wind. The dune care programs should be accompanied by community education regarding the role of dunes and dune vegetation to provide a buffer to storms, in addition to ecological benefits. Dune rehabilitation also helps manage sand drift.	LMCC DPIE – Crown Lands Dept	Salts Bay Black Neds Bay barrier dunes Sand islands Pelican wetland	commenced/ ongoing

Management Action	*Responsibility/ Partners*	*Focus*	*Status*
Approach - On-ground works			
Investigate long term options for managing the risk of sea level rise to the transformation of existing estuarine wetlands at Black Neds Bay and Pelican. Planned retreat is likely to be the only practical option available if future inundation hazards are realised. The effect of long-term wetland retreat on surrounding settlements will need to be investigated and the risks managed. The investigation shall include consultation with the various asset owners affected by the option. Wetland management should focus on allowing for migration of habitats up-slope wherever possible, although this will be constrained by surrounding settlements	LMCC DPIE – Crown Lands Dept	Black Neds Bay wetland, Pelican wetland, Coon Island wetland	commenced
Undertake pilot projects for re-establishing estuarine wetland communities, such as saltmarsh and seagrass, which will be affected by higher lake levels. This action will provide knowledge for application later as the need becomes more urgent	LMCC	Within relevant sections of Swansea Channel such as Black Neds Bay wetland, Pelican wetland and Coon Island wetland	commenced/ ongoing
Restore the recreational amenity of Grannies Pool by removing accumulated sand build-up. Sand could be removed using land-based equipment and transported to nearby Blacksmiths Beach for beach nourishment or similar. As part of this action, upgrade and improve maintenance of existing access and public facilities and adjacent reserve areas to improve aesthetics and provide a safe swimming enclosure.	LMCC DPIE – Crown Lands Dept	Granny's Pool Swansea Channel northern breakwater and adjacent reserve areas	complete

SWANSEA CHANNEL

Management Action	*Responsibility/ Partners*	*Focus*	*Status*
Approach - Monitoring			
Investigate triggers for the replacement/retrofit of the western revetment. This would be reliant on the outcomes of the condition assessment and the value of land and assets in proximity to the revetment.	LMCC DPIE – Crown Lands Dept	Swansea Channel, western revetment, upstream from bridge to Wallarah Street (approx. length is 1650 metres)	not commenced
Monitor wetlands to evaluate the performance of protection activities and/or pilot projects for re-establishing estuarine wetland communities. Wetland monitoring, evaluation and reporting should include both desktop and field-based investigations to: • assess vegetation condition and change; • inundation depth and extent; and • wetland health using macroinvertebrate indices	LMCC	Black Neds Bay wetland Pelican wetland Coon Island wetland	not commenced
Survey the beach in cross section at regular profiles along the beach. Survey profiles should be established at 50 to 100 metre intervals along the beach. Preferably, the beach profiles should align with any existing photogrammetric profiles at the beaches, to enable the new data to be assessed in context with the historical data. Where considered useful, install a marker (e.g. stake with signage in the dunes seaward of a significant beach position / assets), as a community education tool to illustrate the natural fluctuations in beach position with storms, and potential recession in the future with sea level rise. The monitoring program and installation of markers / sighting poles could investigate the use of assistance from local dune care groups (e.g. as a pilot program, utilising basic survey techniques such as the Emery method)	LMCC	Salts Bay Black Neds Bay barrier dunes Sand islands	commenced/ ongoing
Collect or otherwise obtain bathymetric hydrosurvey (or equivalent survey) data for Swansea Channel and process the data to identify significant changes to channel bathymetry (particularly scour holes) at the toe of foreshore revetment and groynes. Data should be used to inform the preparation of asset condition assessments and assisting with new infrastructure design related actions	LMCC DPIE - OEH/ CLD	Swansea Channel	commenced/ ongoing
Monitor frequency, depth and spatial extents of storm inundation, tidal inundation and lake flooding events. Monitor and analyse data from tidal gauges to assess local trends in sea and lake levels	LMCC DPIE - OEH	Part C Study Area	commenced/ ongoing
Monitor condition of foreshore assets including revetments, footpaths and groynes. This would involve undertaking an initial conditions assessment to establish baseline conditions for subsequent monitoring and for assisting with retrofitting/ replacement actions. Undertake annual monitoring and reporting of asset condition to identify those assets that require immediate attention	LMCC DPIE – Crown Lands Dept	Swansea Channel, western revetment upstream of bridge, Pelican foreshore, northern revetment downstream of bridge	commenced/ ongoing

Management Action	*Responsibility/ Partners*	*Focus*	*Status*
Approach - Engagement			
Conduct community engagement programs focusing on Swansea Channel and coastal processes	LMCC	Community engagement	commenced/ ongoing
Consult with Awabakal traditional owners and other relevant aboriginal groups when undertaking works or engagement activities relating to the indigenous heritage of Swansea Channel	LMCC Traditional owners groups Bahtabah Local Aboriginal Land Council	Community engagement	commenced/ ongoing
Approach - Partnerships			
The ownership and responsibility for most assets in the Channel or along the foreshore falls to either Crown Lands or LMCC. However, ownership of and responsibility for some assets in Swansea Channel is uncertain and requires clarification. Crown Lands and LMCC are in the process of clarifying and formalising ownership of and responsibility for public assets in Swansea Channel if it is in doubt, especially protective works such as revetments and groynes. LMCC and Crown Lands should agree on a process to ensure ownership and responsibility of new structures is formally recorded at the time of construction, and this is reflected in the respective assets registers of the two organisations	DPIE – Crown Lands Dept	Specifically foreshore revetments, and groynes located along the eastern and western banks of Swansea Channel upstream of Swansea Bridge	commenced/ ongoing
Establish a protocol with Crown Lands about how and when sand dredged from Swansea Channel to maintain navigation could be used for beach nourishment and placed for future use for beach protection works at Salts Bay or elsewhere as required. Sand could be stored in dunes constructed landward of the existing frontal dune system	LMCC DPIE – Crown Lands Dept	Swansea Navigation Channel Salts Bay	not commenced

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APPENDIX 3 - COMMUNICATIONS AND ENGAGEMENT PLAN

1. ABOUT THE PROJECT

1.1 Project background

In 2015, Council adopted a Coastal Zone Management Plan (CZMP) The CZMP comprised four parts: Coastline; Estuary; Swansea Channel; and a four-year action plan. This CZMP will be superceded by a Coastal Management Program (CMP) from December 2021. The CMP is an updated version of the CZMP, including requirements from the NSW Government – Department of Planning, Industry and Environment.

"The purpose of a coastal management program is to set the long-term strategy for the co-ordinated management of land within the coastal zone with a focus on achieving the objectives of this *[Coastal Management] Act [2016].*"

The scope of the CMP aims to cover local issues, challenges and opportunities in coastal management ranging from immediate, 20 years, 50 years to 100 years and beyond, as relevant. The first engagement activities of the project are during Stage 1 – the scoping study. This stage evaluates the previous CZMP plan and outcomes of the action plan to ensure the issues, challenges, opportunities and actions are still applicable and will focus on identifying any gaps for meeting the new requirements of the CMP.

The entire CMP project has five stages:

STAGE 1
Identify the scope of CMP (current project)

STAGE 2
determine risks, vulnerabilities and opportunities

STAGE 3
Identify and evaluate options

STAGE 4
Prepare, exhibit, finalise, certify and adopt the CMP

STAGE 5
Implement, monitor, evaluate and report

The project will run for approximately two years.

Information gathered during the scoping study will not only achieve Stage 1 of the Program but also provide key information to guide preparation of Stages 2 and 3.

Stage 1 includes the following milestones:

- Prepare a Stakeholder Engagement Strategy
- Identify data gaps
- Prepare a scoping study.

We are committed to providing best practice engagement based on our principles of engagement and guided by the International Association of Public Participation (IAP2). As this project moves through the different stages, we will utilise the IAP2 spectrum to guide how we engage with the community and key stakeholders.

Evaluation and review will be conducted by survey to stakeholders at the conclusion of Stages 2 and 3.

1.2 Communication objectives

- To raise public awareness about the project and the importance of coastal and waterway management.
- To interest and encourage community and industry members to participate in engagement opportunities for greater stakeholder involvement in the project.
- To increase understanding of the CZMP and the new requirements of the CMP.
- To encourage community feedback/response to assist in identifying key data gaps, new issues or challenges, and new opportunities for coastal management options, and to evaluate the relevance of existing CZMP issues and actions.

CONSULTATION ON THE COASTAL MANAGEMENT PROGRAM

Statutory provisions

16 Consultation

(1) Before sdopting a coastal management program, a local council must consult on the draft program with:

(a) the community, and

(b) if the local council's local government area contains:

(i) land within the coastal vulnerability area, any local council whose local government area contains land within the same coastal sediment compartment (as specified in Schedule 1), and

(ii) an estuary that is within 2 or more local government areas (as specified in Schedule 1), the other local councils, and

c) other public authorities if the coastal management program:

(i) proposes actions or activities to be carried out by that public authority, or

(ii) proposes specific emergency actions or activities to be carried out by a public authority under the coastal zone emergency action subplan, or

(iii) relates to, affects or impacts on any land or assets owned or managed by that public authority.

(2) Consultation under this section is to be undertaken in accordance with the relevant provisions of the coastal management manual

(3) A failure to comply with this section does not invalidate a coastal management program.

(4) The regulations may amend Schedule 1.

Mandatory requirements

15. A draft CMP must be exhibited for public inspection at the main offices of councils of all local government areas within the area to which the CMP applies, during the ordinary hours of those offices, for a period of not less than 28 calendar days before it is adopted. This mandatory requirement does not prevent community consultation, or other consultation, in other ways.

1.3 Project timeline

Date	*Details*
December 2019 – September 2020	**Stage 1** - Awareness raising and gaps analysis
December 2020 – May 2021	**Stage 2** - studies and information for identified gaps
April – October 2021	**Stage 3** – prepare the CMP, develop management actions
November 2021- July 2022	**Stage 4** – Exhibition and adoption of the CMP

2. STAKEHOLDER AND ISSUES IDENTIFICATION

Stakeholders for the project can be categorised into the following groups:

COUNCIL

STAKEHOLDER CATEGORY	INDIVIDUAL/ORGANISATION
Mayor	Kay Fraser
Councillors	
East Ward	Adam Shultz (ALP), Nick Jones (LIB), Christine Buckley (ALP), John Gilbert (LMIND)
West Ward	David Belcher (ALP), Jason Pauling (LIB), Wendy Harrison (IND), Luke Cubis (LMIND)
North Ward	Brian Adamthwaite (ALP), Kevin Barker (LIB), Barney Langford (ALP), Colin Grigg (LMIND)
Council staff	Executive, Environmental Systems, Assets, Integrated Planning, Communications, Development Assessment and Compliance and Community Partnerships.

STATE AND FEDERAL MEMBERS

STAKEHOLDER CATEGORY	INDIVIDUAL/ORGANISATION
Member for Charlestown	Ms Jodie Harrison MP
Member for Shortland	Mr Pat Conroy MP
Member for Cessnock	Mr Clayton Barr MP
Member for Lake Macquarie	Mr Greg Piper MP
Member for Swansea	Ms Yasmin Catley MP
Member for Wallsend	Ms Sonia Hornery MP
Member for Hunter	Mr Joel Fitzgibbon MP
Member for Newcastle	Ms Sharon Claydon MP

INDUSTRY, COMMUNITY AND LOCAL GOVERNMENT

Refer to stakeholder spreadsheet D09532304

MEDIA

STAKEHOLDER CATEGORY	INDIVIDUAL/ORGANISATION
TV	NBN (Newcastle office)
Radio	Triple M Newcastle/Hit1069, 2NURFM, ABC (1233 Newcastle), NEWFM/2HD
Print	Newcastle Herald, Newcastle Weekly

ONLINE

STAKEHOLDER CATEGORY	INDIVIDUAL/ORGANISATION
Facebook	@lakemaccity
Twitter	@lakemac
Blogs/websites	lakemac.com.au
Instagram	@ourlakemac
LinkedIn	

2. STAKEHOLDER AND ISSUES IDENTIFICATION

2.1 Key issues and responses

Stakeholders' key issues of concern for the project are outlined below, along with strategic communications responses and actions.

Stakeholder issue	*Stakeholder*	*Risk*	*Response/mitigation*
Surf amenity	Bring Blacksmiths Back	High	Surf assessment project underway (UNSW). Possible development of surf amenity plan. Moderation of workshop discussions to ensure balanced input.

3. FAQS

The agreed key messages for this project are:

- Coastal management involves the integrated management of the coastal environment, consistent with the principles of ecologically sustainable development, for the social, cultural and economic wellbeing of the community. Coastal legislation and policy in NSW has changed, with significant reforms over the last five years. The CMP will outline priorities and actions that will see community and government working together to achieve the best outcomes for a healthy coastline, estuary and channel.
- The health of the Lake is integral to the City's identity and prosperity. Whilst lake health has been improving over the last 20 years, it is important to maintain this focus, as it could quickly deteriorate if not considered a priority
- Balancing the desire for recreational use of waterways and foreshores with the need to protect these landscapes is a key consideration in the development of the CMP.
- 30km open ocean coastline, from Glenrock Lagoon to Moonee Beach.
- The coast is used for so many enjoyable activities, such as swimming surfing, beach walking, diving, snorkelling and wildlife watching, it's worth protecting.
- Many more people now live in our region – so more demand on coastal resources. Community recreation preferences are changing.
- Climate change has significant consequences for coastal asset management. New climate change projections based on quality science are available.

By collaborating with the community to review the CZMP we can identify new opportunities for coastal management and improve the health of our lake, waterways and coastline while maintaining community access and recreation in these areas.

4. COMMUNICATION ACTIVITIES ACTION PLAN SUMMARY

ENGAGEMENT STAGE 1
– Awareness raising and scoping study preparation (gaps and risks) (16 December 2019 – 30 September 2020)

Activity	*Stakeholders*	*Timeframe*	*Details*	*Responsibility*	*IAP2 Status*	*Status /comments*
Online						
Shape Lake Mac website	All stakeholders	January 2020	Shape Lake Mac project page to include: ■ discussion forum as main feedback mechanism ■ frequently Asked Questions ■ key dates ■ document library	Communications, Environmental Systems	Inform, Consult, Involve	complete
e-Newsletters: ■ Shape Lake Mac ■ Your City Online ■ Planning ■ Eco Advocate	Subscribers	February 2020	Share relevant updates and opportunities for consultation through eNewsletters	Communications, Environmental Systems	Inform	complete
Email notification	Identifies stakeholder email list	January 2020	Promote awareness of the project, what it is trying to achieve, how people can contribute and what information we are seeking to identified stakeholders on email.	Communications	Inform	complete
Social media posts via: ■ Facebook ■ Twitter ■ Instagram ■ LinkedIn	Followers	February 2020	Post regular updates on Council's social media platforms to keep the community informed and provide details of consultation opportunities	Communications	Inform	complete
Print						
Footpath stickers	Beach goers/lake users	January 2020	Place the footpath stickers at the four beach locations and at key locations around the lake. Promote awareness of the project and encourage use of the SLM site.	Communications	Inform	complete

Activity	*Stakeholders*	*Timeframe*	*Details*	*Responsibility*	*IAP2 Status*	*Status /comments*
Media						
Media release	Media	February 2020	Issue media release promoting opportunity for community to share their feedback	Communications	Inform	complete
Other						
Attend Community Events	Community event attendees	20 February 7,8 March	Toronto Markets Surfest, Newcastle Beach	Communications, Environmental Systems	Inform, Consult and Involve	complete
Portfolio Committees, as appropriate	Councils and key staff	Reconsider for later stage when CMP going to Council	Brief the committee members and provide an opportunity for members to contribute to the scoping study.	Environmental Systems	Inform, Consult and Involve	No further action for Stage 1
Attend Coastal Zone Management Committee meetings	Coastal Zone Management Committee members	Next meeting date: 6 February 2020	Attend Committee meetings and provide an update on progress with the CMP	Environmental Systems	Inform, Consult and Involve	
Attend Youth Advisory Council (YAC) meeting	YAC members	Next Meeting date: 12 February. Endless Summer Youth Event (23 Feb)	Attend YAC meeting and promote awareness of the project. Record discussion and any outcomes/ actions. Encourage participation through SLM and sharing on YAC social media channels, discuss ways to engage young people.	Environmental Systems	Inform, Consult and Involve	complete
Internal briefing	Identified internal stakeholders	TBC	Hold a meeting to brief identified internal stakeholders about the project. Share information and work through the project aims, stages and timeframes. Highlight opportunities for their participation and why it is important.	Environmental Systems	Inform, Consult and Involve	complete

ENGAGEMENT STAGE 1
– Awareness raising and scoping study preparation (gaps and risks) (16 December 2019 – 30 September 2020)

Activity	*Stakeholders*	*Timeframe*	*Details*	*Responsibility*	*IAP2 Status*	*Status /comments*
Other						
Focus group	Selected groups of industry and community members	June 2020	Conduct a short online forum to analyse any gaps between the CZMP and CMP and to review the risk ratings. Opportunities for new information to be gathered and included.	Communications, Environmental Systems	Consult and Involve	complete
Coastal Zone Management Committee	Committee members	June 2020	Workshop session as part of monthly committee meeting to review risk ratings, identify any additional gaps and to prioritise these gaps.	Environmental Systems	Consult and Involve	complete
Consultation summary	All stakeholders	June/July 2020	Feedback regarding risk assessment changes and gaps collated. Report on community forum provided by Deliberately Engaging.	Environmental Systems	Inform	complete

ENGAGEMENT STAGE 2
– Studies, information for identified gaps (December 2020 – May 2021)

Activity	*Stakeholders*	*Timeframe*	*Details*	*Responsibility*	*IAP2 Status*	*Status /comments*
Online						
Shape Lake Mac website	All stakeholders	February / March 2021	Shape Lake Mac project page to include: ■ discussion forum as main feedback mechanism ■ frequently Asked Questions ■ key dates ■ document library	Communications, Environmental Systems	Inform, Consult, Involve	
e-Newsletters: ■ Shape Lake Mac ■ Your City Online ■ Planning ■ Eco Advocate	Subscribers	February / March 2021	Share relevant updates and opportunities for consultation through eNewsletters	Communications	Inform	
Email notification	Identifies stakeholder email list	January 2021	Promote awareness of the project, what it is trying to achieve, how people can contribute and what information we are seeking to identified stakeholders on email.	Communications, Environmental Systems	Inform	
Social media posts via: ■ Facebook ■ Twitter ■ Instagram ■ LinkedIn	Followers	February 2021	Post regular updates on Council's social media platforms to keep the community informed and provide details of consultation opportunities	Communications	Inform	

ENGAGEMENT STAGE 2
– Studies, information for identified gaps (December 2020 – May 2021)

Activity	*Stakeholders*	*Timeframe*	*Details*	*Responsibility*	*IAP2 Status*	*Status /comments*
Other						
Presentation to Unique Landscapes Portfolio Committee Meeting	External Coastal Management Plan Group and Coastal Zone Management Committee	February 2021	Brief the committee members and provide an opportunity for members to contribute	Environmental Systems	Inform, Consult, Involve	
Councillor Briefing	Councillors	March and July 2021	Presentation to Councillors	Environmental Systems		
Wave overtopping workshop	Council staff, Coastal Management Program Group and Coastal Zone Management Committee	February / March 2021	Consultant to facilitate.	Consultant Environmental Systems	Inform, Consult, Involve	
Attend Coastal Zone Management Committee meetings	Coastal Zone Management Committee members	February and April 2021	Attend Committee meetings and provide an update on progress with the CMP	Environmental Systems	Inform, Consult and Involve	
Government agencies	Stakeholders as identified	January 2021 onwards	Regular meetings to discuss key issues and barriers to management options development	Environmental Systems	Inform, Consult and Involve	
Evaluation survey (online)	Identified stakeholders and CZM committee members	June/July 2021	Evaluation of Stage 2 consultation (short online survey)	Communications, Environmental Systems	Consult, Involve	

ENGAGEMENT STAGE 3
– Prepare the CMP, developing management actions in partnership with stakeholders
(April 2021 – October 2021)

Activity	*Stakeholders*	*Timeframe*	*Details*	*Responsibility*	*IAP2 Status*	*Status /comments*
Online						
Shape Lake Mac website	All stakeholders	February / March 2021	Shape Lake Mac project page to include: ■ discussion forum as main feedback mechanism ■ frequently Asked Questions ■ key dates ■ document library	Communications, Environmental Systems	Inform, Consult, Involve	
e-Newsletters: ■ Shape Lake Mac ■ Your City Online ■ Planning ■ Eco Advocate	Subscribers	February / March 2021	Share relevant updates and opportunities for consultation through eNewsletters	Communications	Inform	
Email notification	Identifies stakeholder email list	January 2021	Promote awareness of the project, what it is trying to achieve, how people can contribute and what information we are seeking to identified stakeholders on email.	Communications, Environmental Systems	Inform	
Social media posts via: ■ Facebook ■ Twitter ■ Instagram ■ LinkedIn	Followers	February 2021	Post regular updates on Council's social media platforms to keep the community informed and provide details of consultation opportunities	Communications	Inform	

ENGAGEMENT STAGE 3
– Prepare the CMP, developing management actions in partnership with stakeholders
(April 2021 – October 2021)

Activity	*Stakeholders*	*Timeframe*	*Details*	*Responsibility*	*IAP2 Status*	*Status /comments*
Other						
Presentation to Unique Landscapes Portfolio Committee Meeting	External Coastal Management Plan Group and Coastal Zone Management Committee	February 2021	Brief the committee members and provide an opportunity for members to contribute	Environmental Systems	Inform, Consult, Involve	
Wave overtopping assessment workshop	Council staff, Coastal Management Plan Group and Coastal Zone Management Committee	February/ March 2021	Facilitated by consultant. Internal and external stakeholders and Coastal Zone Management Committee members invited.	Environmental Systems	Inform, Consult, Involve	
Attend Community Events	Community event attendees	December 2021 – February 2022	Assess face-to-face options	Communications, Environmental Systems	Inform, Consult and Involve	
Attend Coastal Zone Management Committee meetings	Coastal Zone Management Committee members	Bimonthly, commencing February 2021	Attend Committee meetings and provide an update on progress with the CMP	Environmental Systems	Inform, Consult and Involve	
Attend Youth Advisory Council (YAC) meeting	YAC members	June-October 2021	Provide an opportunity for YAC members to contribute to management options development	Environmental Systems	Inform, Consult and Involve	
Evaluation survey (online)	Identified stakeholders and CZM committee members	November 2021	Short online survey	Communications, Environmental Systems	Consult, Involve	

ENGAGEMENT STAGE 4
– Finalise, exhibit, adopt and certify the CMP
(November 2021 – June 2022)

Activity	*Stakeholders*	*Timeframe*	*Details*	*Responsibility*	*IAP2 Status*	*Status /comments*
Online						
Shape Lake Mac website	All stakeholders	December 2021 – January 2022	Shape Lake Mac project page to include: ■ discussion forum as main feedback mechanism ■ frequently Asked Questions ■ key dates ■ document library	Communications, Environmental Systems	Inform, Consult, Involve	
e-Newsletters: ■ Shape Lake Mac ■ Your City Online ■ Planning ■ Eco Advocate	Subscribers	December 2021	Share relevant updates and opportunities for consultation through eNewsletters	Communications	Inform	
Email notification	Identifies stakeholder email list	December 2021	Promote awareness of the project, what it is trying to achieve, how people can contribute and what information we are seeking to identified stakeholders on email.	Communications, Environmental Systems	Inform	
Social media posts via: ■ Facebook ■ Twitter ■ Instagram ■ LinkedIn	Followers	October 2021 – April 2022	Post regular updates on Council's social media platforms to keep the community informed and provide details of consultation opportunities	Communications	Inform	

ENGAGEMENT STAGE 4
– Finalise, exhibit, adopt and certify the CMP
(November 2021 – June 2022)

Activity	*Stakeholders*	*Timeframe*	*Details*	*Responsibility*	*IAP2 Status*	*Status /comments*
Media						
Media release	Media	December 2021	Issue media release promoting opportunity for community to share their feedback	Communications	Inform	
Other						
Councillor Briefing	External Coastal Management Plan Group and Coastal Zone Management Committee	February 2022	Presentation to Councillors	Environmental Systems	Inform, Consult, Involve	
Attend Community Events	Community event attendees	December 2021 – February 2022	Assess face-to-face options prior to October 2021	Communications, Environmental Systems	Inform, Consult and Involve	

Appendix 4 - CMP Detailed Business Plan

The Business Plan shows how the CMP provides value to the community and the environment.

Value is achieved when the strategic benefits of the program as a whole, and of individual strategies, are greater than the strategic costs, when measured in economic terms. Strategic benefits are identified in relation to an agreed vision and objectives for the coastal zone and key localities within it.

Where stakeholders (council departments, public authorities, elected representatives and the community) perceive value in the proposed actions, decisions will be made to prioritise funding for their implementation.

1.1 Purpose

A business case or plan provides the justification for undertaking a project, program, or portfolio. It provides clear and structured information about:

Step 1: What is proposed and what is the aim? Why action is needed.

- The nature of the project, program, or portfolio.
- The issues it is designed to address (or risks being mitigated).
- The vision, goals and objectives of the project or program.
- The proposed actions.

Step 2: Why focus on these actions?

- Why these actions offer an effective pathway to achieve the objectives (the benefits of the proposed actions in the proposed priority order).
- What alternatives have been considered (and why they are not appropriate, in terms of their feasibility, economic viability or other factors).

Step 3: The costs of action, over the life of the program and beyond, where relevant.

- Costs, budget available and proposed timing.
- Distribution of costs in relation to benefits (who pays and who benefits), especially the balance between public good benefits and private benefits. Is the distribution fair and equitable? How robust is the assessment?

Step 4: How will costs be met?

- Roles and responsibilities for implementation.
- Available sources of funding and the proposed funding and financing model.

Step 5: Uncertainties and risks.

- Risks associated with budgets, roles, and responsibilities (that could prevent the project or program achieving its objectives).
- How progress will be tracked and reported.
- Contingency processes if actions are not able to be implemented.

Step 6: Conclusion.

- How the CMP adds value and how risks will be managed.

This CMP Business Plan addresses these six steps.

The business plan is consistent with s15(1)(d) of the CM Act, the requirements of Part A and Part B of the Manual and Mandatory Requirements identified in the CMP Checklist (DPE 2020).

It responds to five Mandatory Requirements:

- MR8(x) A CMP must include a business plan.
- MR9(i) The business plan included in the CMP must identify all proposed coastal management actions identified elsewhere in the CMP.
- MR9(ii) The business plan included in the CMP must identify the full proposed capital, operational and maintenance costs, and recommended timing, of proposed coastal management actions.
- MR9(iii) The business plan included in the CMP must identify any proposed cost sharing arrangements and other viable funding mechanisms for the proposed coastal management actions to ensure delivery of those actions is consistent with the timing for their implementation under the CMP.
- MR9(iv) The business plan included in the CMP must identify the distribution of costs and benefits for all proposed coastal management actions.

The Business Plan focuses on four key points and is linked to the implementation schedule for the CMP:

- **What will the CMP cost over its life**? (**Step 3** above and **MR 9(i)**): the full costs of implementing the CMP, including capital, operational (staff time for research, project management and reporting) and maintenance costs. The costs of maintaining structures built to protect public and private assets must be included.
- **How are costs and benefits distributed across the community and environment**? (**Part of Step 2**, and **Step 3, and MR9(iv)**): the distribution of costs and benefits, considering the allocation of costs and benefits to the local council (one or more councils), public authorities, the environment (i.e. the public good value of healthy and functioning coastal systems); directly impacted private landholders and indirectly affected private land holders. Is there a balance between costs and benefits that leads to a fair and equitable outcome?
- **Where will the funds come from**? (**Step 4 and MR9(iii)**): how funding to implement the CMP will be sourced for short, medium, and longer-term actions, and for capital and maintenance investments.

- **How will Council make sure the right funds are available at the right time**? (**Step 4 and MR9(ii), MR9(iii)**): How the council will work with stakeholders to integrate scheduling (the priority of strategic actions) and various sources of funding.

1.2 Strategic Context

The strategic context of the CMP is discussed in **Section 1** of the CMP, but key points are reiterated here so that the Business Case is directly aligned with what the CMP is intended to achieve.

1.2.1 The Purpose and Function of the CMP

A CMP is an integrated, long-term program of strategic actions for the coordinated management of land within the coastal zone, with a focus on achieving the objects of the CM Act. A CMP contributes to improving the social, cultural, and economic wellbeing of the people of NSW, by balancing coastal risks and opportunities at the local and regional scale.

The Lake Macquarie CMP will protect and strengthen the resilience of the values of the coastal zone of the city, in the context of change.

The CMP is consistent with the principles of ecologically sustainable development and relevant United Nations Sustainable Development Goals. Council has adopted the UN SDGs and they are integral to its Sustainability Policy and Environmental Sustainability Strategy and Action Plan.

1.2.2 Vision, Goals and Objectives

The Business Case links the proposed actions to council's vision, goals, and objectives for the coastal zone. These are explored in **Section 1 and 4** of the CMP.

Council's vision is that the community will enjoy the benefits of **A healthy, resilient coastal zone.**

In defining this vision, council has drawn on:

- the community's expressed high value of the natural landscape of the coastal zone.
- the community's love for coastal recreation – beach, foreshore, and waterways.
- a strong belief that a healthy environment is fundamental to community use and enjoyment.
- knowledge that continuing healthy coastal environments and community use and enjoyment are vulnerable to the pressures of climate change and intensive demand from a growing population.

In developing the CMP Business Case, Council has identified benefits of the proposed program of actions in relation to its capacity to contribute to enhanced alignment with the objects and management objectives of the CM Act, noting that this CMP is an integrated program of actions for sustainability across the whole of the coastal zone. Council's specific local principles for the CMP are adapted from the objects of the CM Act. They also highlight some important roles and responsibilities of the Council as a key planner, decision maker, land manager and economic catalyst for a city of more than 210,000 people. Integration of these roles with the objects of the CM Act contributes to the value case for the CMP for the coastal zone of the city of Lake Macquarie.

Council's Principles for Coastal Zone Management

- *Contribute to global sustainability.*
- *Use an evidence-based approach.*
- *Focus on the causes rather than reactively addressing symptoms.*
- *Integrate management of coastal hazards and ecological health across the coastal zone*
- *Build upon success of:*
    - *applying catchment management and soft engineering principles.*
    - *local adaptation planning using a locally based community co-design approach.*
    - *community and volunteer engagement.*
- *Enhance Aboriginal involvement in coastal zone management.*
- *Apply an adaptive approach.*
- *Embed climate change and circular economy principles.*
- *Recognise and enable multiple benefits provided by healthy coastal areas, including essential ecosystem services, recreation, cultural, health, wellbeing, and economic benefits.*
- *Utilise the best available tools (including technology, innovation, land acquisition, planning controls, and economic analysis) to avoid and mitigate risk.*

1.2.3 Why Action is Needed

In Stage 1, Council identified four priority threats to the environment of its coastal zone and three priority threats to the social, cultural, and economic (SCE) values of the coastal zone, over the period to 2050. The threats to the environment and to social and economic values are closely related. Key threats are summarised in **Table 1.1**.

Table 1.1 shows that the environmental values of the coastal zone are affected by all these risks. The estuary is affected by all five risks, from either environmental or SCE value perspectives.

The impacts of climate change on the natural systems of the coastal zone, on the maintenance of settlement structure and infrastructure and on safe public access are identified as the highest risk for estuary, channel, and coastline.

The actions in the CMP address these key threats and risks. Actions are organised in relation to specific issues associated with the key threats and risks.

Table 1.1 Key threats to the values of Lake Macquarie's coastal zone

Threat	Environment values	Social, cultural, and economic values (SCE)	Estuary	Coastline	Channel
Impacts of climate change and coastal hazards	Yes	Yes	Extreme – Environment Extreme SCE	Extreme – Environment. High - SCE	High environment Extreme SCE
Impacts on water quality	Yes	Yes	High – Environment High SCE	High SCE	High SCE
Modification of catchment vegetation	Yes	n/a	High - Environment	n/a	n/a
Modification of the waterway	Yes	n/a	High - Environment	n/a	High - Environment
Access to the marine estate	Yes	Yes	High - SCE	High - SCE	High - SCE

1.3 Proposed Programs of Actions

Mandatory Requirement 8(iv)

The CMP presents a structured program of actions to respond to current and future risks and to continue demonstrated effective management responses.

The program of actions that is proposed to address threats and risks, and meet council's objectives and vision for the coastal zone is summarised in the implementation plan which forms **Section 4.4** of the CMP.

In identifying this program of actions, Council has considered a wide range of possible responses to mitigate risks and strengthen resilience in the coastal zone – for both natural systems and local communities.

The responses in the program include actions brought forward from the existing CZMP (certified in 2016), new actions identified by Council staff or agency staff and new actions suggested by the Lake Macquarie Community. Options were discussed at workshops with community and public authority stakeholders in late 2021.

All potential management responses suggested by stakeholders were included in the evaluation process. The tables in **Appendix 8** of the CMP show how the full list of potential actions has been evaluated, to identify actions which are feasible, affordable, provide value for money and satisfy community objectives. This evaluation process is consistent with the Mandatory Requirement (**MR8(v)**) to evaluate the feasibility, economic viability, and community acceptability of potential management responses. The analysis in **Appendix 8** provides the logic and evidence for exclusion of some potential actions from the implementation schedule and Business Plan.

The program of actions that emerges from the evaluation process:

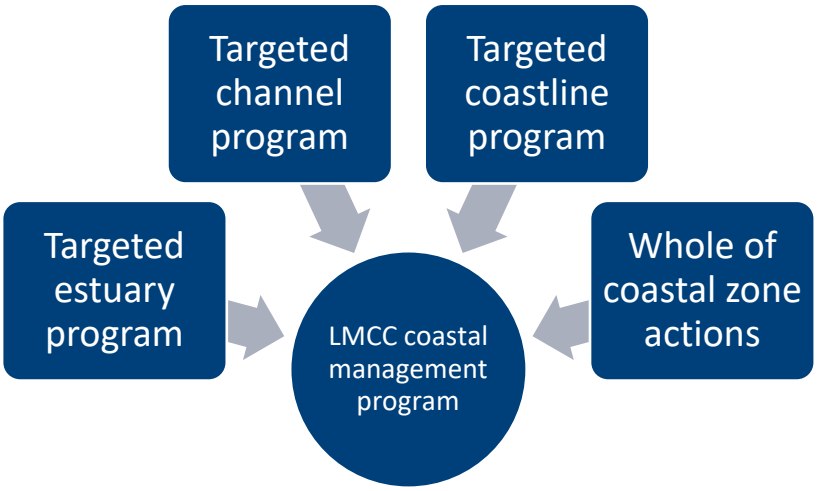
- provides a 10-year program of actions to protect the coastal values of the City, and foreshadows longer term strategic priorities and adaptation processes.
- is supported by sub programs targeted to the three broad components of the coastal zone that are recognised by the community of the city (see **Section 1.3.1**).
- is structured around high risks identified in Stage 1 across the whole coastal zone of the city of Lake Macquarie, and confirmed with additional studies in Stage 2 of the CMP.
- includes programmed actions that add knowledge through monitoring or research; engage community and stakeholders; take on ground action to mitigate risks from coastal hazards and threats to coastal values; and monitoring and reporting of progress.
- is directly linked to Council and state government priorities.
- is a cost-effective way to provide clear benefits for the natural systems of the coastal zone and for the people of Lake Macquarie who enjoy social and economic activity based on healthy coastal systems.

1.3.1 Sub-Programs of Actions

This section provides information relevant to Mandatory Requirement 8(iv).

Council has considered actions to address threats and risks to the Lake Macquarie estuary, the channel, and the open coastline separately, but acknowledges that these systems are not independent of each other. By identifying subprograms of actions for these three components of the coastal zone of the city, the CMP reflects the key processes and distinctive community uses of each component.

The CMP also recognises that some responses (such as governance arrangements, monitoring and reporting, recognising Awabakal cultural values and a range of community involvement, engagement, and information actions) are relevant to all parts of the coastal zone.



Importantly, the program of actions for the Lake Macquarie estuary recognises that estuary health is strongly dependent on water quality and the balance of catchment and tidal flows. Water quality affects habitat quality and diversity, and community amenity. Risks to water quality in the Lake Macquarie estuary depend on six factors, each of which may be modified by climate change:

- The quality and volume/flow rate to the lake from the immediate catchment – such as stormwater from urban areas within the coastal environment area.
- The quality of flows from the wider catchment, particularly from the catchments and riparian zones of the main tributary systems of the lake, including Cockle Creek, Stony Creek, Dora Creek, Wyee Creek, North and South Creeks and Sheppards Creek. These catchments include the coastal environment area but also extend beyond the coastal environment area.
- The rate of tidal circulation from the entrance. This is partly affected by structures in the entrance channel which affect its morphology and hydrodynamic processes.
- Industrial discharges to the estuary, such as cooling water from major coal fired power stations.
- Groundwater flows, especially potentially contaminated groundwater from former industrial or power generation sites. These sites are generally outside the coastal environment area.
- Resuspension of bed sediments and recycling of nutrients and contaminants in bed sediments.

The program for Lake Macquarie includes actions to address these drivers of water quality and estuary health. It continues the approach that has been integral to significant success in improving lake health and community amenity over the last 20 years, including the 10-year Lake Macquarie Improvement Program.

Maps in **Section 1.4** of the CMP shows how these drivers of water quality are spatially related to the Coastal Environment Area and other coastal management areas. Most of the urban areas of north Lake Macquarie (in the catchments of Cockle Creek, North and South Creek and Sheppards Creek) are outside the mapped coastal zone as defined by the boundaries of the coastal environment area, coastal wetlands and littoral rainforest area and coastal use area. Similarly, the ash dams for power stations around Lake Macquarie, extensive power transmission corridors and rural lands along Dora Creek, Stony Creek and Wyee Creek are outside the mapped boundaries of the coastal zone. While the narrow peninsulas that define the form of western Lake Macquarie are mapped within the coastal zone, runoff from these areas is not a key source of risk to water quality and estuary health.

1.4 How the CMP Adds Value

This section provides information relating to Mandatory Requirement: 9(iv).

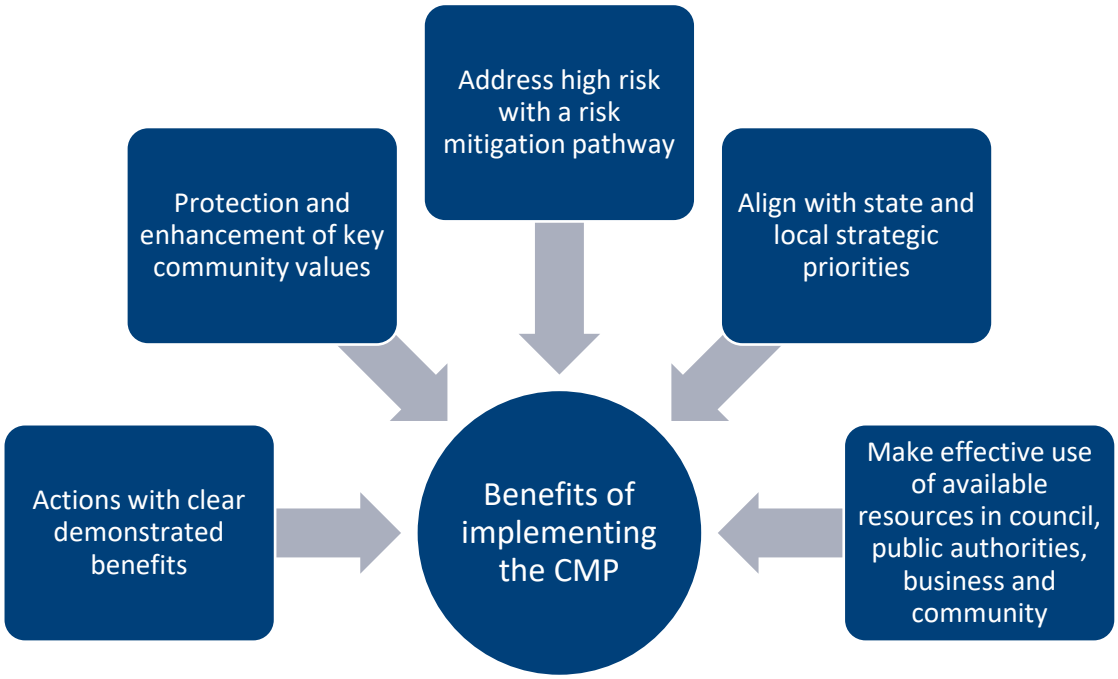
1.4.1 A Framework for Delivering Benefits

The value of implementing the CMP arises from its capacity to deliver several types of benefits, including:

- continuing actions with clear demonstrated benefits
- delivering protection or enhancement of key community values of the coastal landscape
- addressing high risks as a priority and providing an efficient pathway for mitigating risks to values

- demonstrably aligning with state-wide objectives and priorities and with council's strategic direction as identified in its Community Strategic Plan and other elements of its strategic framework
- making effective use of available resources in council, public authorities, business, and community.

Council has treated these benefits as equally important.



The following sections elaborate on these aspects of benefit or value and show how implementing the Lake Macquarie CMP will contribute.

The benefits accrue to the local environment, the local community and to the State of NSW, consistent with the objects of the CM Act. These natural system, social and economic benefits are clear but qualitative.

It is important to note that these are qualitative benefits, and for most it is not currently feasible to quantify economic value. There are currently limited quantitative data which would enable dollar values to be placed on these benefits in a meaningful way.

The CMP includes an action for Council to contribute to the development of better valuation and quantification of the qualitative benefits of implementing a CMP across the diverse coastal zone of a coastal city.

1.4.2 Continuing Actions with Demonstrated Benefits

LMCC has a strong track record of effective management of issues and values in its coastal zone. This is reflected in the high levels of community satisfaction with council's environmental management (see **Section 1.4.3**). Key elements of Council's successful approach include:

- A catchment-based approach to estuary health, including works to better manage urban stormwater and works to reduce sediment, nutrient and contaminant loads from the wider catchment. Council's collaborative, catchment-based approach has seen the lake that is central to the city move from being identified as having high environmental and community health risks, to an A grade water quality rating (for the main body of the waterway, and most tributaries), which has been maintained over the last three years. This is a direct contribution to community values of a natural, healthy waterway that supports recreational activity (boating, fishing, swimming).
- Avoiding open coast risks by excluding private development from high hazard areas.
- An adaptive approach to hazard and risk, so that responses are linked to thresholds of impact.
- Strengthening public access and amenity, which are key to the valued coastal lifestyle of the city's residents. Council's Lake Activation Strategy illustrates the approach to access and amenity, strongly supported by the community.
- A collaborative approach to issues, including public authorities and the community. This is illustrated by the success of the Lake Macquarie Improvement Program which developed from the Premier's Taskforce for Lake Macquarie. It is also illustrated by Council's success in embedding coastal adaptation in community development and land use planning for communities on the eastern side of Lake Macquarie which are vulnerable to long term tidal inundation. Council's approach to public land management in the coastal zone also draws directly on community involvement, through investment in Landcare.

These successful strategies continue in the CMP.

1.4.3 Community Values

Lake Macquarie is a city with a lake at its heart and a coastline of natural beaches and headlands along its eastern boundary.

For Lake Macquarie Council, the coastal zone comprises 32% of the area of the city.

Forty-five percent of the population of the city lives within the coastal zone.

Council completed a survey of community satisfaction with council's management of the city in November 2021 (Micromex 2021). The survey results are consistent with previous surveys and highlight the following values and priorities (**Table 1.2**).

Table 1.2 Summary of Micromex Survey Results 2021

Highest rated services/facilities – Importance Road maintenance **Lake/foreshore/coastal management** Parks and playgrounds Footpaths/cycleways/shared paths Long term planning for the city	**Highest rated services/facilities – Satisfaction** Overall appearance of the city ovals and sporting facilities **Lake/foreshore/coastal management** Swimming pools Swimming pool programs and activities
Most valued aspects of living in Lake Macquarie **Natural environment – beaches and lakes 48%** Location – proximity to cities, services, facilities, and family Lifestyle – relaxed, quiet, rural	**Priority issues over the next 10 years** Roads – potholes, supporting infrastructure, maintenance. Traffic management – congestion, traffic lights **Environmental concerns**

A good performance, in terms of value and satisfaction, was also identified for:

- adapting to climate change
- balancing development and maintaining the environment
- planning for natural disasters
- public jetties and boat ramps
- visitor and tourism services

Community comments about the most valued aspects of living in Lake Macquarie provide insights into components of management that are perceived to add value. These include:

- the lake and the space.
- environmental aspects – local waterways, rivers, lakes.
- perfect balance with access to services and facilities, but not overpopulated.
- relaxed area and the lake is beautiful.

The community value attached to the natural environment of the coastal zone (beaches, lakes) increased between 2020 and 2021.

Council's 2021 survey identified the following statements as most agreed upon by the people of Lake Macquarie. These statements are all directly relevant to investment in managing the natural spaces (public land) of the coastal zone.

In addition to these, 70-85% of people agreed with the statement 'our natural environment is protected and enhanced'.

The analysis in the 2021 survey highlights the key importance of 'shared decision making' as a driver of satisfaction with council's performance. This strengthens the case for including actions in the CMP which provide information for the community, engage them in decisions and promote and provide support for collaborative approaches.

These community satisfaction survey results point to some key factors to consider in the CMP business case. The value of implementing the CMP will increase if it focuses on:

- Protecting the natural landscapes, processes and functions of the lake, channel, and coastline.
- Recognising and showcasing the city's Aboriginal and aquatic heritage.
- Providing safe public access to public open space on the shores of the lake, channel, and coastline.
- Maintaining and enhancing facilities for visitors in the coastal zone.

Actions to protect and promote these values are included in the CMP.

Figure 1, from Micromex 2021, provides a summary of the Micromex analysis of how respondents ranked issues, by importance and level of satisfaction. This figure provides a four-way matrix of issues, showing the distribution of issues considered by the community to be:

- Higher importance and lower satisfaction. These issues are where Council should improve its service delivery. In this quadrant, services relevant to the benefits of the CMP include long term planning for the city (the CMP is a significant contribution to this), balancing development and maintaining the environment (a key principle of the CMP), and footpaths/cycleways and shared paths (many of these provide public access to or around the foreshore and coastline and the CMP includes several actions to improve pedestrian and cycle access and amenity).

- Lower importance and lower satisfaction. Micromex 2021 proposes that these are ‘niche’ issues, which are good to provide but, make a lower contribution to the well-being of the community. An alternative explanation of why some issues are in this group could be that they are the community’s baseline expectation of Council performance, but the quality of service does necessarily change the community’s perception of Council’s performance. Curiously, ‘adapting to climate change’ was placed in this quadrant by the respondents. Further analysis would be required to understand why these respondents saw adaptation as a lower priority, given strong support for adaptive planning in areas where coastal hazard risks are obvious and increasing.

- Higher importance and higher satisfaction. Micromex 2021 proposes that Council should maintain its service level for these issues. Lake, foreshore, and coastal management is the highest point in this quadrant, highlighting the value of continuing with programs with demonstrated success.

- Lower importance and higher satisfaction. Micromex 2021 describes these services as ‘social capital’. These services are value adding components of the community’s lifestyle, i.e., not seen as fundamental to well-being, but a positive area of focus. Services relevant to the CMP include public jetties and ramps, visitor and tourism services and support and programs for community groups. A key delivery mechanism for the CMP is Council’s support for Landcare.

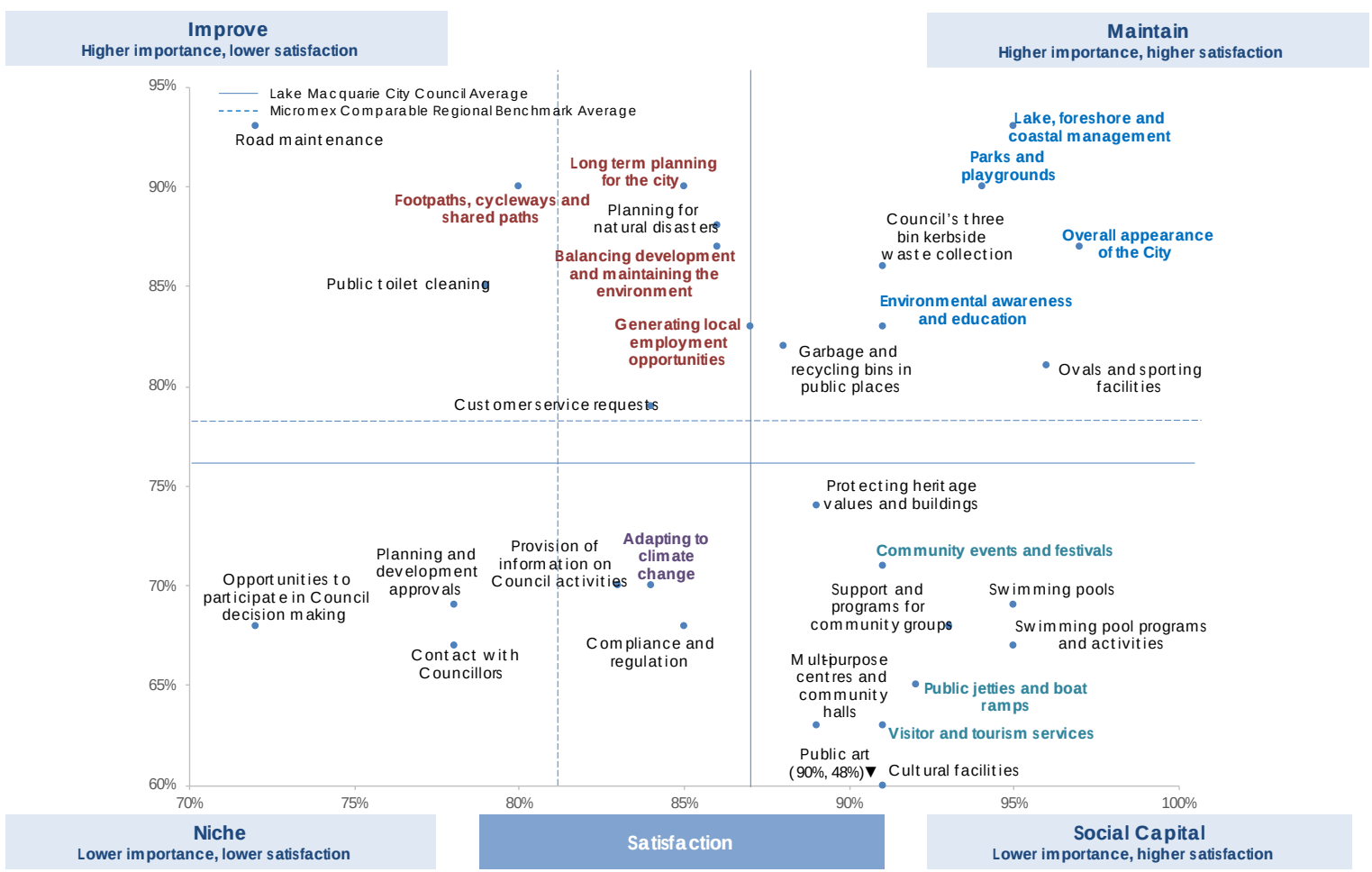


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Figure 1 **Ranking of importance and satisfaction of council services (Micromex 2021)**

1.4.4 Aligning with State-Wide Objectives and Priorities

As noted in **Section 1.2**, Councils objectives and principles for its CMP align with and build on the objects of the CM Act.

NSW Government priorities for the coastal zone are also illustrated in three main publications:

- Marine Estate Management Strategy 2018
- NSW Guidelines for applicants 2021-22, Coast and Estuaries Grants Program (noting that priorities for the program may change from year to year)
- DPE Future Directions Statement 2021

In evaluating the benefits of the proposed programs of actions in the Lake Macquarie CMP, Council has considered the priorities that are highlighted in this strategic guidance.

1.4.4.1 Marine Estate Management Strategy

The Marine Estate Management Strategy (MEMS) (2018-2028) was developed to respond to high risks identified in the state-wide Threat and Risk Assessment (TARA) for the marine estate. The TARA also provides regional scale risk assessment. Lake Macquarie is within the Central Region. Council reviewed Marine Estate priorities in Stage 1.

Overall, the TARA identified urban and rural discharges and runoff, climate change and disturbance of estuary habitats (from various threats) as major threats. Lake Macquarie is affected by these threats, and they informed the priorities for the CMP. In the Central Region, which includes most of the densely settled urban areas of NSW, pollutants and disturbance from boating activity, sewage systems, service infrastructure and industrial/thermal discharges are also identified as important threats.

The MEMS also notes the emerging threat of loss of cultural and heritage values, and emerging safety concerns around interactions of marine species and recreational/tourism waterways.

The Lake Macquarie CMP includes actions which address these issues in the local context, including a strong focus on urban stormwater (the SQID program), actions relating to overflows from the sewage system, further studies of the cumulative and long term effects of historical industrial and power generation discharges, projects to investigate interactions of recreational use and the natural systems of the coast, controls on boating activity in high vulnerability seagrass communities, stronger protections for important natural areas and actions to provide further opportunities for Aboriginal community involvement.

The Lake Macquarie CMP will provide a direct contribution to better management of MEMS priorities.

1.4.4.2 Future Directions Statement

The Future Directions Statement (FDS) sets out the five priorities of the NSW Government in the delivery of the coastal management framework. These are outlined below.

- Delivering outcomes.
- Reviewing legislation and updating guidance.

- Supporting coordination, collaboration, and engagement.
- Providing science and information.
- Funding and financing.

It is important to note that these priorities relate to responsibilities of the NSW government in supporting CMP development and implementation, rather than the value of local programs of actions. However, it is reasonable to discern from the FDS priorities some of the features that will demonstrate benefit in a local council CMP. These include programs which:

- incorporate strategic approaches and actions which demonstrate collaboration between the local council, public authorities, and local communities.
- address high priority risks and threats.
- are structured with measurable and reportable outcomes.
- include risk avoiding land use planning.
- are structured with adaptive risk management thresholds and triggers.
- demonstrate an holistic approach to estuary health.
- are clearly linked to community values, including Aboriginal community values.
- incorporate measures to avoid or mitigate future risks.
- incorporate improved coastal science, monitoring and reporting.
- identify sustainable funding and financing strategies.

The programs of actions in the Lake Macquarie CMP demonstrate each of these lines of evidence of a beneficial CMP.

1.4.4.3 Coast and Estuary Grants Program Guidelines 2021-22

The grant funding guidelines identify the role of the funding program as supporting local councils to prepare and implement their CMPs, to deliver the objects of the CM Act. The objectives of the five streams of funding are identified in **Table 1.3**.

Table 1.3 Grants Program - Program objectives and priorities.

Stream	NSW Government objectives and priorities	Lake Macquarie CMP
Stream 1 – prepare a CMP. Funding from this stream has assisted Council to prepare the CMP	• transition a CZMP to a CMP • meet statutory objectives of new framework. • prepare tasks within the framework. • enable current and future risk mitigation. • encourage and promote resilience of public assets to climate change. • promote integrated and coordinated management. • support public participation.	Preparation of the CMP includes these aspects.
Streams 2 to 5 – implement a CMP	• support implementation of actions within a certified CMP. • result in net benefits to the local and wider NSW community. • deliver at least one of the following: o actions to support climate change adaptation. o actions to improve natural resilience to coastal hazards and climate change. o actions that manage risks to public assets, benefits, or interests. o actions that maximise delivery of public benefits and interests. o actions that reduce the state's liability in relation to coastal natural disaster relief and recovery. o actions to reduce unacceptable and immediate risks from coastal hazards, from legacy issues. o actions to reduce or remove potential impacts of future risks. • apply beneficiary pays principle.	• supports continuing net benefit of improved lake health and coastline in public ownership. • focuses on strong public benefit and reduced public risk or liability (see **Section 1.4.5**). • focuses on continuing high risks to a coastal lake with an urban catchment and the future risks associated with climate change – to seagrass, coastal wetlands, safe public access and amenity to estuary foreshores and beaches on the open coast, and low-lying urban areas and assets. • The primary beneficiary of all actions in the CMP is the public good.
CVA	Actions should relate to the management objectives of the CVA: • Ensure public safety and prevent risks to life. • Mitigate future risk from hazards and climate change. • Maintain the presence of beaches, dunes, and natural features. • Maintain public access, amenity and use of beaches and foreshores.	The CVA is not mapped in the Lake Macquarie coastal zone. The CMP does include actions to understand and respond to public safety risks on the open coast, such as at Redhead surf club. It addresses vehicles driving on public land. The CMP includes actions to strengthen and raise the height of coastal dunes along Nine Mile Beach, to reduce the risk of wave overtopping and coastal inundation hazards.

Stream	NSW Government objectives and priorities	Lake Macquarie CMP
	• Encourage land use that reduces risks from coastal hazards. • Reduce exposure to coastal hazards such as restoring or enhancing natural defences, including beach nourishment, beach scraping. • Prioritise actions that support continued functionality of essential infrastructure during and after a coastal hazard emergency. • Improve resilience by improving adaptive capacity and reducing reliance on emergency response. • community education about coastal hazards.	Council has been working with local communities in high-risk areas for several years to develop local adaptation strategies for coastal hazards (tidal and catchment inundation). These planning processes include full cost benefit analysis. The CMP includes actions brought forward from adopted local adaptation strategies.
CWLRA	Projects are to meet one or more of the management objectives: • Protect wetlands and littoral rainforests in their natural state, biological diversity, and ecosystem integrity. • Promote rehabilitation and restoration of degraded wetlands, including weed management, salinity management, habitat restoration and conservation. • Improve resilience of coastal wetlands • Support social and cultural values of coastal wetlands and littoral rainforests, including track management, interpretation signage and public education programs. • Promote other objectives of the SEPP.	The CMP includes actions to better understand how coastal wetlands will be affected by climate change and sea level rise, to inform decisions about the best approach to protect wetlands in different parts of the channel and lake systems, as sea level rises. A major budget item in the CMP is investment in Landcare, supporting community involvement in biodiversity programs across the city. These often address threats to coastal wetlands. The CMP includes actions to enhance public access around wetlands, by creating boardwalks and bird watching opportunities in appropriate locations and providing more information about wetland values.
CEA	Projects are to meet one or more of the management objectives for the CEA: • Protect and enhance coastal environmental values and natural coastal processes, scenic value, ecosystem integrity (i.e., ecosystem services) • Reduce threats and improve the resilience of coastal waters. • Improve water quality and estuary health. • Support social and cultural values. • Maintain the presence of beaches, dunes, natural features of foreshores.	This is the largest part of the Lake Macquarie coastal zone. The CEA is the heart of the city and a major focus of the CMP. A primary focus is protection of coastal ecosystem integrity on headlands, rock platforms, beaches, dunes, lake foreshores. Around the lake, Council and other public authorities manage 100km of public foreshore land, which is fundamental to public access and amenity. These paths are ranked by the community as high importance and where satisfaction gains can be made.

Stream	NSW Government objectives and priorities	Lake Macquarie CMP
	• Maintain public access and amenity, including managing access ways on the open coast.	The CMP continues Council's successful approach to estuary water quality and health, including its program of SQIDS on urban stormwater systems and broader management of sources of sediment, nutrient and contamination from the catchment.
CUA	Actions to protect and enhance scenic, social, and cultural values of the coast to accommodate both urbanised and natural stretches of coastline.	The CMP includes actions to maintain and restore public access to scenic walks and lookouts along the coast.

1.4.5 Public Benefit

The proposed programs of actions in the Lake Macquarie CMP focus on providing public benefit. All costs or funding sources are from various public funds (local, State or Commonwealth) and all actions have been identified as having public benefit. Unless otherwise specified in the Implementation Plan, the public benefit from these actions is 100%.

- For the open coastline, almost the entire length of the Lake Macquarie coastline and coastal environment area is public land. Public assets include the entrance training walls, beaches, coastal walking paths and lookouts, protected coastal ecological communities, other foreshore reserves and access structures, and surf clubs (built by Council).
- For the channel, Council's focus is on the protection of public foreshore land, coastal wetlands, boating access infrastructure and entrance control structures (training walls).
- For Lake Macquarie estuary, council's focus is on continuing to improve and maintain water quality, biodiversity, and waterway health, as well as maintaining and enhancing recreational access, amenity and economic activity that are consistent with protecting waterway health.
- There are extensive areas of residential land around Lake Macquarie that are low lying and will be subject to tidal and catchment inundation risks in the medium term. Council's approach to these lands and communities is to focus on how it can use its roles and responsibilities such as strategic land use and development assessment planning, to avoid and mitigate future risk. Council also focuses on future viability and amenity of public assets that contribute to the wealth of the city, such as holiday parks.

This focus on public benefit, via a healthy environment or services that support whole of community access, amenity, and lifestyle, means that the detailed analysis of the distribution of public and private benefit is not necessary in this CMP. While some private benefits may accrue (e.g., a private waterfront land holder may benefit from a healthy waterway in terms of their property value), they are incidental to the public good.

1.4.6 Benefits of an Integrated Approach

The benefit of the CMP is that it provides an integrated, program-based approach to strengthen and maintain natural environment, social, cultural, and economic values in the coastal zone.

In the Lake Macquarie context, the CMP is a program of strategic actions that will create and maintain value:

- protect the community's most valued asset and continue to restore its condition and resilience.
- provide for low risk, sustainable coastal settlement patterns in the future.
- enable community involvement, action, and a shared commitment to maintaining the city's unique natural environment and its lifestyle.
- continue council's record of care for the coastal environment.
- maintain the community's safe access and enjoyment of the coastline, foreshores, and waterways.
- provide a high level of service for a growing urban community which embraces a culture of coastal recreation.
- keep people informed about what is being done and what has been achieved.
- recognise the coastal values and stewardship of Awabakal people and create opportunities for Aboriginal people to be involved in decisions about coastal culture, coastal processes, ecology, and access.
- enable economic activity that is consistent with and leverages the values of the natural systems of the coastal zone.

1.4.6.1 Value from Program Structure

The structure of the program of actions contributes to the way it adds value or creates benefits. A well-structured program will add value (or avoid unnecessary risks) by:

- ensuring that big decisions are informed by the right level of information, including robust science and community input. Where there is uncertainty or a lack of evidence about coastal processes (physical or ecological), the CMP identifies a short-term action to provide new information (see **Section 1.4.6.2**).
- respond to high and unacceptable risks first. Ensure that decisions about change are made at the right time to balance unacceptable risks to natural and built assets and activities, with other values (such as economic activity, employment, and social cohesion) that are important for community resilience.
- manage uncertainty by monitoring change and management effectiveness and providing information to stakeholders.

Figure 2 shows how different types of coastal management actions within the CMP align with these three aspects of value.

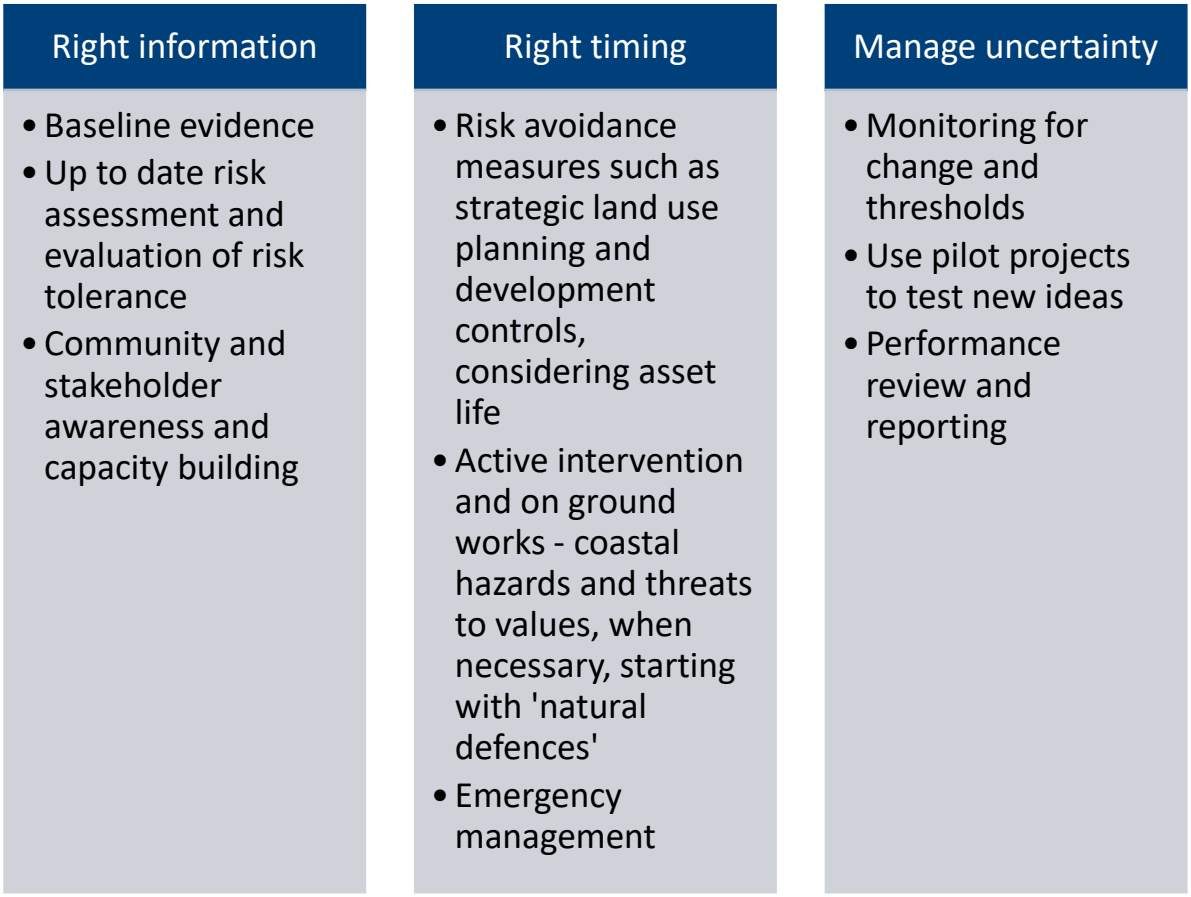


Figure 2 Alignment with aspects of value

The proposed actions are a strategic program which will:

- **continue current successful initiatives** to improve the health of the coastal zone and strengthen resilience to both environmental change and pressures from land and waterway use (all actions, plus regular performance review and reporting).
- **investigate emerging issues and provide new information** about ongoing complex challenges (baseline evidence, risk assessment, monitoring and performance review).
- **provide information to the community in inclusive ways** and maintain opportunities for the community to be involved in managing the coastal zone and their contribution recognised (community and stakeholder awareness and capacity building, performance review and reporting).
- include **short term and longer-term actions that are linked to risk** (risk avoidance measures, pilot projects, active intervention and on ground works, emergency management).

1.4.6.2 Linking a Sequence of Actions for High Risks into the Program

For each of the high-risk issues/threats that were identified in the Stage 1 Scoping Study, the CMP includes:

- Actions to collect good baseline data, if there is currently insufficient information to support strong decision making.
- Actions that test thresholds where a threshold has been identified for a change of approach (e.g., from community awareness raising and monitoring, to more intensive on ground intervention).
- Risk avoidance measures such as planning and management controls, to prevent the risk from increasing.
- On ground works such as dune management, coastal protection works, wetland rehabilitation to reduce threats and hazards, if the evidence indicates that direct action is warranted. The CM Act directs that natural defences (dune management, wetland management) should be used in the first instance to manage coastal hazard risks, stepping up to more structural protection if the natural defences cannot deliver the agreed objective.
- Emergency management provisions where coastal hazards present high risks to assets and life that cannot be controlled by other measures.
- A process for monitoring, evaluating, and reporting progress, including the benefits of implementing the CMP.

1.4.7 Summary of Value and Benefit

The Stage 1 Scoping Study (LMCC 2020) identified benefits of developing a CMP, and some risks that could arise if council did not convert its certified CZMP to a CMP. The benefits and risks are noted in **Table 1.5**. The table also provides a review of the extent to which these benefits have been achieved and risks avoided in the **development** of the CMP. Many of the benefits do not have real effect until the CMP is certified and **implemented**.

Table 1.4 also provides a summary of the additional benefits which are expected to accrue from implementing the Lake Macquarie CMP. As noted in **Section 1.1**, these benefits are qualitative. Council supports further work to quantify benefits, to provide a clearer indication of the extent to which its CMP delivers financial benefits for council, its partners, and the community – at the local scale and as part of the State of NSW.

Table 1.4 presents the value of the CMP as an **integrated program**. Information about the benefits and costs of individual actins within the program is in the evaluation tables in **Appendix 8** of the CMP.

Table 1.4 Summary of Qualitative Benefits from CMP Development and Implementation

Benefits identified in Stage 1	Extent to which development of Stages 1-4 have enabled these benefits	Additional benefits from implementation	Where these benefits are delivered and to which parts of the community
Clear guidance on current and future actions and cost sharing arrangements	This is the purpose of the CMP – to provide a long term coordinated strategy for the management of the coastal zone. Coordination includes an understanding of the equitable allocation of costs and benefits, and timely contributions of budget (direct investment or in kind) by public authorities	The CMP identifies and explains Council's priorities for the management of the coastal zone over the next decade, set within a longer-term strategic context of environmental and community change. Council has identified funding and delivery partners, as relevant, for all actions. Council's highest investment in the CMP is in ongoing and improved management of its urban stormwater management (SQIDS) and supporting community involvement in land management on public land, via Landcare. These actions are Council's responsibility and will be directly funded by Council (see **Sections 1.6**, **1.7** and **1.8**)	All coastal management areas. Lake, channel, and coastline. Benefits are directed to public assets and the public value of the coastal landscape
Preservation (protection) of key community values of the coast	The development of the CMP recognises high community values as identified in community surveys. Protection of natural and recreational values of the coastal zone is an objective of the CMP and a focus of management actions. Stages 1 to 4 identify important strategies to continue to protect these values. The outcome will be achieved by effective implementation, including monitoring, and communicating of progress.	Implementation of the CMP will continue demonstrated successful and value generating programs across the coastal zone, which maintain the nexus between healthy natural systems and community lifestyle. This nexus is recognised and respected by the local community.	All coastal management areas. Actions address continuing threats to water quality which is fundamental to ecological health and to community recreational amenity. Actions maintain public access to foreshores, beaches, headlands, and wetlands, in the context of facilities for nature observation, walking, boating, and swimming.

Benefits identified in Stage 1	Extent to which development of Stages 1-4 have enabled these benefits	Additional benefits from implementation	Where these benefits are delivered and to which parts of the community
Standardised processes and documentation and fewer activities or projects that duplicate each other	The CMP provides a framework for coordinated management of the coastal zone. It identifies where there is potential for duplication and recommends ways to better manage resources	Actions from the CMP which are Council's responsibility will be delivered through Council's IP&R Implementation Strategy and Annual Operational Plans. These require whole of Council engagement and negotiation. The CMP also identifies the value of coordinated monitoring activities to reduce duplication of state and local government efforts (e.g., for estuary health, water quality, sea grass) and better sharing of information. It includes an action to rationalise monitoring and improve communication and data sharing.	All coastal management areas. Lake, channel, and coastline. Directed at efficient and coordinated delivery of programs by state and local government
Collaboration with adjacent councils and other agencies which provides better knowledge transfer and delivery of outcomes	LMCC has a strong history of collaboration with Central Coast Council and public authorities. The CMP development process has created an opportunity to refresh and refocus these working relationships	Council has identified relevant public authorities for multiple actions and has engaged with them to strengthen commitment to the implementation process – in terms of resources and timing. The distribution of responsibilities is shown in **Section 1.7**. Implementing the CMP will require further close engagement of public authorities, but also offers an opportunity to increase accountability.	Central Coast Council collaboration – southern Lake Macquarie. Public authority collaboration – whole of coastal zone, with specific localities relevant to individual organisations.

Benefits identified in Stage 1	Extent to which development of Stages 1-4 have enabled these benefits	Additional benefits from implementation	Where these benefits are delivered and to which parts of the community
Identification of risks and management responses for adaptation to coastal processes, both now and into the future. Development of actions for adapting to coastal hazards over time	Lake Macquarie (estuary) has extensive areas of development and wetlands that are highly vulnerable to sea level rise. These were identified in the CZMP, and detailed local adaptation plans have been prepared for two of the highest risk areas.	Implementation of early actions from the LAPs is included in the CMP. Priorities for implementation in the CMP include monitoring a range of processes and consequences so that thresholds for change in risk can be refined.	Tidal inundation: CEA, CWLRA and CUA as they apply to land along the channel, foreshore reserves and residential areas in low lying areas around the lake. Catchment inundation – tributary creeks in the CEA and low-lying areas where catchment and tidal inundation interact. Widespread community benefits for safe and sustainable recreation, settlement patterns and infrastructure provision
Identification of improvements in land use and infrastructure planning	The development of the CMP has reinforced Council's focus on assets and infrastructure which support public access, use and enjoyment, while protecting important environmental values of the waterways and foreshores. It also reinforces the merit of Council's approach to risk avoiding long term land use planning.	The CMP is linked to the Lake Activation Strategy which identifies priority locations and a schedule of improvements to recreational access infrastructure around the Lake Macquarie foreshore. The CMP identifies actions to manage risks to surf club infrastructure, at Redhead. The CMP includes an action addressing overflows from sewage reticulation infrastructure. It continues Council's approach to long term asset and land use planning, to avoid coastal risks.	Across the whole of the coastal zone.

Benefits identified in Stage 1	Extent to which development of Stages 1-4 have enabled these benefits	Additional benefits from implementation	Where these benefits are delivered and to which parts of the community
Improved grant funding opportunities, resource sharing and streamlined procurement processes.	Council has considered the priorities of the Coast and Estuary Grants Program in developing its understanding of actions that will contribute to state-wide benefits.	The CMP is consistent with Coast and Estuary grant funding priorities as identified in the current grant program guidelines. These may change. Council will apply for grants from the C&E program where relevant. It will also fund some actions directly from its own resources and will seek other grant or implementation partners for works outside the coastal zone which have direct benefits for identified coastal zone values. These partners include LLS, HWC and industry.	Whole of coastal zone and all communities across the local council area.
Collaboration with emergency agencies to develop emergency action sub plans specific to coastal hazard management.	A Coastal Zone Emergency Action Sub-Plan (Appendix 5 of the CMP) has been prepared as part of the CMP.	Coordination of Council, SES, and other agency actions in the event of natural hazard emergencies. Coastal emergencies are integrated with the broader emergency response plan for the city.	Emergency action planning in the Lake Macquarie coastal zone deals primarily with combined catchment and tidal inundation. Council also has emergency action plans for protecting public safety in the event of major coastal erosion events and wave overtopping of popular coastal recreation points.

Benefits identified in Stage 1	Extent to which development of Stages 1-4 have enabled these benefits	Additional benefits from implementation	Where these benefits are delivered and to which parts of the community
Identification of beneficiaries of proposed works to explore potential cost share arrangements, including private owners and investor sector financiers.	In Lake Macquarie CMP, almost all actions are on public land and have public beneficiaries (i.e., the actions protect the environment or protect public access and amenity. The potential for investor sector contributions to the cost of implementing the CMP (e.g., through developer contributions) is discussed in **Section 1.8** of this Business Case. An example is the use of developer contributions to pay for environment protection and public amenity actions in accordance with development consent conditions.	Council's focus is on management of public land and public assets, and on actions which provide a public benefit. This approach flows through all of Council's strategic planning. This means that the CMP includes actions which will require collaboration with other public land managers such as Crown Lands and NPWS. Council has identified that the development of the city to accommodate a growing population (residents and visitors) has potential to impact on public assets and public benefit. To address this, funds from developer contributions can be used to supplement Council's other budget sources to provide services valued by the community, and to protect the natural systems of the coastal zone.	Whole of coastal zone and all sectors of the community
Compliance with the planning process outlined in the Manual.	This is not a specific benefit of preparing a CMP, other than maintaining Council's reputation for good coastal management and continuing its contact and influence in the broader coastal management community.	The CMP complies with the Mandatory Requirements checklist for CMPs. This will support good relations between council and DPE, which is its primary partner in NSW government.	All requirements and all parts of the community.
A strong and defendable strategic basis for management decisions affecting the coastal zone.	This is a core function and benefit of the CMP.	The CMP provides the rationale for conversations with the community about priority actions in the coastal zone, including what will be done and what is not feasible or economically viable.	All parts of the coastal zone and whole of community.

Benefits identified in Stage 1	Extent to which development of Stages 1-4 have enabled these benefits	Additional benefits from implementation	Where these benefits are delivered and to which parts of the community
A consistent and transparent process for identifying coastal management issues that is underpinned by a risk-based framework.	This is a core function and benefit of the CMP.	The risks and risk level identified for Lake Macquarie reflect council's investment in coastal zone management over 30 years. This investment means that some risks are now reduced, and attention can turn to emerging issues and risks.	All parts of the coastal zone and all sectors of the community.
Avoided risks identified in Stage 1, from developing a CMP			
Limited understanding of true long term risk exposure to coastal hazards.	Many of these risks were identified in the CZMP. The development of the CMP has increased knowledge about wave overtopping risks (coastal inundation) on the open coast, by completing a specialist study for Nine Mile Beach.	CMP actions include monitoring of coastal condition, tide levels and hazard events, which will continue to build evidence of actual change in hazards and risks.	Focus on areas where hazards are known to be present and further data are needed to identify appropriate thresholds for change to the level of intervention. This includes low lying areas of eastern Lake Macquarie, Nine Mile Beach.
Inadequate representation of coastal risks in management tools and guiding documents (LEP, DCP), increasing the community's current and future risk exposure and creating future management problems, financial burdens, and public safety risks.	Council is well advanced with LEP and DCP clauses relating to avoidance of coastal hazard risks.	The CMP will continue to support risk avoidance and risk mitigation in land use planning. Council has also commenced preparation of a multi hazard assessment for north-western lake Macquarie, which will contribute to a better understanding of the areas which are affected by coastal hazards and other natural hazards to the extent that planning controls are required to mitigate risk.	All areas subject to tidal inundation and combined catchment and tidal inundation. The multi hazard study is the first step towards a cumulative risk profile for the city, which will benefit all residents.

Benefits identified in Stage 1	Extent to which development of Stages 1-4 have enabled these benefits	Additional benefits from implementation	Where these benefits are delivered and to which parts of the community
Reactionary and *ad-hoc* protection works that could result in negative impacts on public safety, loss of beach access and amenity and other environment and tourism impacts.	*Ad-hoc* protection works are an issue along estuary foreshores and tributary creeks of Lake Macquarie, but are not a big issue on the coastline. There are also legacy *ad-hoc* protection works on multiple lake frontage properties. These affect shoreline erosion and nearshore habitat, interacting with private jetties and ramps.	The CMP presents an opportunity to turn the focus from the main body of the lake to tributary creeks, including protection works, water quality and flood risks.	Primarily relates to CEA, but also affects some CWLR areas, such as around Fennell Bay. The benefit of better management of foreshore structures on lake and tributary foreshores is a public benefit in terms of water quality and habitat diversity/protection.
Frustration within community and agencies regarding a lack of guidance for appropriate coastal management works.	Stage 2 studies have investigated appropriate protection works and other measures enhanced coastal management of the coastline such as dune rehabilitation.	Development of strategic and technical guidance on coastal management is principally the responsibility of DPE and MEMA agencies. Council is contributing to knowledge through its local adaptation planning programs and through work on SQIDS and wetland restoration.	Further guidance in the Toolkit will assist council and its local partners to manage tributaries, foreshores, and wetlands.
Poor understanding of future risk leading to possible loss of good faith legal protection.	Council has developed a good understanding of future risk through its CZMPs and recent targeted local adaptation planning	Implementing the CMP will include monitoring actions brought forward from the LAP which will bring better understanding of the rate of change of hazard and risk associated with tidal inundation. Studies required to update the navigation dredging strategy in Swansea Channel will also enhance understanding of the interaction of coastal hazards and channel management.	All coastal management areas in eastern Lake Macquarie and other low-lying areas. Foreshore and waterway users.

Benefits identified in Stage 1	Extent to which development of Stages 1-4 have enabled these benefits	Additional benefits from implementation	Where these benefits are delivered and to which parts of the community
Reduce access to funding sources for capital works.	The CMP development process has facilitated identification of a range of funding sources (see **Section 1.9**).	Implementation of the CMP will involve further exploration of funding sources, particularly for the second and following 4-year Implementation Strategy. Note that most of the actions and the required budget, for Lake Macquarie are not capital works. The long history of coastal management in Lake Macquarie and Council's approach to risk avoidance and mitigation (using natural defences where possible) means that operational costs and staffing are the keys to success.	Capital works may be required in the later part of CMP implementation, subject to the completion of additional studies in the first 4 years. Capital works are principally for coastal protection along the channel and for selected sites on the coastline. Any works on the entrance training walls are not Council's responsibility.
Limitations to future government and external funding opportunities.	See **Section 1.9**.	See **Section 1.9**. Council has carefully considered future government and private funding sources for the longer term. In the first four-year period, Council will further consult the community and NSW Treasury about rate levies to support long term protection of the natural systems of the coastal zone that underpin community lifestyle.	Whole of coastal zone and whole of community.

Benefits identified in Stage 1	Extent to which development of Stages 1-4 have enabled these benefits	Additional benefits from implementation	Where these benefits are delivered and to which parts of the community
Additional benefits from implementing the CMP – not specifically identified in Stage 1.			
NSW Government objectives and priorities: MEMS FDS Coast and Estuary Grants Program priorities	The development of the CMP has investigated the relationship between local issues and priorities and state-wide issues and priorities.	The Lake Macquarie CMP closely aligns with and supports the achievement of priorities identified in MEMS, FDS and the Coast and Estuary Grants program. This means that local scale actions in Lake Macquarie will contribute to the achievement of these state-wide objectives and goals.	Whole of coastal zone and marine estate and whole of local community.
Benefits of program structure.	The Business Plan highlights the value of staged actions to address coastal management issues. This is the program structure for the CMP. The program for each key issue includes baseline data gathering and analysis if needed to clarify risk, it includes community awareness, policy development, on ground works (where necessary), and ongoing monitoring of outcomes. This provides for adaptive management and continuous review of thresholds for change.	Implementing the CMP will continue Council's previous successful approach.	Whole of coastal zone and whole of community.
Benefits of continuing demonstrated successful approaches.	Council's monitoring and review of previous management provides clear evidence of approaches that work in this context. These approaches are strongly supported by the community.	Successful programs will continue and be strengthened. Ongoing monitoring and performance review will provide evidence to support decisions about necessary changes in approach. Ongoing reporting of this information provides transparency for the community. Having demonstrated successful responses set in an adaptive framework will also encourage review and innovation to ensure that benefits are maintained.	Whole of coastal zone, and whole of community.

Benefits identified in Stage 1	Extent to which development of Stages 1-4 have enabled these benefits	Additional benefits from implementation	Where these benefits are delivered and to which parts of the community
Aligned with community values and Council's Community Strategic Plan Protect natural landscapes, processes, and functions. Recognise and showcase aquatic heritage. Public access to quality open space on foreshores and coastline.	This alignment means that all Council's strategic plans are working towards the same objectives for the city, which are based on community values and strategic context of the city. This enhances efficiency and cost effectiveness – in delivery and in monitoring of performance.	Implementing the CMP will continue this integration of the CMP with Council's other strategic planning initiatives.	Whole of city and whole of coastal zone.

1.5 Budget and Finance Context of the CMP

1.5.1 Historical Funding Arrangements

Lake Macquarie Council has been planning and implementing actions to protect the health and functions of its coastline and estuary for more than three decades. Within the coastal zone of the city, the highest risks relate to the health of the Lake Macquarie estuary and management actions have focused on reducing these risks.

Over the last 20 years, Council has funded coastal zone actions that are its responsibility through use of its general funds (from ratepayers), special rate levies, grants, asset replacement reserves, developer contributions and loan funds. Ongoing opportunities to invest funds from these sources are discussed in **Section 1.9**.

Historically, management of coastal risks in Lake Macquarie has also been funded through two innovative programs. The Lake Improvement Project demonstrated the value of integrated, program-based funding to address coastal risks in a complex system with management responsibilities distributed across multiple entities.

1.5.1.1 Program Based Funding for the Lake Improvement Project, 1999 to 2009

Historically, the management of the Lake Macquarie estuary has benefited for a unique funding arrangement established by the 'Premier's Taskforce into Lake Macquarie' (1998), which identified that a lack of a dedicated and secure funding stream as a key barrier to effective management of the lake.

The Lake Macquarie Project Management Committee was appointed by the then Minister for Climate Change and the Environment, which included the regional directors of the relevant State Government departments, local government representatives, community representatives and an independent chairperson.

Funding for the 10-year life of the Lake Improvement Project (1999 to 2009) totalled around $20 million which was provided through a local government contribution (generated through the special rate variation known as the 'Lake Levy') which was matched by the NSW Government by a direct allocation from Treasury.

This program-based funding model enabled multiple benefits for the management of the coastal zone. It allowed council to plan for continuous delivery of projects (not wait for a new funding round); it maintained community and agency engagement and provided flexibility to adapt the program if new constraints or critical opportunities emerged.

1.5.1.2 Environment and Sustainability Levy

Following the cessation of Lake Improvement Project in 2009, responsibility for the coordination of management of the estuary reverted to Council. Since this time, Council has continued to fund lake improvement which was in-part funded via a 'Environment and Sustainability Levy' that was in effect from 2011 till 2014.

In 2012 Council was successful in gaining IPART approval for a General Rate Variation to General Income, and a component of additional rate income was used to fund lake and coastal management. This General Rate Variation concluded in 2017, and Council does not currently charge any levies or Special Rate Variations for lake of coastal zone management activities.

1.6 The Cost of Implementing the CMP

This section discusses the total cost of implementing the actions in the CMP, over the next decade.

It is important to note that Council is not able to provide detailed costing for every action over this time frame. Budgets identified in the second and subsequent four-year period are estimates only and will be refined within the funding cycles required by IP&R. In general, budget estimates and allocations for major capital works are likely to be better documented in advance than minor projects or allocations of staff time.

For the Lake Macquarie CMP, most actions are operational items that involve staff time and/or community time or agency staff time.

In general terms, Council has:

- detailed budget information for actions that are to be implemented in the next one-year operational plan.
- good but less detailed and less certain funding detail for actions to be implemented over the first four-year planning cycle (IP&R Implementation Strategy).
- indicative information only for budgets for specific projects beyond four years. Similarly, state agency budget planning is less certain beyond four years, as issue specific and location priorities for investment, and available budgets change.

1.6.1 How Costs Have Been Identified

To identify the budget required for each action in the CMP, Council's coastal management team has:

- Reviewed its previous project budgets and actual costs, including consultation activities, communications, pilot studies, and related activities.
- Sought advice from coastal engineers for actions that will require construction of coastal protection structures or development of models.
- reviewed technical guidelines where relevant for costs for various types of environmental management.
- Consulted within the environment and sustainability team.
- Consulted with its Landcare team.
- Consulted with other relevant teams and divisions within Council and with Council leadership.
- Consulted with public authorities and with Central Coast Council to engage their expertise and experience on actions that are their responsibility, and actions which will require collaboration.

- reviewed responses from recent community satisfaction surveys about community priorities.

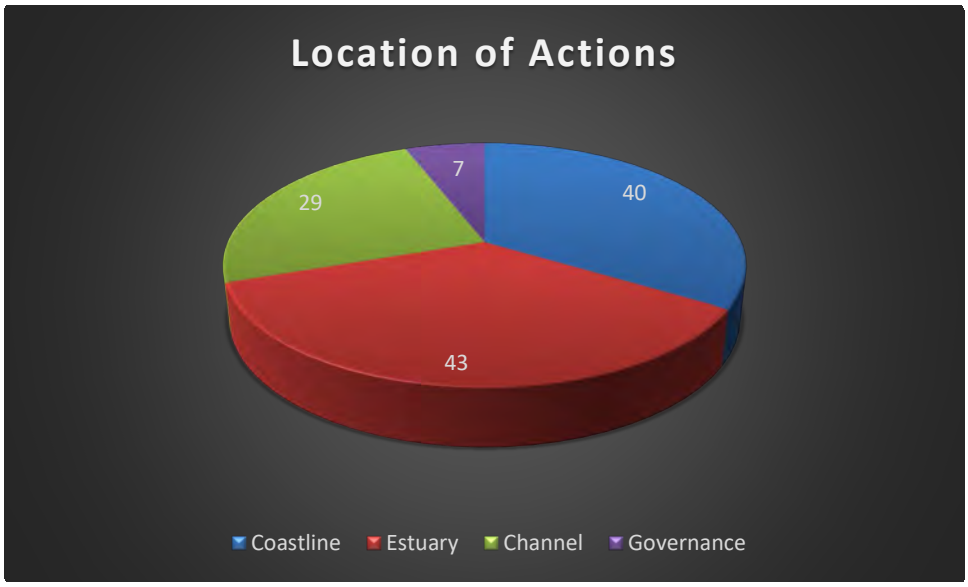
With the information obtained from these sources, Council has compiled an itemised costing for all actions, which includes estimated capital, maintenance, and operational costs (excluding staff time). Indicative staff time is provided separately for each action.

Costs are shown in the Implementation Tables for and total of 119 actions:

- Forty actions across seven issues for the coastline
- Forty-three actions across fourteen issues for the Lake Macquarie estuary
- Twenty-nine actions across nine issues for Swansea Channel
- Seven governance actions that apply to the whole coast.

The implementation tables for the CMP include actions proposed to be carried out in the catchment of Lake Macquarie estuary, where the treatment of issues will have a significant and direct benefit for lake water quality and estuary health. Examples include the streambank and riparian zone rehabilitation program in major tributary creeks. These works stabilising eroding banks and restoring riparian habitats and biodiversity. Stabilising creek banks reduces a prominent source of sediment and nutrient to the lake.

The implementation tables also show when the costs will be incurred, i.e., to commence in the first year of implementation, in the first four years of implementation or in Years 5-10 of implementation.



1.6.2 Operational Costs

Operational costs include costs for materials and costs associated with staff time required for project management and/or to carry out the work. Approximately fifty five percent of the actions in the CMP are 'ongoing' actions where a continuing management commitment (which may involve maintenance costs, as well as operational costs) is required. Forty five percent of the CMP actions are identified as 'one off,' e.g., they may involve an investigation of a specific issue to inform future management decisions.

Twenty five percent of the actions identified in the Implementation Tables will be the responsibility of Council (although some of these also involve the community) and a further group of actions will be led by Council but involve in partnership with a public authority.

While the indicative cost of most operational activities is low to moderate (generally less than $20,000 per year) or is primarily staff time, a key implementation strategy for the CMP, with a high annual budget, is council's support for Landcare. Council has allocated $1.3 million per year to support Landcare activities across the city. This budget is for an integrated program across the entire city, not just within the coastal zone.

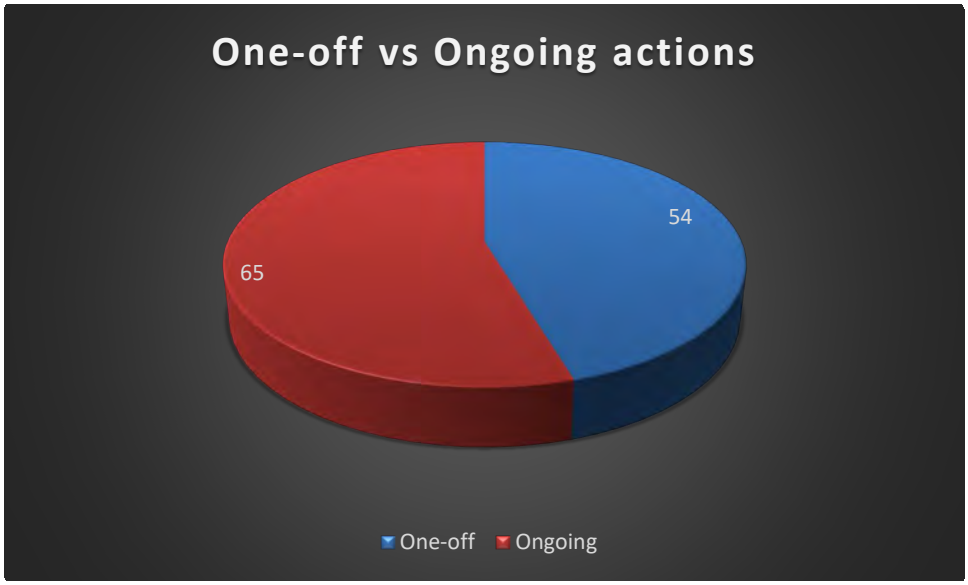
Other significant operational commitments include ongoing lake water quality/estuary health monitoring, including mapping and monitoring of sea grass (currently funded by MEMS). This will be enhanced to provide good data about specific potential impact areas, such as around boat ramps, jetties, and popular foreshore reserves. The CMP includes update of some lake management framework documents such as the mooring management plan and the sustainable navigation dredging framework for Swansea Channel. These are key to balancing the natural and recreational values of the estuary.

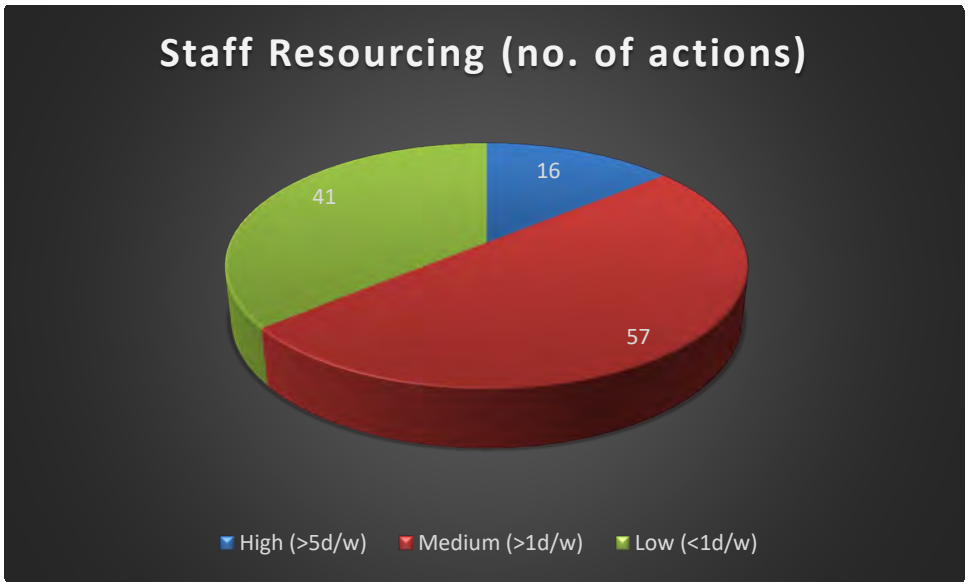
Overall, the cost of staff to provide the services identified in the CMP, over the full life of the program is a significant part of the cost of sustainable management of the coastal zone and of the city's environment. This is consistent with Council managing a large and complex coastal lake, multiple beaches and headlands and the dynamic environment of Swansea Channel. All parts of the city's coastal zone are highly valued by the community and there are high community expectations of effective management of the city's natural assets.

Indicative staff time required to deliver the CMP is shown in the Implementation Tables as High (more than five person days a week), medium (more than one person day/week, but less than five person days/week), or low (less than one person day per week).

The summary graph below shows that more than 80% of the actions in the CMP are anticipated to require low or moderate staff resources commitments. This reflects the wide range of issues to be addressed across a diverse and complex coastal zone, and the scope of investigations, communications, monitoring, stakeholder engagement, data analysis and project management tasks involved. Approximately 17% of CMP actions will require full time staff commitments.

Examples of actions requiring a high staff commitment include the continuing delivery of adaptation planning and a resilience planning approach to coastal risk, which council has been developing through its local adaptation planning projects. The collaborative engagement involved in local adaptation planning requires high staff effort but has demonstrated community resilience benefits. Council has also indicated a high staff commitment to the detailed design and planning for Hunter Water Corporation's proposed desalination plant at Nine Mile Beach; and for maintaining beach access ways and dune protection at the city's beaches. There is a high staff commitment for improving water quality urban design and managing the process of replacing or upgrading stormwater devices (SQIDS) on creeks and stormwater systems draining to the lake.





1.6.3 Capital Costs

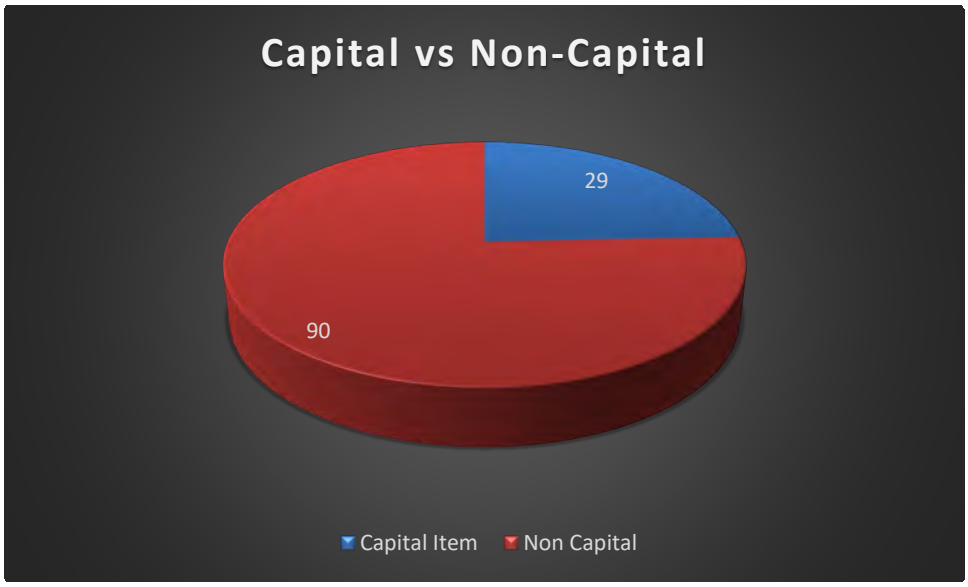
Approximately 75% of the actions included in the programs in the CMP are non-capital items.

However, there are some important capital investments, including:

- Dredging works in LT Creek to remove historic sediment accumulation in the upper tidal reaches which is affecting the health of the creek as well as local navigability.
- Staged coastal protection works to prolong the life of Redhead surf club and subsequently to relocate it out of the immediate hazard zone (beyond the time frame of this CMP).
- Asset upgrades and replacement for SQIDS, which are a key element of water quality management for the city's urban area.

- Coastal protection works to stabilise the Pelican foreshore on Swansea Channel. A separate cost benefit analysis was prepared for these engineering works in 2021.

Council proposes investigations and discussions with NPWS and other stakeholders about upgrade and extension of the coast walking track from Caves Beach to Fraser Park. The capital costs for this work are not included in the CMP budget, as the scope and scale of the work has not been defined. The costed operational actions in the CMP will provide further information to enable design and calculation of future capital costs, which are likely to exceed $2 million. A project specific business case will be prepared when more information is available.

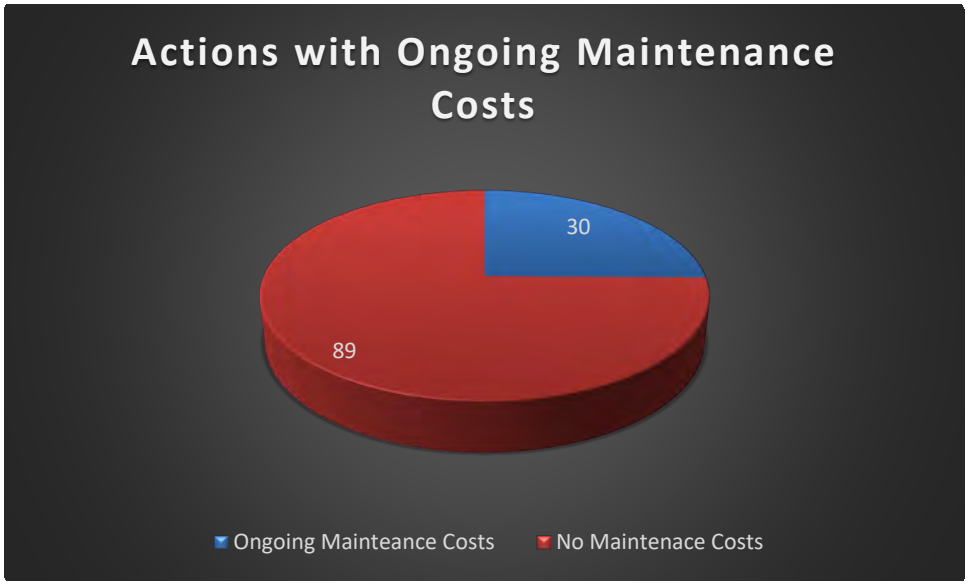


1.6.4 Maintenance Costs

Consistent with council's natural defences or soft engineering approach to coastal protection works and the focus on policy, planning and communications activities, only 25% of the actions in the CMP relate to maintenance of engineering assets or infrastructure.

Council's principal maintenance cost is for maintenance of SQIDs around the lake, including both concrete structures and vegetated SQIDs. Council currently spends $1.6 million/year on maintenance of these stormwater structures, protecting the lake from sediment and nutrient load in urban runoff.

Other important maintenance costs are the cost of ongoing navigation dredging in Swansea Channel to maintain navigability for deep keel yachts and larger cruiser vessels, and an allowance for maintenance of foreshore protection works at Pelican (and elsewhere along Swansea Channel). The distribution of costs for channel foreshore protection works will depend on the results of studies to clarify ownership of structures.



1.7 Distribution of Costs and Benefits

A distinctive feature of the Lake Macquarie CMP is that its focus is on public land and public benefit. The priority of the CMP is to protect natural systems and the health of the coastal zone in an area where community access, use and amenity are also important. Almost the entire open coastline of Lake Macquarie is public land, managed by council or NPWS. Approximately 100km of the shoreline of the Lake Macquarie estuary is in public tenure.

All costs or funding sources are from various public funds (local, state or Commonwealth) and all actions are identified as having broad public benefit. Unless otherwise specified in the Implementation Plan, the public benefit is 100%. Note that actions C2.1 and C2.6 provide benefit to the Lake Macquarie Airport, which is privately owned. This is recognised in the Implementation Plan.

The benefits of the CMP as a whole, of programs of actions for lake, channel and coastline and subprograms to address specific issues, are public benefits. The management actions benefit the health of the coastal zone which supports a wide range of public social and economic benefits. The CMP does not include coastal protection works (in the channel, on the lake foreshore or on the pen coastline) or other measures which are designed for private benefit.

Council has worked closely with communities in eastern Lake Macquarie over the last decade to develop local adaptation plans for coastal hazards and risks that will increase with climate change. The aim of these local adaptation plans is to protect the naturel environment of the area, particularly coastal wetlands, and to maintain the public benefits associated with a resilient and connected community. Some measures in the local adaptation plans will benefit private landholders by allowing homes to be maintained within the communities.

Council's role and that of other public authorities in this context is to provide a clear planning framework with requirements to mitigate risk in new or renewed residential and commercial properties; to manage risks to public assets such as holiday parks and infrastructure (including stormwater systems); and to manage risks to public foreshore land. Other measures in the local adaptation plans, such as raising and

filling residential land, will benefit private landholders, but will be paid for by the relevant landholders as part of the development process.

The public benefit focus of the CMP means that costs also accrue to council and public authorities, on behalf of the environment and community.

Allocation of management roles and responsibilities between council and public authorities is discussed in **Section 1.7.1**. The community also as important roles in implementing the CMP (for instance through time invested in Landcare projects).

The implications of this benefit and cost distribution for the funding of coastal zone management in Lake Macquarie are discussed in **Section 1.8**.

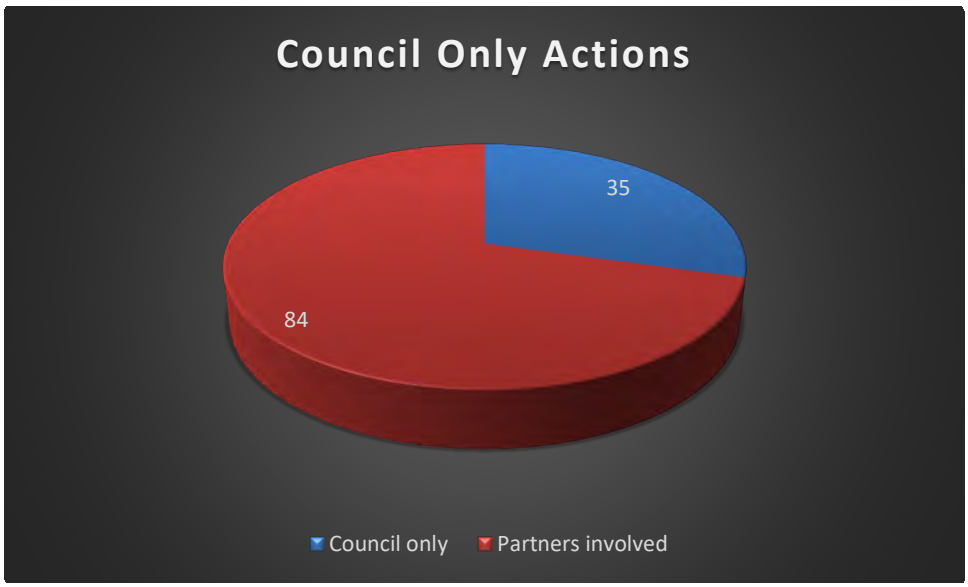
1.7.1 Roles and Responsibilities for CMP Implementation

Approximately 29% of the CMP actions are a specific role or responsibility of Council and will be implemented by Council. Some of these will be delivered in partnership with one or more public authorities, or with community representatives.

Approximately 71% of actions involve a partnership between Council and a public authority.

Overall, council is the lead for approximately 80% of CMP actions, with public authorities leading 20%.

Council has consulted with the relevant public authorities about leadership and funding of these actions and discussions are ongoing.



1.8 Proposed Funding Model

1.8.1 Budget Planning

Council operates its budget planning in accordance with the requirements of the Integrated Planning and Reporting Framework (IP&R) established by the Office of Local Government.

Council budgets are developed in relation to four-time frames:

- Operational Plan – Detailed budget allocation for 1 year.
- Implementation strategy – 4-year cycles, linked to the Community Strategic Plan.
- Community Strategic Plan – 10-year cycles.
- Longer term budget planning for asset replacement.

1.8.2 Current Funding Arrangements

Council currently funds coastal zone management activities utilising its internal funding allocations and a variety of external funding sources. An analysis of funding has been undertaken to determine funding and expenditure patterns.

As activities related to the management of the coastal zone are dispersed throughout Council's operations, there is no stand-alone budget for coastal zone management. It is also difficult to delineate between some coastal zone management activity, and other citywide programs. By way of example, the maintenance of a park on the foreshore of the lake is funded from a parks maintenance budget which relates to all parks and reserves, so the figures provided are approximations rather than precise numbers.

Council divides its funding streams between 'operational' expenditure (which tends to be recurrent expenditure that occurs every year and relates to the provision of services) and 'capital' expenditure (which

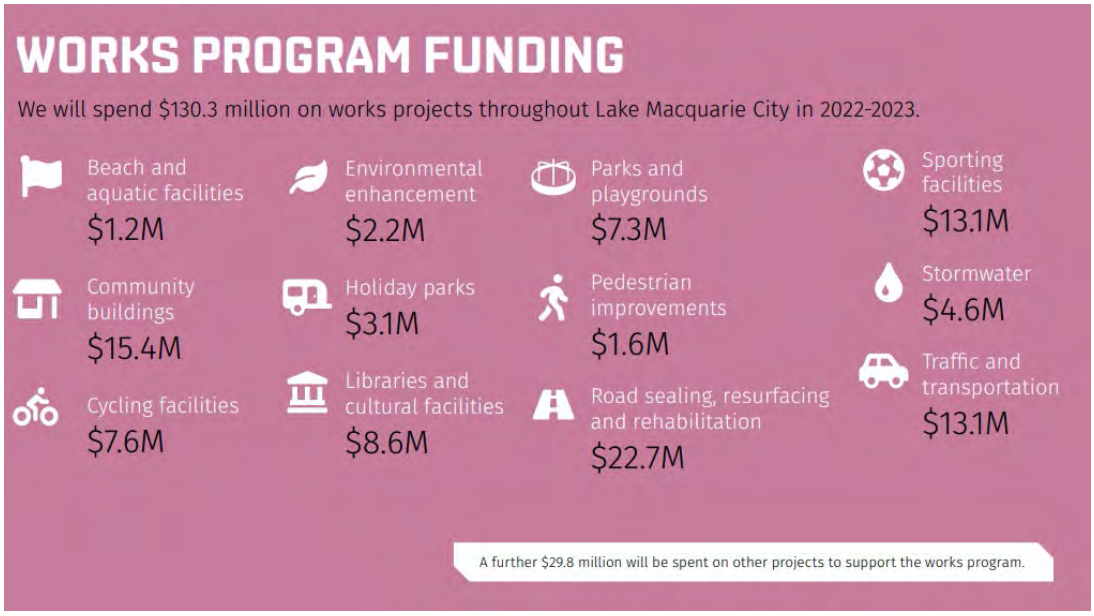
tends to be standalone projects related to a new or replacement capital item). Capital expenditure is managed through council's Capital Works Program, which works to manage the prioritisation and 'pipeline' of capital programs from inception to delivery.

Council's 'operational' expenditure for coastal zone management is estimated to be around $3 - 4 million per year for the next 4-year period, i.e., the period of the current Implementation Strategy under IP&R. This figure includes staffing and delivery of projects such as lake health monitoring, dune and wetland rehabilitation works, community engagement activities, and research.

A substantial proportion of this expenditure is related to the maintenance of the large network of Stormwater Quality Improvement Devices (SQIDs) that project water quality (approximately $1.6m million p/a), and the Lake Macquarie Landcare program (approximately $1.3 million p/a – noting that this is a citywide program and provides benefits to the whole city not just the 'coastal zone'). (Note: If the SQID maintenance and Landcare budgets are excluded, operational expenditure is approximately $800,000 p/a).

Council's 'capital' expenditure for coastal zone related activities is more variable than the recurrent operational expenditure. It varies from year to year depending on the quantum of coastal zone related projects within the City's Capital Works Program (noting that the overall Capital works program expends approximately $130 million per year and only a small proportion of these projects relate directly to the management of the coastal zone).

An overview of Council Capital works program for 2022/23 is below:



A summary of the coastal zone related capital projects and budgets for the next 4-year period (from Council's 2022-26 Delivery Program) is provided below.

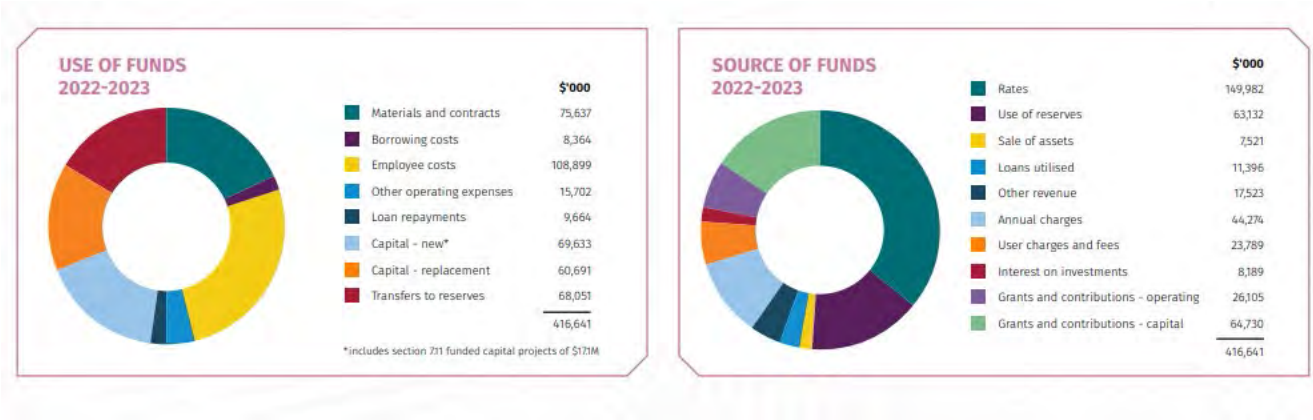
Work Order Title	SubProgram	22/23 Budget	23/24 Bud	24/25 Bud	25/26 Bud	Total
NC Stormwater Treatment Devices	Stormwater and drainage	450,000	436,503	434,356	459,184	**1,780,043**
NC Foreshore Stabilisation And Littoral Vegetation	Environmental enhancement	35,000	35,000	35,000	35,000	**140,000**
NC Creek Stabilisation And Riparian Vegetation Works	Environmental enhancement	100,000	215,736	218,799	123,980	**658,515**
AMP - AR SQIDS - Budget Only	Stormwater and drainage	124,169	127,895	131,731	135,285	**519,080**
Swansea Crown Reserve Program	Parks and playgrounds	200,000	200,000	250,000	250,000	**900,000**
Toronto Lions Park Anzac Parade Toronto - new pontoon jetty	Beach and Aquatic facilities	170,000	100,000	0	0	**270,000**
Toronto Foreshore Masterplan	Parks and playgrounds	800,000	1,500,000	3,053,600	700,000	**6,053,600**
New Recreational Fishing Platform Foreshore Reserve Bolton Point	Beach and Aquatic facilities	100,000	0	0	0	**100,000**
AMP - AR Lake Foreshore Rehabilitation	Environmental enhancement	91,500	0	0	0	**91,500**
NC Shared Pathway Fernleigh Track extension to Belmont Foreshore	Cycling Facilities	50,000	50,000	0	0	**100,000**
AMP - AR Lake Foreshore - Belmont Public Wharf opposite 58 Brooks Parade Belmont - wharf replacement	Beach and Aquatic facilities	60,000	1,000,000	0	0	**1,060,000**
AMP - AR Lake Foreshore - Bolton Point Boat Ramp 68A Middlepoint Point Road Bolton Point - boat ramp replacement	Beach and Aquatic facilities	40,000	0	409,774	0	**449,774**
NC Swansea Western Foreshore construct boardwalk carpark wayfinding and landscaping DPIE grant Public Spaces Legacy Pr	Parks and playgrounds	1,893,971	0	0	0	**1,893,971**
NC FCP -FAST Fernleigh Awabakal Shared Track - Railway Pde Belmont to Green St/Ocean Pde Belmont South-footpath cons	Cycling Facilities	5,190,000	483,000	0	0	**5,673,000**
NC Fernleigh Awabakal Shared Track Public Art	Libraries and cultural facilities	72,336	10,000	0	0	**82,336**
NC Coon Island Reserve Swansea - foreshore stabilisation	Environmental enhancement	193,500	0	0	0	**193,500**
AMP - AR Community Buildings - Redhead Surf Life Savings Club - boat shed replacement	Community Buildings	0	0	50,000	0	**50,000**
AMP - AR Community Buildings - Blacksmiths Surf Life Saving Club - boat shed replacement	Community Buildings	0	0	50,000	0	**50,000**
NC Swansea Recreation Trail Bargoed House	Parks and playgrounds	50,000	150,000	0	0	**200,000**
NC Green Point Masterplan	Parks and playgrounds	100,000	150,000	0	0	**250,000**
New viewing platform and accessable pathways Blacksmiths Beach	Beach and Aquatic facilities	100,000	200,000			**300,000**
AMP - Blacksmiths Surf Life Saving Club - Signage Upgrade	Beach and Aquatic facilities	8,240	0	0	0	**8,240**
AMP - Catherine Hill Bay Surf Life Saving Club - Signage Upgrade	Beach and Aquatic facilities	10,370	0	0	0	**10,370**
AMP - Redhead Surf Life Saving Club - Signage Upgrade	Beach and Aquatic facilities	10,370	0	0	0	**10,370**
AMP - Caves Beach Surf Life Saving Club - Signage Upgrade	Beach and Aquatic facilities	10,370	0	0	0	**10,370**
AMP - AR Parks Facilities - Ungala Road Blacksmiths - beach access board and chain walkways replacement	Parks and playgrounds	50,000	0	0	0	**50,000**
AMP - AR Recreation and Community - Blacksmiths Channel Reserve 47A Pacific Highway Blacksmiths - fish cleaning table re	Parks and playgrounds	0	0	19,941	0	**19,941**
AMP - AR Recreation and Community - Blacksmiths Beach Reserve 116 Ungala Road Blacksmiths - 3 x outdoor shower replac	Parks and playgrounds	0	0	0	34,056	**34,056**
Catherine Hill Bay Sportsground and SLSC Concept Planning - s7.11 North Wallarah Contributions Plan	Sporting Facilities	70,000	0	0	0	**70,000**
SGR - Salt Bay Track Swansea Heads - sealing of gravel road section to carpark at Salt Bay Track	Sealing gravel Roads	200,000	0	0	0	**200,000**
		10,179,826	**4,658,134**	**4,653,201**	**1,737,505**	**21,228,666**

Due to the fluctuations from year to year, and lack of detail on projects in the later years of the program (as projects are still in planning and are yet to be fully costed) it is difficult to describe an accurately average annual capital expenditure, but annual expenditure in the $3 to $6 million range is predicted into the future for coastal zone management activities.

1.8.3 Source of Funds

Council funds its operations using a variety of funding sources, and the overall funding sources for 2022/23 are illustrated below.

In 2022-23, Council is proposing that 36% of its budget for **all responsibilities** will be funded from rate revenues. Grants for capital projects and operating projects together account for 19.8% of the budget and reserves comprise 15.1%. Annual and user charges combine to account for 16.3% of the annual budget for the coming year. Community contributions as work in kind, such as by Landcare groups, is important for the management of some types of coastal assets in Lake Macquarie.



Council funds its expenditure on **coastal zone management** through including:

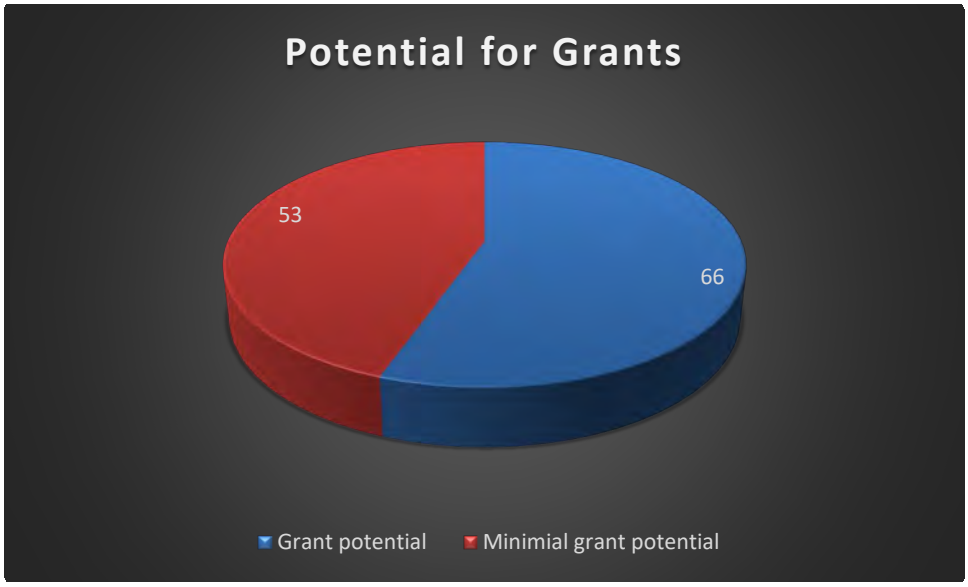
- general funds
- grants
- asset replacement reserves
- developer contributions
- loan funds.

Whist the specific details on funding sources vary between activities, typically:

- operational activities are funded predominantly by general funds.
- capital projects are funded by loan funds and developer contributions (in the circumstance where the capital item is specified in, and levied for in a Development Contribution Plan, which tend to focus on the provision of community, recreational and transport facilities). Funds from asset replacement reserves are also used where the expenditure relates to the replacement of an existing asset.

Grant funding is also used to supplement Council funding and is sourced from a variety of State and Federal grant programs. However, the NSW Coast Estuary and Floodplain Grants have been the most significant source of recurrent grant funds for coastal zone management activities over recent years, where protection of natural systems is the focus of the action. Council has also been successful in obtaining grants for boating infrastructure such as launching ramps, jetty upgrades and pump out facilities, from Transport for NSW (TfNSW) boating programs. Some strategic planning initiatives and regional scale projects have been funded through regional development grants from State and Commonwealth government.

Over the past 4-year delivery program period, grants for coast and estuary related projects worth approximately $1.5 million have been received by Council. This varies from year to year, and equates to average annual grant income of $375,000 p/a.



1.8.4 Council's Long-Term Financial Plan

Council has historically operated in a surplus position. However, in recent years, Council has been operating in a strategic deficit, intentionally utilising reserves to fund expenditure for the purposes for which the reserves were held, in some cases to offset fee increases. In the 2021-22 financial year, Council financial statement indicates a deficit of $641,000.

Council aims to return the financial operating result to a surplus position over the course of the Delivery Program 2022-2026 and will actively seek opportunities to continue towards a two per cent (of operating income, excluding capital income) surplus operating position.

The challenges faced by Council in maintaining long-term financial security are summarised in the figure below.

As a result of these challenges, it is not feasible for Council to significantly increase current levels of expenditure on coastal zone management related activities without impacting upon long-term financial sustainability unless addition sources of revenue are available.

1.8.5 Opportunities for Funding Coastal Zone Management

Several opportunities to increase funding for coastal zone management activities have been identified. These are outlined in the following sections.

1.8.5.1 Special Rates

As described in the 'Historic Funding Arrangement' section above, Council has historically utilised 'special rates' (often referred to a 'levies') to provide additional income to fund coastal zone management activities. For most of the period from 1999 till 2017, additional income was received to fund coastal zone manage through the 'Lake Levy', 'Environment and Sustainability Levy', or the 'Special Variation to General Income'. Inherent to the approval for the process establishment of any of these funding sources, Council was required to demonstrate community support. Community surveys and engagement activities have previously indicated a high 'willingness to pay' by Lake Macquarie's ratepayers for coastal zone management related activities, especially activities related to protecting and enhancement the health of the lake.

Council does not currently charge any Special Rates (levies) for lake of coastal zone management activities. However, if a new Special Rate was introduced and approved, it has the potential to provide additional income for coastal zone management activities (and potentially other environmental sustainability related programs) and assist in improving Council's long-term financial sustainability.

1.8.5.2 Stormwater Charge

Section 496A of the Local Government Act 1993 include a provision that allows local councils to introduce an annual charge for stormwater management services. Many local councils already implement this charge (which is not currently charged in the by Lake Macquarie City Council).

It is well recognised that urban stormwater has a significant role in influencing the health of the estuary, and the installation and maintenance of stormwater treatment systems is important to estuary health, but places a significant financial pressure on councils. The introduction of a stormwater charge to Lake Macquarie has potential to provide financial resilience for council and environmental benefits to the coastal zone.

1.8.5.3 Increased Grants

Additional income from grant programs has the potential to result in an increased financial capacity for Council to undertake coastal zone management activities.

However, several issues need to be considered in relation to grants, including:

- Instability (changing priorities and funds available) of grant programs.
- Many grant programs focus on new Capital projects as compared to ongoing Operational projects/program (noting that many actions in the CMP are recurrent operational rather than new capital).
- Receipt of large grants for new capital items results in additional ongoing maintenance costs to Council for maintenance and depreciation of grant funded capital items, which can place additional burdens on Council's long-term financial sustainability.
- The administration burden of some grants is high, resulting a large amount of staff time being required for administrative purpose, reducing the staff resourcing for other projects.
- The project level funding provided by most grant programs is less effective at delivering long-term outcomes as compared to longer-term funding provided at a program level.

1.8.5.4 Developer Contributions

Developer contributions enabled under the Environmental Planning and Assessment Act 1979 are linked to the provision of items specifically identified in Development Contributions Plans. They provide a significant source of funds for Council's Capital Works Program. This funding is specifically linked to the provision of items specifically identified in Development Contributions Plans.

Historically, these plans have focused mainly on the provision of community, recreational and transport facilities as required by legislation, and have not included a significant focus on coastal zone management infrastructure. However, the ongoing review of these plans provides an opportunity to consider the potential inclusion (where appropriate and consistent with legislation) of an increased emphasis of coastal zone management related infrastructure.

1.8.5.5 Coastal Protection Service Charge (CSPS)

The CPSC is a fee that councils can levy on a parcel of rateable land where either the current or previous owner has voluntarily constructed, or contributed to the cost of constructing long-term coastal protection works, that provides benefits to the associated land.

The CPSC is underpinned by:

- Section 496B(1) of the Local Government Act 1993 (NSW)
    - provides Council the ability to make and levy an annual charge for the provision of coastal protection services, being services that relate to existing coastal protection works.
- Section 27(2)(b) of the Coastal Management Act 2016 (NSW)
    - Section 27 of the *Coastal management Act 2016 (NSW)* states development consent must not be granted for coastal protection works under the *Environmental Planning and Assessment Act 1979* (NSW), unless adequate funding for the life of the coastal protection works is established by either or both of the following:
        - legally binding, lifecycle restoration and maintenance cost funding arrangements have been established with the relevant owner(s) of the protected land and / or the council / public authority, and /or
        - payment to the relevant council of an annual charge for coastal protection services.
- NSW Government 'Coastal Protection Service Charge Guidelines'
    - describes the requirements associated with levying the CPSC, including eligibility criteria and allowable CPSC funded activities.
        - The CPSC covers councils' reasonable costs of providing coastal protection services to the land on which the charge is levied. The CPSC provides for maintaining and repairing the works and mitigating any impacts (such as replacement of eroded beach sand).

Council understands that:

- An asset management plan is required to levy the CSPC to cover expected maintenance, repair, and impact management costs (including inflation). The net present value of the costs associated with delivering the asset management plan will form the basis of the CPSC calculations.
- The CPSC can only cover **maintenance and repair costs of existing structures** and applied to landowners who have voluntarily constructed a coastal protection work, or contributed to the capital cost. That is, the CPSC cannot be used to fund capital works on new structures, and / or structures not agreed to by landowners.

The NSW Government recommends the CPSC does not vary considerably from year to year, to avoid an unexpected cost impost on landowners. In circumstances where Council does not increase the CPSC fully, Council should fund the required services through one or more of the following mechanisms outlined under 'Emergency repair costs':

- external reserve (equity)
- loans (debt), or
- special one-time payment (equity).

1.8.5.6 Crown Reserve Funding Model

Previous analysis undertaken as part of the Long-term Dredging Strategy for Swansea Channel identifies that in 2012 "Boat owners in Lake Macquarie contribute approximately $7 million annually to the State government in licences and fees" (Umwelt 2013) and this amount is expected to have risen significantly since this time (due to inflation and the significant increase in vessel numbers locally).

However, currently only a relatively small proportion of this income is invested directly by the NSW Government back into the Lake Macquarie area for boating or lake management related purposes.

Establishment of a framework whereby income generated by activities based on Lake Macquarie is reinvested locally into lake management and the provision of boating related infrastructure and services has previously been suggested as a potential model that could have significant benefits for the management of Lake Macquarie and the local boating community. As the lake is Crown land, the creation of a Crown Reserve Funding Model that reinvests income generated from the reserve back into its management is an option that may provide benefits.

1.8.5.7 Beneficiary Pays (for Projects that Provide Private Benefit)

As discussed above, there are very few projects in this CMP that are for private benefit. Council's focus is on projects on public land (or waters).

1.8.6 Actions to Enhance the Security of Coastal Zone Management Funding

The following actions have been identified as potential means of increasing the availability and security of funding for Council's coastal zone management activities into the future.

1. Investigate the introduction of Special Rate Variation provide additional income for coastal zone management activities.
2. Investigate the introduction of a Stormwater Charge.
3. Continue to seek grant funds where appropriate.
4. Advocate to have the Coast and Estuary program (and other relevant funding programs) funding modified so the grant guidelines to provide for program level funding over longer terms rather than short term project level funding.
5. Where appropriate and consistent with legislation, include relevant coastal zone management actions in the review of Developer Contribution Plans to increase access to developer contribution funding.
6. Investigate Coastal Protection Service Charge for funding of the maintenance of specific large-scale foreshore projects, particularly those in Swansea Channel.

7. Advocate to have the Coastal Protection Charge expanded to fund 'new' coastal and foreshore protection works (not just maintenance).

8. Investigate and advocate for Crown Reserve Model to be utilised for lake and boating related programs.

9. Apply beneficiary pays principles for foreshore and coastal protection projects that have a private benefit.

10. Continue to investigate emerging opportunities for additional income.

1.8.7 Funding Opportunities Conclusion

Compared to many other local government area, Lake Macquarie council has well established funding mechanisms to provide for effective coastal zone management. Funding for coastal zone management has been embedded into Council's planning and resourcing strategies for many years. It is considered that Council is well placed for the next 4-year 2022-26 Delivery Program term to continue to delivery effective coastal zone management using the current funding arrangements, with supplemental grant income for specific projects.

However, it is noted that many of the actions contained in the CMP are reliant on staff resources rather than a specific budget allocation. Hence, Council will review the allocation of its environmental and risk management staff resources and consider the provision of additional staff resources when considering its ongoing investment in coastal zone management related activities.

The ongoing financial pressures experienced by local governments means that there is less certainty about Council's ability to allocate the necessary amount of funding to provide for effective management of the coastal zone in period beyond council's current 2022-26 Delivery Program.

To improve council's coastal zone management capacity in the medium to longer term, and improve its overall financial sustainability, several actions to enhance the security of coastal zone management will be investigated over the first four years of the Program, to secure appropriate funding for the subsequent 4-year implementation strategies.

1.9 Conclusion – the Business Proposition for Implementing the CMP

Investment in the health, use and amenity of the coastal zone has long term benefits for the urban community of Lake Macquarie. The business proposition for investing in a healthy coastal zone with quality infrastructure for access and use can be summarised in nine key points.

Although these values are qualitative, and currently the budget required for delivery of the program is estimated only, there can be no doubt that investing in a healthy coastal environment, within a major regional city, and within easy reach of other large population centres, sets up very significant social and economic values. Council's community satisfaction surveys provide clear evidence of this healthy coast - happy community nexus.

- A demonstrated track record of enhancing community lifestyle values by protecting and restoring natural systems.

- Value for the community – a healthy lake underpins recreational amenity and economic development opportunities.
- Value for the people of NSW. The Lake Macquarie CMP is strongly aligned with NSW government priorities and rationale for protecting and restoring a healthy coastal zone.
- Community commitment and involvement – one of the highest budget items is to support Landcare projects which engage community volunteers to protect the health of lake side ecological communities.
- Public investment in public land and for public benefit.
- Efficient use of Council resources, targeted to real priorities for a coastal city with high lifestyle values and expectation of council's environmental performance.
- A program based and adaptive approach – right investment at the right time, across a spectrum of baseline data collection, technical and socioeconomic investigations, communications, detailed planning, on ground works to protect coastal processes and to strengthen safe and sustainable public access and the monitoring and reporting that delivers accountability.
- Flexible and innovative longer term funding mechanisms are available to extend current resources. This includes investment inputs from public authorities when an action is their responsibility – costs will be met by the right organisation. It may also include direct community contributions (via reintroducing a version of the coastal environmental management levy), to offset the direct benefits to the people of the city.
- The value of partnerships - achieving more together.

  The Lake Macquarie CMP creates value and provides a positive return on investment, for the local community and the people of NSW.

LAKE MACQUARIE CITY

COASTAL ZONE EMERGENCY ACTION SUBPLAN (CZEAS)

Contents

Definitions

BCaRT	Lake Macquarie Council Business Continuity and Resilience Team
Beach	An area that is generally composed of sand or pebbles or similar sediment that extends landwards from the lowest astronomical tide to the line of vegetation or bedrock or structure.
Beach erosion	The offshore movement of sand from the sub-aerial beach during storms or an extreme or irregular event.
BoM	Bureau of Meteorology.
Combat Agency	The agency identified in the Local, Regional or State Emergency Management Plan (EMPLAN) as the agency primarily responsible for responding to a particular emergency.
Coastal emergency	Beach erosion, coastal inundation or cliff instability occurring through storm activity or extreme or irregular events which threatens to endanger the safety or health of people or destroys or damages, or threatens to destroy or damage any property.
CMP	Coastal Management Program.
CM SEPP	State Environmental Planning Policy (Coastal Management) 2018.
Coastal protection works	Activities or works to reduce the impact of coastal hazards on land adjacent to tidal waters and includes sea walls, revetment and beach nourishment.
CM Act	Coastal Management Act 2016.
CZEAS	Coastal Zone Emergency Sub-Plan.
DPIE	Department of Planning Industry and Environment.
EMPLAN	Emergency Management Plan.
LEMO	Local Emergency Management Officer.
LEOCON	Local Emergency operations Controller.
Council	Lake Macquarie City Council.
SES	State Emergency Service.
SERM Act	State Emergency and Rescue Management Act 1989.
SLSC	Surf Life Savings Club.
Emergency coastal protection works	Works comprising the placement of sand, or the placing of sandbags for a period of not more than 90 days, on a beach, or a sand dune adjacent to a beach, to mitigate the effects of coastal hazards on land.

1.
Introduction

Coastal councils are required to prepare a Coastal Management Program (CMP) in accordance with the Coastal Management Framework. Lake Macquarie City Council (Council) is required to develop a Coastal Zone Emergency Action Sub-Plan (CZEAS) under the Clause 15(1)(e) of the *Coastal Management Act 2016* (CM Act) and the CZEAS is to be included as a sub-plan of the CMP.

1.1 Purpose and aims of the CZEAS

The purpose of a CZEAS is to identify and facilitate the implementation of appropriate emergency responses for coastal hazard related emergencies.

The aims of the plan are to:

- protect human life and public safety
- minimise damage to property and assets
- minimise impacts on social, environmental and economic values
- not create additional hazards or risks.

Clause 15(3) of the CM Act specifies:

A CZEAS is a plan that outlines the roles and responsibilities of all public authorities (including the local council) in response to emergencies immediately preceding or during periods of beach erosion, coastal inundation or cliff instability, where the beach erosion, coastal inundation or cliff instability occurs through storm activity or an extreme or irregular event. For the purposes of this CZEAS, those roles and responsibilities include the carrying out of works for the protection of property affected or likely to be affected by beach erosion, coastal inundation or cliff instability.

A CZEAS must identify any requirements for how emergency coastal protection works, within the meaning of the State Environmental Planning Policy (Coastal Management) 2018 (CM SEPP), are to be carried out. Clause 19(4) of the CM SEPP defines emergency coastal protection works to mean 'works comprising the placement of sand, or the placing of sandbags for a period of not more than 90 days, on a beach, or a sand dune adjacent to a beach, to mitigate the effects of coastal hazards on land'.

The CZEAS should be prepared to facilitate effective emergency responses by:

- defining a coastal emergency and triggers for emergency response actions
- identifying the locations that may be affected by beach erosion, coastal inundation or cliff instability that would constitute a coastal emergency
- outlining the roles and responsibilities of all public authorities (including the local council) and coordinating their response to emergencies immediately preceding or during periods of beach erosion, coastal inundation and cliff instability
- identifying the locations and types of works that may be undertaken for the protection of property and assets
- outlining what actions are to be undertaken in the prevention, preparation, response and recovery phases of emergency management
- informing the public and potentially affected property owners about their responsibilities during a coastal emergency and what actions they are and are not permitted to undertake.

This plan does not include:

- matters dealt with in any plan made under the State Emergency and Rescue Management Act 1989 (SERM Act) in relation to the response to emergencies
- proposed actions or activities to be carried out by any public authority or relating to any land or other assets owned or managed by a public authority, unless the public authority has agreed to the inclusion of those proposed actions or activities in the program.

1.2 Activation

The arrangements in this CZEAS are always active and do not require formal activation. This plan supports the Lake Macquarie EMPLAN which is always active in anticipation of the need to coordinate support and resources requested by combat agencies.

1.3 Extent of CZEAS

This CZEAS extends to land mapped in Figure 1 which includes coastal areas potentially impacted by beach erosion,coastal inundation or cliff instability. Council's open coast extends from Ghosties Beach in the south to Glenrock Lagoon (Burwood Beach) in the north, approximately 32 km of coastline. The coastline typically consists of beaches and rocky headlands with prominent features including the two breakwaters at the Lake Macquarie entrance channel, the large sandy coastline of 9 mile beach and numerous small drainage outlets. The CZEAS extents are shown in Figure 1.

The following studies assisted with Council's understanding of risks from potential coastal emergencies:

- BTM WBM, Lake Macquarie Coastal Zone Hazards and Risk Assessment Final Report, Final Report, August 2013 (BTM WBM 2013)
- BTM WBM, Lake Macquarie Coastal Zone Management Options Study Final Report, Final Report, May 2012 (BTM WBM 2012)
- Robert Carr Australia (RCA), Lake Macquarie Coastline Hazard Study - Glenrock Lagoon to Little Beach, Preliminary Geotechnical Hazard Zoning of Coastal Cliffs/Slopes, RCA Ref 8613-301/3, March 2013 (RCA 2013)
- Cardno Geotech Solutions (Cardno), Slip Slidin' Away, Coastal Cliff Stability and Safety Assessment, Cardno Ref: CGS2214, February 2015 (Cardno 2015)
- Cardno, Geotechnical Assessment, Clifftop Stability in High Hazard Coastal Locations, Cardno Ref: CGS3129, June 2017 (Cardno 2017)
- Salients, Lake Macquarie Wave Overtopping Assessment, June 2021 (Salients 2021).

The spatial extent of this CZEAS covers the predicted beach erosion, cliff instability and coastal inundation events based on the information provided in the above reports and the experience of Council Staff. The key at risk locations to potential coastal emergencies are outlined in Section 2. The CZEAS is related to impacts to the open coastal zone from coastal emergencies. It does not extend to Council coastal estuary and channel except in the case of Reid's Reserve which is adjacent to the southern channel training wall and impacted by coastal emergencies.

Figure 1: CZEAS extent.

1.4 Defining a coastal emergency

This CZEAS defines a coastal emergency as 'beach erosion, coastal inundation or cliff instability occurring through storm activity or extreme or irregular events which threatens to endanger the safety or health of people or destroys or damages, or threatens to destroy or damage any property'. This definition was informed by Clause 15(3) of the CM Act and Clause 1(4) of the SERM Act. The term 'property' is defined in Section 4 of the SERM Act and includes property, assets and the environment in the State.

The broader use of the term 'emergency' as defined in the Clause 1(4) of the SERM Act and used in plans under the SERM Act are outside the scope of this CZEAS. This includes emergency management under Local, Regional or State Emergency Management Plans (EMPLANs).

The objective of an EMPLAN is to ensure the coordinated response by all agencies having responsibilities and functions in emergencies. During an emergency, hazard specific EMPLANs are implemented by the identified lead Combat Agency. The State Emergency Service (SES) would be the lead Combat Agency during a coastal emergency response which triggers an EMPLAN for storm activity (NSW State Storm Plan 2018). Under the NSW Storm Plan (2018) Action 1.4.3 identifies that the emergency management of coastal erosion not caused by storm activity will be controlled and coordinated by the Local Emergency operations Controller (LEOCON). Council would follow the direction of the Combat Agency and provide support as outlined within the Lake Macquarie Flood Emergency Sub-Plan 2013, Lake Macquarie EMPLAN, State Storm Plan 2018 and this CZEAS.

CZEASs can be implemented without enforcement of Local, Regional or State EMPLANs. Coastal emergencies which do not trigger the implementation of EMPLANs under the SERM Act will be managed by Council. An example might include a large swell and high tide overtopping breakwaters and presenting a risk to life or property. It is not possible to determine a trigger event for such an occurrence. Therefore, the determination for Council to invoke this CZEAS would be based on monitoring of the beach state. The ongoing monitoring of the coastal zone is encompassed by typical Council operations and actions in the CMP.

If required, the Lake Macquarie EMPLAN could be implemented following a request from the Local Emergency Management Officer (LEMO) in consultation with the LEOCON and SES. The severity of the emergency defines the scale of response. A coastal emergency outside the resources and capabilities of Council should trigger a request for assistance by the LEMO from the appropriate agency or initiate the implementation of the Lake Macquarie EMPLAN and broader emergency management arrangements. Figure 2 provides a simplified flow chart establishing the lead Combat Agency during an emergency.

Nine key agencies which may have roles and responsibilities during coastal emergency events:

- Commonwealth Bureau of Meteorology (BoM)
- NSW State Emergency Service (SES)
- NSW Police
- Department of Planning, and Environment (DPE)
- Council
- Marine Rescue NSW
- NSW Ambulance Service
- Surf Life Saving NSW
- Reconstruction NSW.

Council maintains a contact register of all key agencies, compiled as part of the Local Emergency Management Committee charter.

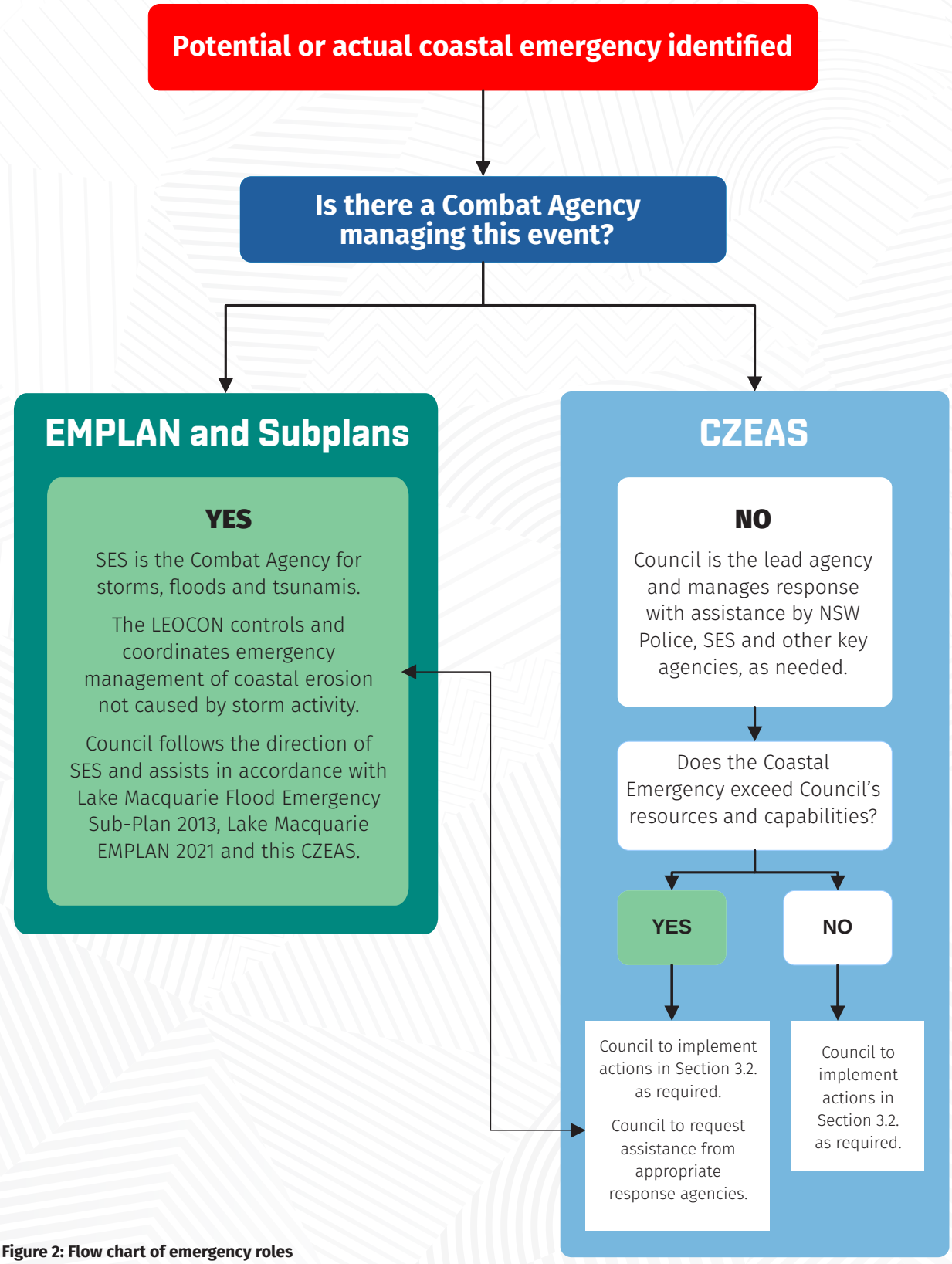


Figure 2: Flow chart of emergency roles

1.5 Review

This CZEAS is to be reviewed within five years of adoption. Earlier review may be required:

- Following a coastal emergency and critical review of this CZEAS as outlined in final action in recovering phase of the emergency management cycle (Figure 12)
- After a review of the Local, Regional or State EMPLANs or relevant sub-plans that identify changes impacting the CZEAS
- new/updated scientific hazard information becomes available.

2.

Overview of hazards and key at risk locations

2.1 Beach erosion

Beach erosion is defined as the offshore movement of sand from the sub-aerial beach during storms or an extreme or irregular event. A beach erosion emergency occurs when property or life are at risk and can occur without a storm event, for example:

- Heavy swell from major offshore climate and ocean drivers which raise water levels can cause significant and sudden erosion
- Erosion from low to moderate swells acting on a depleted beach profile
- Slumping of the erosion escarpment or erosion protection structures after an event has passed.

Council identified the following key locations potentially at risk to a beach erosion emergency:

- Redhead Surf Life Savings Club (SLSC), Belmont-Swansea SLSC and Caves Beach SLSC including their adjacent carparks and amenities, and the private sewer line to the surf club on Redhead Beach
- Carparks, Flowers Drive and disused railway line (heritage listed) on Middle Camp Beach, Catherine Hill Bay
- Road bridge Catherine Hill Bay, between Catherine Hill Bay & Middle Camp on Flowers Drive
- Two helicopter landing areas – Redhead (First Creek) and Blacksmiths (Granny's Pool)
- Viewing platform located off Maneela Street, Blacksmiths.

The above locations were based on experience of Council staff and property which is within the medium risk zone during the immediate planning horizon shown on Drawings G-1 to G-9 in the BTM WBM 2013 report. The key at risk locations to beach erosion are shown on Figure 3 and 4.

Beach erosion during events determined as low risk in the immediate planning horizon (BTM WBM 2013 Drawings G-1 to G-9) might threaten the following property and assets:

- Up to three properties on Ebsworth Street, Redhead (and associated sewer and water lines)
- One private property on Flowers Drive, Catherine Hill Bay
- The outfall and effluent main to Belmont Sewage Treatment Works on Nine Mile Beach.

Erosion risks to key assets include:

- stormwater and drainage outlet structures located on beaches
- defined beach and dune access tracks under the care and control of Council
- beaches and dunes.

In the immediate planning horizon, these assets are considered to be designed to accommodate expected erosion events or are temporarily affected by erosion, limiting their use by the community (such as beaches and accessways). Large scale preparedness works protecting beaches, dunes and access tracks from erosion/recession are outside the scope of this CZEAS and are managed under the actions of the CMP.

The landward extent of the erosion hazard as considered in this CZEAS will increase as sea levels rise due to climate change, particularly in the locations of Redhead Beach, Blacksmiths Beach and Ungala Road, Belmont Wastewater Treatment Plant and the southern end of Middle Camp Beach, Catherine Hill Bay. The risks of beach erosion in planning horizons of 2050 and 2100 are outside the scope for this CZEAS, however, these increasing risks should be considered in future coastal emergency planning measures.

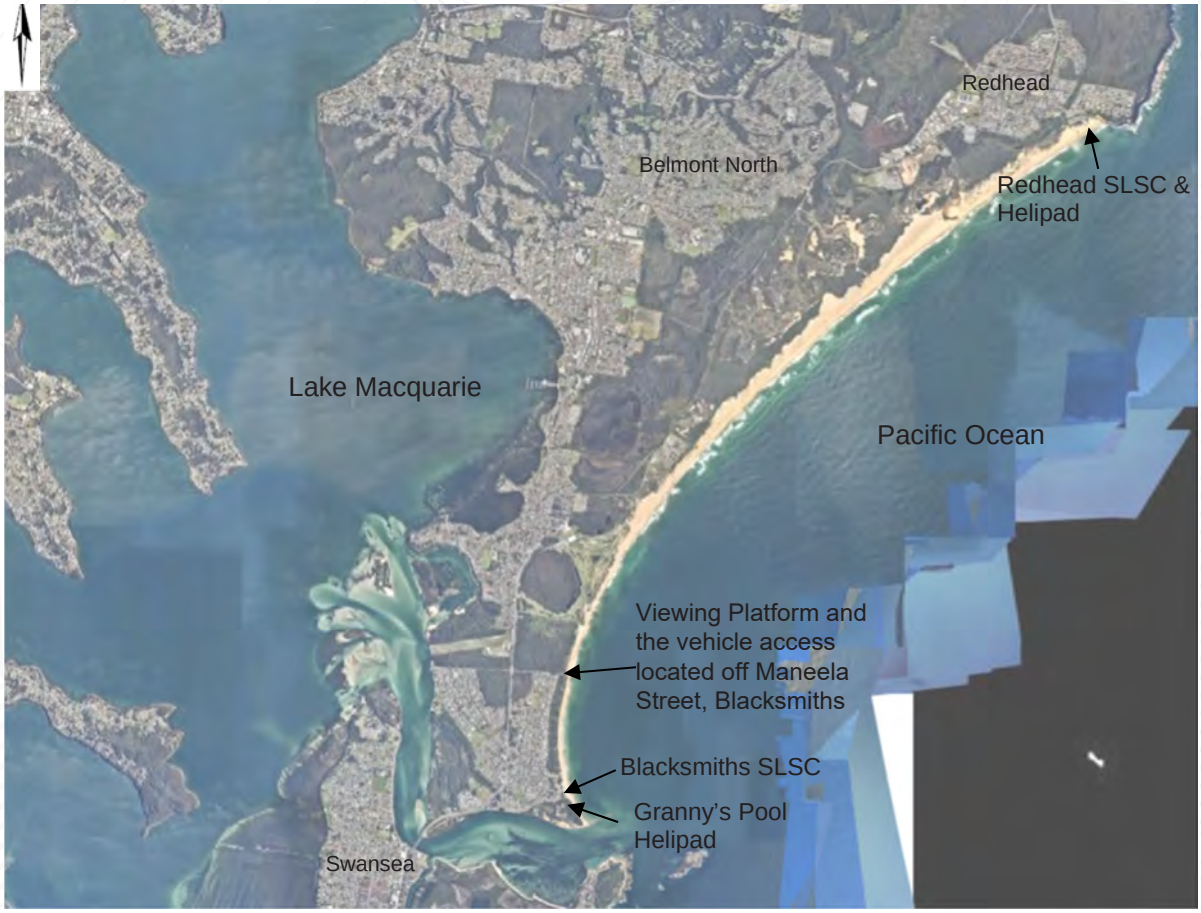


Figure 3: Northern open coast zone and key locations for property at risk to beach erosion.

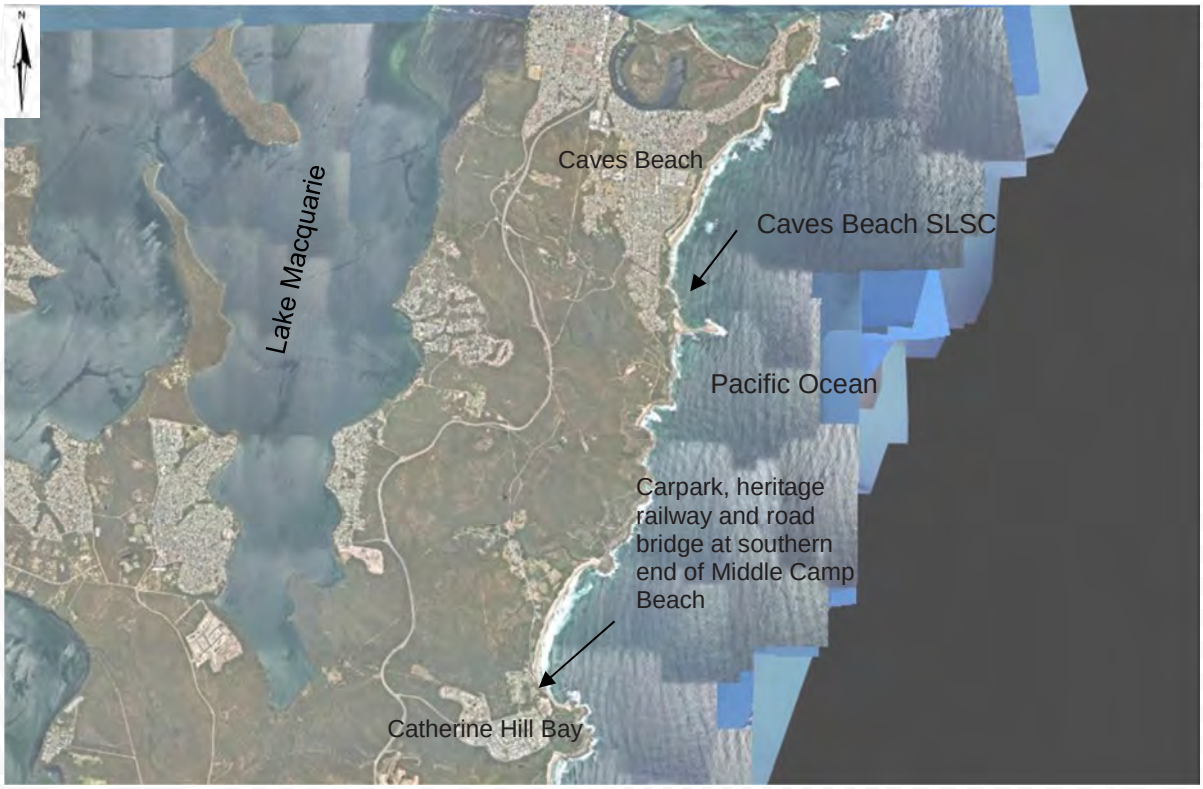


Figure 4: Southern open coast zone and key locations for property at risk to beach erosion.

2.2 Coastal Inundation

Coastal inundation occurs when a combination of marine and atmospheric processes raises water levels at the coast above normal elevations, causing land that is usually 'dry' to be inundated by seawater. It is often associated with storms and wave overtopping of natural or man-made structures that can cause inundation of land behind those structures. Wave overtopping and inundation can cause damage to properties and can be a risk to public safety.

Key sites for potential coastal inundation are shown on Figures 5 and 6 and include:

- Redhead SLSC, Caves Beach SLSC and their adjacent amenities and carparks
- Carparks and Road bridge at Flowers Drive, Catherine Hill Bay
- Reids Reserve, Swansea Heads
- Ocean Road connecting to Belmont Waste Water Treatment Plant and 4WD beach access to third creek at 9 mile beach
- Swansea channel northern breakwaters and footpath extending to Granny's Pool
- Blacksmiths residential area.

The key locations left were based on the BTM WMB 2013 report, the Salients 2021 report and the experience of Council staff. Salients recommended the use of the CZEAS as one potential measure to manage coastal inundation risks in the immediate planning horizon. The risks from coastal inundation will increase as sea levels rise due to climate change. In the medium to longer term, actions within the CMP or future iterations of the CMP should address increasing risks from coastal inundation and sea level rise. For example, Salients recommended the raising of low-lying beach accessways to Blacksmiths Beach and formalising these accessways with trafficable surfaces to minimise degradation of the dunes.

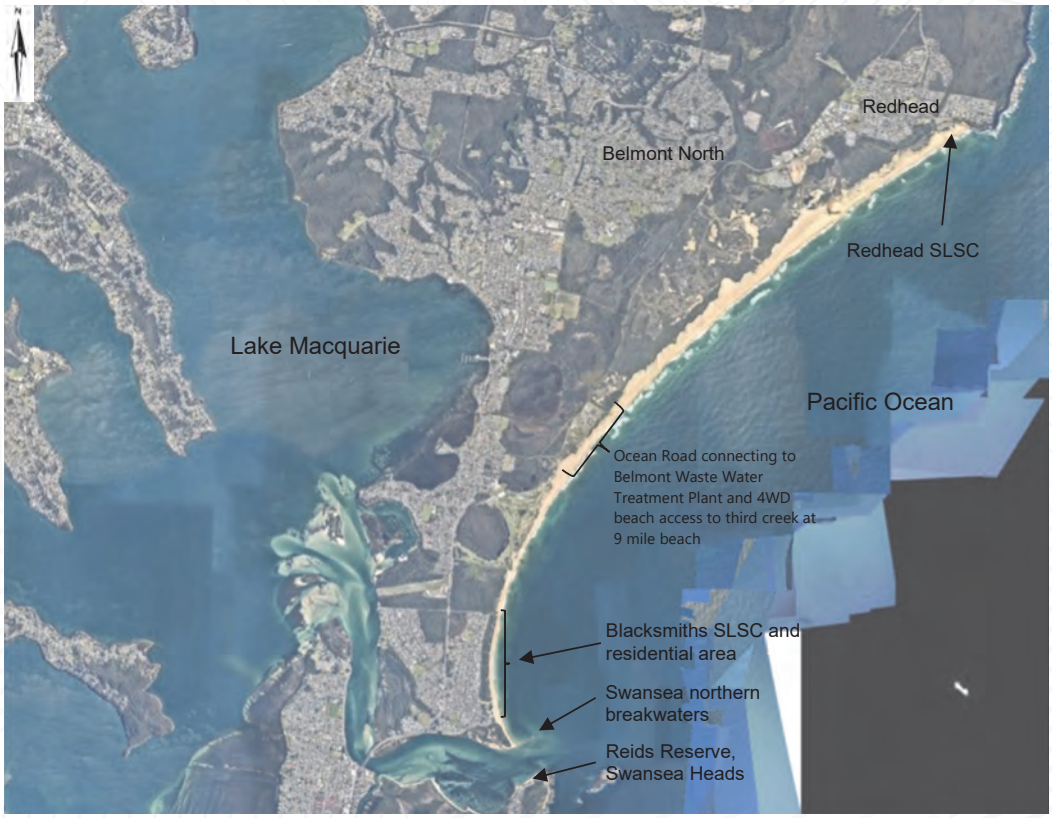


Figure 5: Northern open coast zone and key at risk locations for coastal inundation.

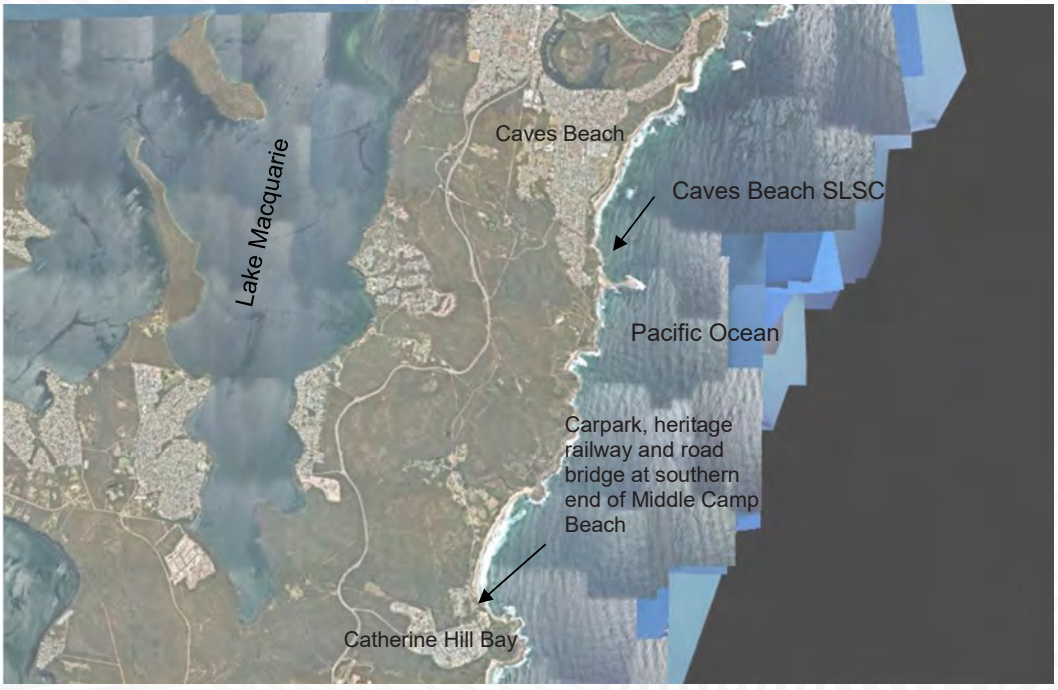


Figure 6: Southern open coast zone and key at risk locations for beach inundation.

2.3 Cliff instability

Cliff instability refers to a variety of geotechnical processes on coastal cliffs and bluffs, including rock fall, slumps and landslides. It may be driven by coastal processes such as wave undercutting and overtopping or by differential weathering of rock layers in cliffs and bluffs or by surface and groundwater flows. Instability may occur during or following a coastal storm event, but may also occur at other times. There may be very little warning that a cliff instability incident is imminent. These hazards may endanger life and property at the site of the process e.g. through collapse of a lookout platform or walking track, or undermining of dwellings and at the toe of the cliff or bluff. They may result in risks to boaters and fishers in adjacent marine areas.

Based on RCA 2013, Cardno 2015 and Cardno 2017, the key at risk areas to cliff instability include:

- The southern side of Redhead bluff (see Figure 7 and Photographs 1 and 2)
- Caves Beach picnic area and SLSC Storage (Figure 8 and Photographs 3, 4, 5 and 6)
- Seacliff at the south end of Caves Beach (Figure 8 and Photographs 7 and 8)
- Middle Camp Beach (Figure 9 and Photographs 9 and 10)
- The top of the cliff at Catherine Hill Bay (Figure 10)
- Catherine Hill Bay sea cliff near the old coal pier (Figure 10 and Photograph 11)

There are also risks to life due to geomorphic hazards i.e. people being swept off rocks or falling from cliffs. The response to an emergency due to a geomorphic hazard are not within the scope of this CZEAS and would be manage by other response agencies. Council operations including actions in the CMP and ongoing monitoring and maintenance of natural areas by Council will manage risk to life or property from cliff instability outside of a coastal emergency.

Figure 7: Location of risk area for cliff instability at Redhead.

Figure 8: Location of risk area for cliff instability at Caves Beach.

Figure 9: Location of risk area for cliff instability at Middle Camp Beach, Catherine Hill Bay.

Figure 10: Location of risk area for cliff instability at Catherine Hill Bay.

Photograph 1: Insipient failure of rock wedges at southern end of Redhead Bluff, photographed 2015.

Photograph 2: Southern end of Redhead Bluff with cliff instabilities which have risk to life.

Photograph 3: Caves Beach picnic area, photographed January 2021.

Photograph 4: Caves Beach storage area, photographed January 2021.

Photograph 5: Caves Beach picnic area, example of historic conglomerate boulder rockfalls (up to ~5m diameter) photographed January 2021.

Photograph 6: Caves Beach picnic area, exposed conglomerate with rockfall protection from bushland and safety fencing, photographed January 2021.

Photograph 7: Potential cliff instability at southern Caves Beach with red arrows showing open joint, photographed 2015.

Photograph 8: Location of potential cliff instability at southern Caves Beach viewed from the Lookout, photographed 2015.

Photograph 9: Ongoing spalling and rockfall from old fill platform at Middle Camp Beach, Catherine Hill Bay, photographed 2015.

Photograph 11: Old coal pier footings undermined, Catherine Hill Bay, photographed 2015.

Photograph 10: Rockfall at Middle Camp Beach, Catherine Hill Bay, photographed 2015.

3.

Coastal Emergency Management

3.1 Defining when a coastal emergency will be initiated

The initiation of actions in the CZEAS will be determined from one or a combination of the following:

- the scale and severity of storm or coastal erosion warning from key agencies such as the BoM, NSW SES, NSW Police or Manly Hydraulics Laboratory
- discussions between key agencies (as identified in Section 1), Council's LEMO and relevant Council staff
- concerns which arise from the monitoring of key at risk locations (as identified in Section 2)
- concerns which arise from the public.

3.2 Actions of the CZEAS

This CZEAS implements actions during five phases of the emergency management cycle: prevention, preparation, alert, response and recover. The process and actions for each phase of the emergency management cycle are shown in Figure 11 and Figure 12. The actions are applicable to most coastal emergency situations. Discretion should be used when implementing actions prior to, during or after a coastal emergency.

Figure 11: Emergency management cycle in coastal management context

Preparation

- Council's LEMO will liaise with key agencies and relevant Council departments/staff to determine whether to initiate appropriate actions in this CZEAS (following process shown in Figure 2).
- Identify type of emergency works which might be required, sources of materials and where they can be stored. This may include sand and sandbags, signage and fencing to control access.
- Liaise with utility providers (water, sewerage, etc.) in areas where assets may be impacted during an emergency.
- Identify the location of access ways where materials (sand and/or sandbags) could be moved onto the beach.
- Detail any procedures or approvals required to make access ways available, e.g. keys for locked gates, or landowner's consent from DPIE.
- Identify where signage would be erected and specific warnings, such as warning pedestrians of potential wave overtopping on walkways, promenades and on cliffs or bluffs.
- Identify when and how works will be removed.
- Ensure the emergency contact register (maintained through the Local Emergency Management Committee) is available for all relevant Council staff.
- Ensure there is a template available to register any implemented emergency protections measure.
- In conjunction with the SES, identify those properties which may potentially require evacuation or the movement of readily movable household items during storm events.

Prevention

- The implementation of actions in the CMP and relevant plans such as Council's Local Adaptation Plans or Asset Management Plans will ensure the ongoing management, maintenance and, where necessary, improvement of dune and beach protection measures.
- Provide advice to the community, landholders and the SES about the potential for a coastal erosion emergency and the types of responses that are permitted and not permitted.
- Council senior leadership responsible for the coordinated management of disaster impacts undertake regular simulations/ training to improve coordination, preparation, response and recover to coastal emergencies

Figure 12: Actions of the CZEAS

Alert

The alert phase it triggered when one of the following occurs:

The Australian Bureau of Meteorology (BoM) issues a Severe weather warning for: **Damaging Surf** which may lead to significant beach erosion or damage to property."

or

Severe weather warning for: **Abnormally high tides** which are likely to cause localised coastal flooding Advice of a significant coastal wave or storm event is received from agencies (eg., DPE, SES) or other coastal warning systems (eg., UNSW Water Research Laboratory)

- Assess threats to life and property arising from a possible coastal erosion emergency e.g. beach monitoring, storm warnings or coastal erosion warnings from the DPE, SES, UNSW Water Research Laboratory or BoM
- Council Lifeguards inform local SLSCs of potential coastal erosion emergency and, if required, coordinate actions to close beaches, beach access
- Council to begin monitoring the effects of erosion in key at risk locations (Section 2.1).
- Ensure appropriate plant, equipment and experienced personnel are readily available, and assess any potential environmental impacts associated with the placement and removal of emergency coastal protection works and how those impacts will be managed. This should include consideration of how placement of these works may increase the risk to adjacent property along with any cultural heritage places and ecological values which may be affected by the proposed emergency works.

Response

- Implement the communication protocol in conjunction with the combat agency (SES) to advise landholders, residents, public authorities and other organisations that a coastal emergency is likely or is occurring and that actions in the CZEAS are to be implemented.
- Increase surveillance of beach erosion and inundation hazards.
- Install emergency coastal protection works to address beach erosion, coastal inundation or cliff instability, in compliance with the CM Act and CM SEPP. These works include the placement of sand or sandbags (which must be removed within 90 days) on a beach or sand dune adjacent to a beach:
  - Council is the lead agency for this work, the SES may assist with coordination
  - Works must only be implemented when it is safe to do so.
- Install emergency works for coastal emergencies that may arise without the presence of storm conditions, such as beach erosion and inundation associated with high water level anomalies that are not storm driven (extreme or irregular events).
- Where damage to access ways or walkways is identified and/ or reported to Council, Council will take appropriate action to close off these pathways and/or advise the local community of the hazard(s).
- Where damage to assets is identified through monitoring, Council will assess the damage and any opportunities for limiting further damage that may be appropriate during the event.
- Install temporary fencing and/or signage on council managed land (e.g. foreshore reserves and beach access ways) affected by beach erosion, coastal inundation or cliff instability resulting from major storm activity or an extreme or irregular event, where this has resulted in unsafe conditions.
- Close council managed roads affected by beach erosion, coastal inundation or cliff instability hazards.
- Liaise with other agencies (e.g. Roads and Maritime Services, Crown land in New South Wales, National Parks and Wildlife Service) if debris from coastal hazards creates a safety hazard in adjoining areas (or liaise with road owners to enable closure).
- Close water, electrical and/or sewer infrastructure affected by beach erosion, coastal inundation or cliff instability hazards (or liaise with asset owners to enable shut down).
- The installation of emergency works including sand bags, fencing or signage and the closure of any beaches, roads, water or sewer infrastructure or access ways must be recorded to ensure appropriate management post-emergency.

Recover

- Council's LEMO in consultation with relevant Council staff/ departments and key agencies determines the emergency response phase is complete and that the remediation stages of the plan are to commence.
- Monitor the condition, performance and impact of any coastal protection works.
- Inspect all beaches and accessways to determine any damage or dangers to property or public safety.
- Remove any threats to public safety, such as debris deposited or exposed on beaches.
- Remove any sandbags within 90 days.
- Restore access to beaches, headlands and estuary foreshores.
- Maintain temporary safety fencing and associated warning signage, as necessary.
- Issue clean-up orders under the Local Government Act 1993.
- Assess the structural integrity of unprotected assets affected by or damaged during the emergency event. Geotechnical, structural and/or coastal engineering investigations may be required to understand residual risk following an emergency event.
- Liaise with property owners to ensure any private and/or public structures do not pose a risk to the public.
- Undertake works to re-establish or enhance the natural protective features of the coast, such as dune shaping and revegetation.
- Advise the community of any ongoing dangers, such as high, unstable or near-vertical erosion escarpments drying out and/or geotechnical hazards collapsing without notice (in high-use public areas the Council may consider collapsing these escarpments with machinery).
- Ongoing dangers may need to be fenced and signposted to discourage public access until such time as the beach naturally recovers or works are undertaken to reduce risk to public safety. Areas with ongoing dangers should be closed until the area has been assessed.
- monitor water quality based on current regular testing and evaluate risk to public. Implement actions to reduce or mitigate risk to public e.g. close beaches or increase water quality monitoring.
- Council to monitor surf hazards and evaluate risk to public. Implement actions to reduce or mitigate risk to public e.g. close beaches or increase number of Life Guards.
- Issue orders under the Local Government Act and/or the Environmental Planning and Assessment Act 1979 when properties are deemed structurally unsafe or pose a risk to the public.
- Replenish any emergency materials and supplies for future emergency events.
- Critically review the CZEAS, communications plan and operational procedures to ensure they achieved their performance objectives.

3.3 Roles and responsibilities

General responsibilities of emergency service organisations and functional areas are set out in the NSW State EMPLAN, NSW State Storm Plan and NSW State Flood Plan. Specific roles and responsibilities for agencies within Lake Macquarie City are set out in the Lake Macquarie EMPLAN. Roles and responsibilities of key agencies during floods, coastal inundation and coastal erosion are detailed further in the Lake Macquarie City Flood Emergency Sub Plan.

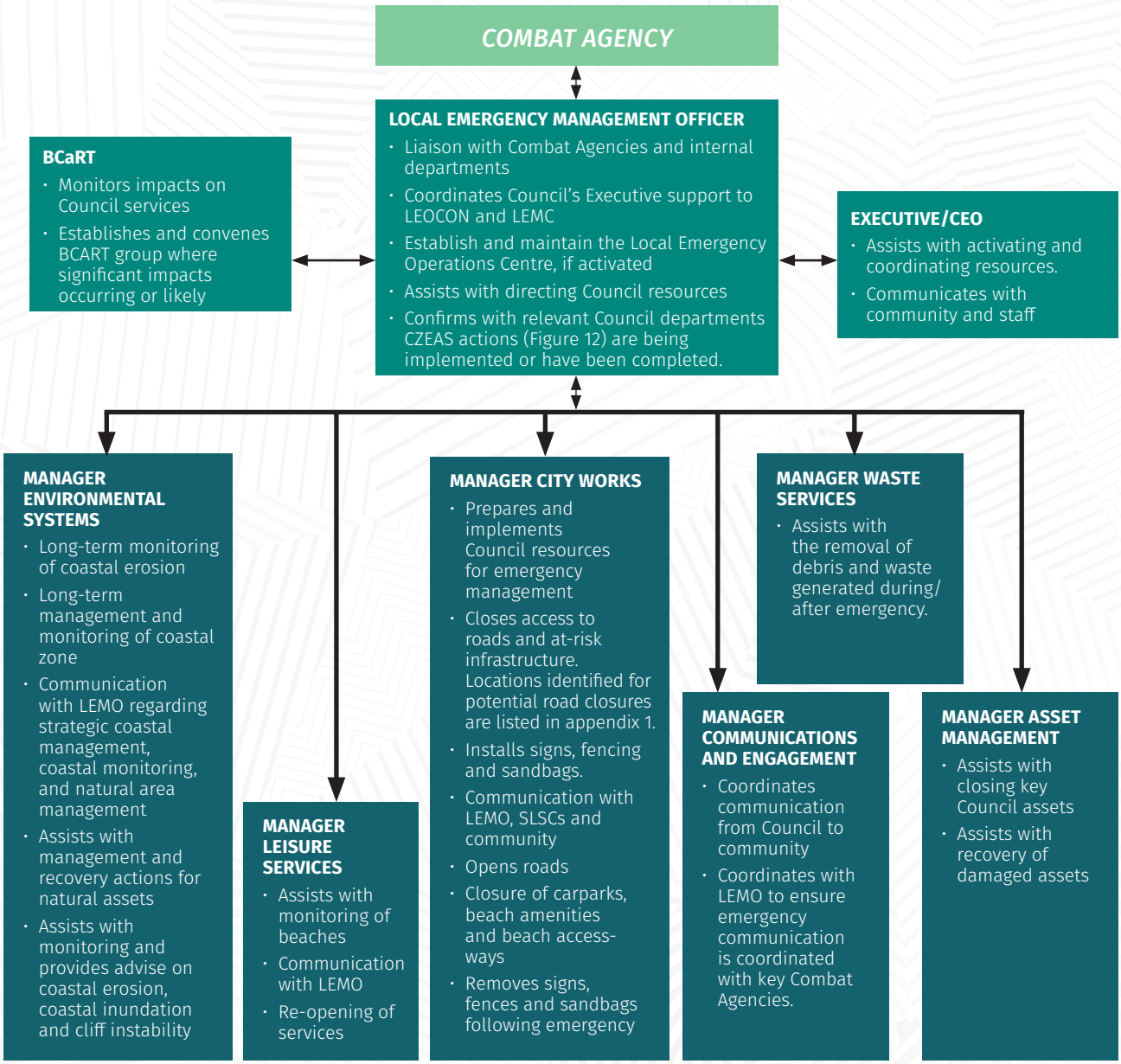
Identified actions will be implemented in response to a coastal emergency with the LEMO acting as the principal liaison between Council and Emergency Services to support a coordinated response shown in Figure 13. Council departments can implement CZEAS actions independently, however, are required to communicate their response with the LEMO to ensure a coordinated response with other departments and any external combat agencies. Council's LEMO maintains a contact register of key agencies, compiled as part of the Local Emergency Management Committee charter.

Council, in coordination with relevant agencies, implement temporary coastal protection works. There are no locations within Lake Macquarie where private property owners can place temporary coastal protection works. Property owners can submit development applications for permanent protection works and these would be processed under Council's existing development application controls.

Any illegal works placed by a property owner may result in prosecution of the person and removal of the works. A property owner may be able to undertake minor works to minimise damage to their property and/or dwelling where such works do not require development approval and do not result in adverse impacts. The types of things permitted without consent are unlikely to provide significant protection from any coastal erosion that is occurring but may limit consequential damage, for example, the sealing of the space at the bottom of a doorway to limit water entry, repair/ replacement of damaged windows, cladding or roofing, clearing of drains, pumping of ponded water, removal of objects from proximity to an escarpment (such as fences, sheds, furniture).

The owner of a property has the right to undertake a wide variety of activities/maintenance in relation to their property which may or may not result from damage during a storm event and which, generally are of a minor nature. As with all activities there is a common law obligation not to cause a nuisance to neighbours or damage to adjacent properties. Generally, works resulting in structural alterations to a building (including demolition or removal), or significant construction (such as a retaining wall or underpinning a structure) or significant earthworks (excavation or placement of fill) would require prior development/building approval.

Council organisational chart for CZEAS and general roles and responsibilities



Appendix 1: Potential locations for road and carpark closures

Redhead

- Redhead SLSC carpark and access road

Blacksmiths

- Ungala Road
- Gommera street (eastern end)
- Swansea Blacksmiths SLSC carpark and access roads
- Grannies Pool carpark and access roads

Swansea Heads

- Reid's Reserve carpark and access road
- Swansea Heads Volunteer Coastal Patrol access road (cliff stability hazard)

Caves Beach

- Caves Beach SLSC carpark and access road
- Mawson Close (eastern portions)

Catherine Hill Bay

- Flowers Drive (southern end)
- Catherine Hill Bay SLSC carpark and access road

For more information

lakemac.com.au @lakemaccity 02 4921 0333 @ourlakemac @lakemac

Coastal Planning Lines

- Immediate
- 2050
- 2100
- 2100 - Critical Utilities, Essential Community & Aged Care Facilities

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Kilometers

N

Coastal Planning Lines

- Immediate
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- 2100 - Critical Utilities, Essential Community & Aged Care Facilities

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Coastal Planning Lines

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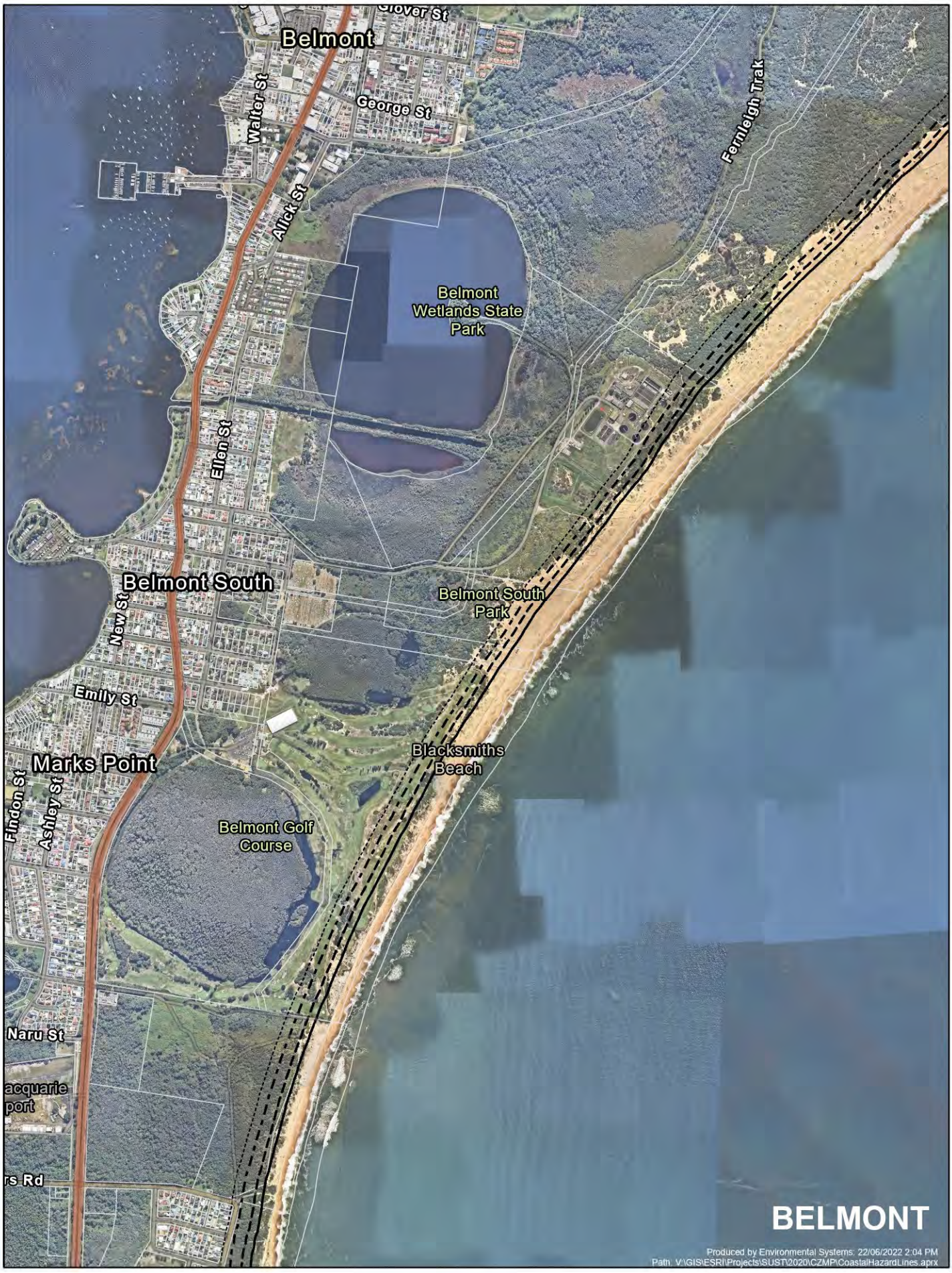

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Coastal Planning Lines

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Coastal Planning Lines

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- 2050
- 2100
- 2100 - Critical Utilities, Essential Community & Aged Care Facilities

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Kilometers

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Coastal Planning Lines

- Immediate
- 2050
- 2100
- 2100 - Critical Utilities, Essential Community & Aged Care Facilities

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Kilometers

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Appendix 7 Foreshore stabilisation works (Coastal Protection Works) prioritisation tool

This tool has been prepared to assist the managers of public foreshore land to prioritise foreshore stabilisation works (Coastal Protection Works).

All of the land highlighted on the following map (including both High and Low wave energy locations) is identified in this CMP for the purpose of meeting clause 2.16 of the *State Environmental Planning Policy (Resilience and Hazards) 2021.*

Prioritisation Criteria

Council's Sustainability Policy 2019 provides a commitment to the four pillars of sustainability (being and to ensure that decision-making considers the needs of current and future generations of Lake Macquarie City).

For us, being sustainable means:

Economic sustainability: we will help to build prosperity for the people of Lake Macquarie City by encouraging economic growth and sustainable development. We will ensure cost-effective delivery of works and services, as well as appropriate maintenance and renewal of our asset base within the framework of present and future financial sustainability.

Environmental sustainability: we will use resources wisely and help to enhance the quality of our natural landscapes. When making decisions we will seek to achieve positive outcomes for our local environment and make an equitable contribution to improving regional, national and global environments.

Social sustainability: we will help to build an inclusive, resilient and connected community that embraces innovation and creativity, and values our heritage. When making decisions and actions that affect the broad community we will undertake inclusive community engagement.

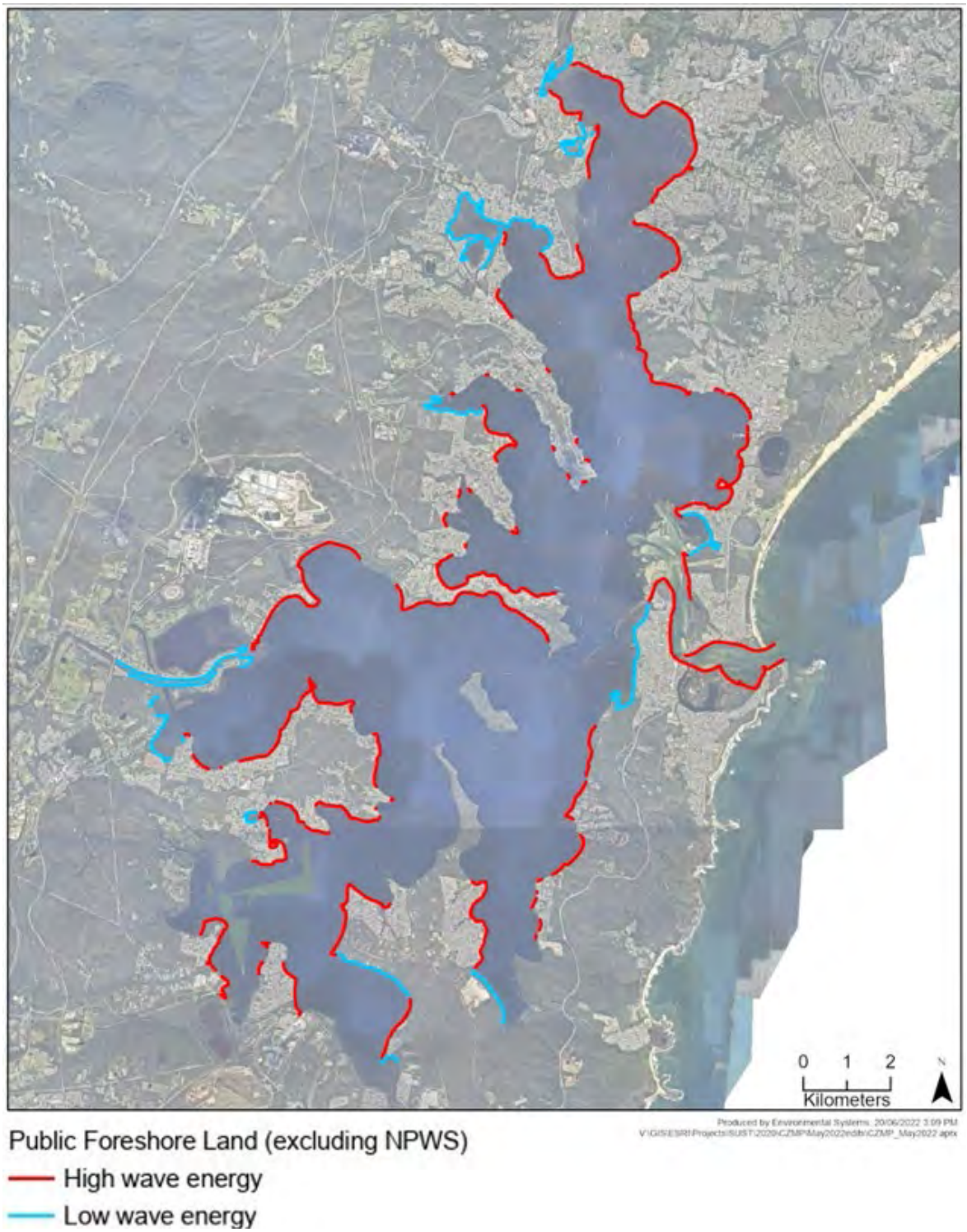
Sustainable governance: we will demonstrate transparency, fairness, ethical practices and accountability. We will encourage and promote effective public, public-private and civil society partnerships

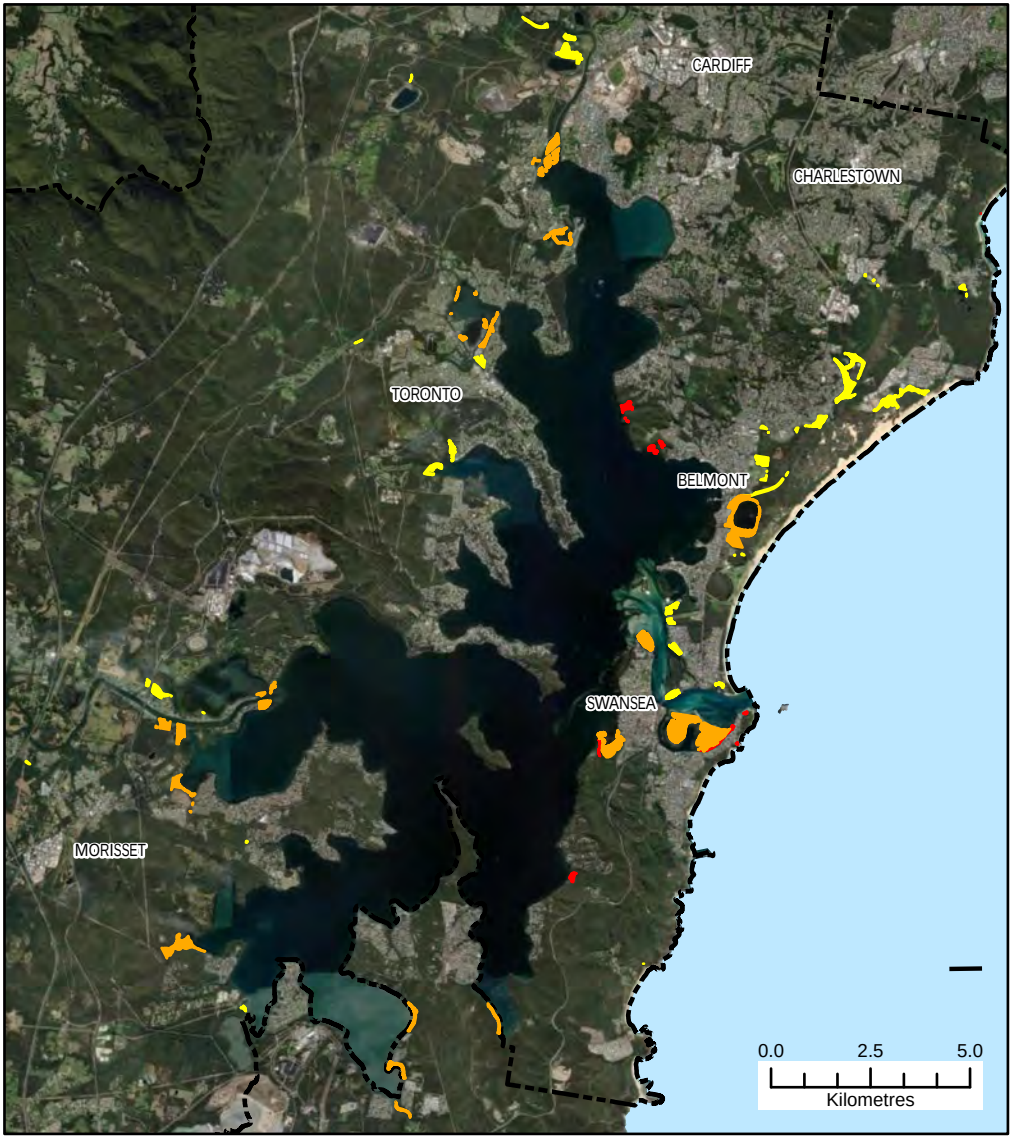
Prioritisation of new foreshore protection works around the estuary will be based on a combined ranking across all 4 pillars of sustainability.

Criteria

Social Sustainability	Environmental Sustainability	Economic Sustainability	Sustainable Governance
Amenity - Lake Activation Strategy (Activation Hierarchy) - Level of public access - Odour issues	Geomorphology - Erosion severity - Wave Energy (refer to map) - Substrate - Nearby stabilisation works - Contamination present	Capital cost	Asset Risk - Threat to Council assets - Threat to Private assets
High number of service requests	Ecology - Nearshore ooze & wrack accumulation - Opportunity to enhance seagrass	Maintenance Costs - Ability to provide a low maintenance solution	Safety Risk - Erosion poses risk to public safety

	- Saltmarsh or Mangrove nearby - Littoral vegetation corridor	- Level of future wrack removal required	
		Public or Private benefit	Reputational or political risk





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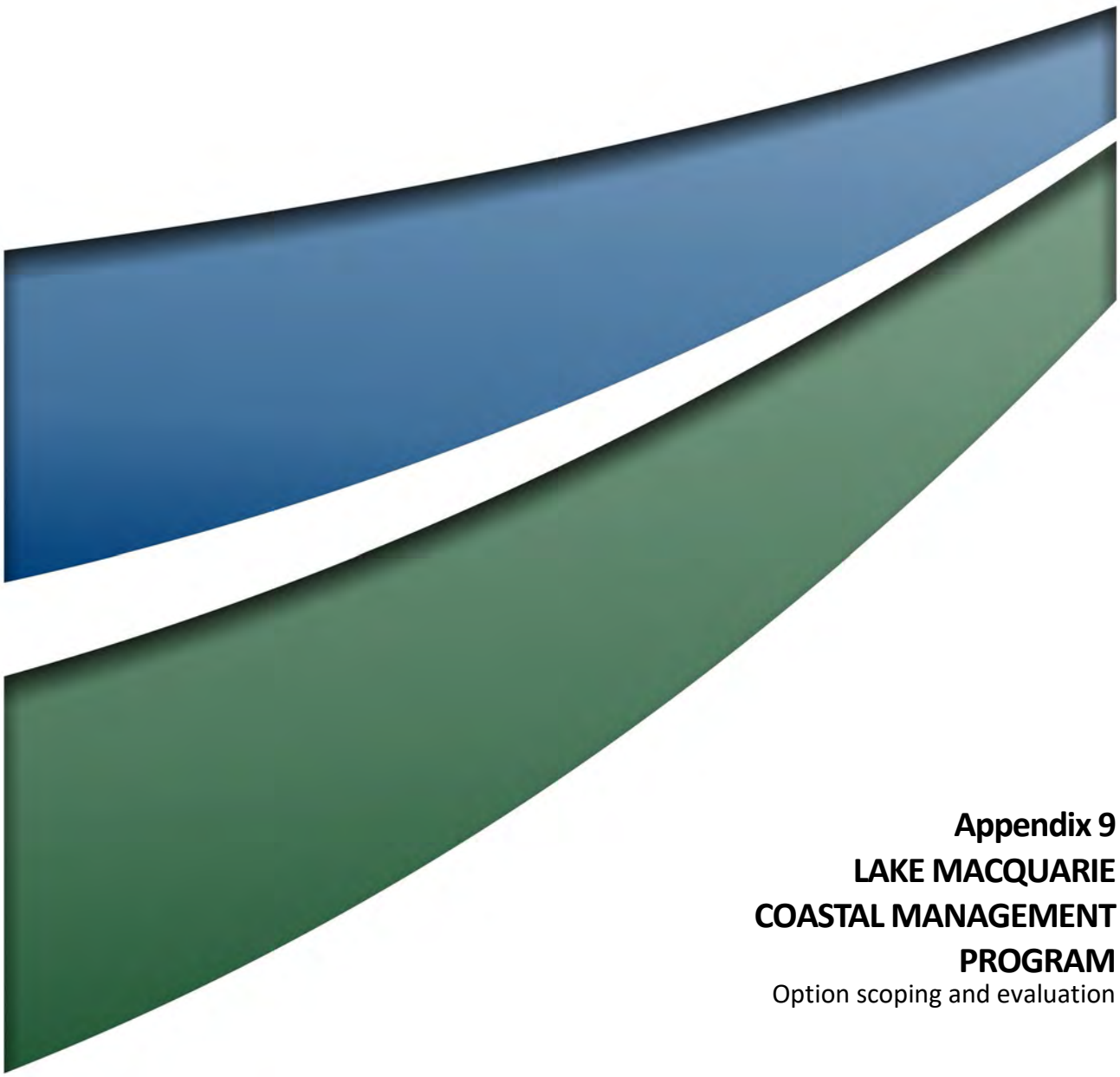
Appendix 8
Environmental Protection Work on Council Controlled Land

- Coastal Wetland - Environmental Protection Work - Medium Priority Site
- Coastal Wetland - Environmental Protection Work - High Priority Site
- Littoral Rainforest - Environmental Protection Work - High Priority Site
- LMCC boundary

umwelt
Environmental & Social Consultants



Appendix 9
LAKE MACQUARIE COASTAL MANAGEMENT PROGRAM
Option scoping and evaluation

FINAL

May 2023

LAKE MACQUARIE COASTAL MANAGEMENT PROGRAM

Option scoping and evaluation

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Lake Macquarie City Council

Project Director: Pam Dean-Jones
Project Manager: Pam Dean-Jones
Report No. 21604_R02_FINAL
Date: May 2023

75 York Street, Teralba, NSW 2284

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Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
V1	Pam Dean-Jones	28 June 2022	Pam Dean-Jones	28 June 2022
FINAL	Pam Dean-Jones	1 May 2023	Pam Dean-Jones	1 May 2023

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Figures

Tables

Appendices

1.0 Scope of This Report

This report outlines the process that Council has followed to identify and evaluate management options, leading to selection preferred actions. Option identification and evaluation are part of Stage 3 of preparing a CMP. In selecting preferred actions, Councils must promote the objects of the CM Act and give effect to the management objectives for each relevant coastal management area.

In Stage 3, Councils also decide the priority of the preferred actions and propose integrated and strategic delivery pathways.

The Manual identifies four main steps to be completed sequentially in Stage 3. This report outlines how Council has followed these steps.

Table 1.1 Steps in Stage 3

Steps and requirements from the Manual	Summary of council's approach
Step 1 – Confirm the strategic direction for each section of the coast. Review the strategic direction identified in Stage 1, to confirm character, values and objectives; vulnerability and risks; opportunities to enhance environmental, social and economic outcomes. Check whether previously identified thresholds for change have been reached.	Council identified strategic context, direction and priorities in Stage 1 (Scoping Study), provided as Attachment xx in the CMP supporting documentation. In Stage 3, Council revisited the strategic direction analysis and reviewed evidence for the NSW Government's strategic priorities for the coastal zone (see **Section 3.1**). Both Council and state-wide strategic priorities have been considered in the evaluation of management options and in identifying priorities for implementation in the Lake Macquarie context.
Step 2 – Identify potential options for integrated management of all relevant coastal management areas. Actions should address any high and/or unacceptable risks affecting the four coastal management areas. The Manual identifies five broad categories of action – which can be adopted on their own or for specific locations or issues. They are likely to be linked over time – this is the function of the Program. actions should also reflect what is being done through MEMS. The CMP may also address other issues that are not currently high or unacceptable risks, applying a risk avoidance approach to reduce future risks to the environment, community and economic activity of the coastal zone.	The coastal zone for LMCC includes the coastal wetlands and littoral rainforests management area, coastal vulnerability area (across open coast beaches, cliffs and estuary components) (not mapped), coastal environment area and coastal use area. The CWLRA, CEA and CUA are mapped in **Figure 4** of the CMP. Potential management options for the whole of the Lake Macquarie coastal zone were identified from multiple sources, including: • Actions brought forward from the previously certified CZMP (ongoing or not yet commenced) • Actions in recently adopted plans and strategies (LAS and LAP) • Actions recommended in technical studies – State of the Estuary, Wave overtopping studies, surfing amenity studies • Actions identified by community, stakeholders (including DPE and other public authorities) or Council staff from a range of divisions of Council. A summary of the consultation process used to review, clarify and update existing management actions, and identify new ones is in **Section 3.3**.

Steps and requirements from the Manual	Summary of council's approach
Step 3 – Evaluate potential actions. The Manual recommends a three-stage evaluation process: feasibility, viability (economic assessment) and acceptability. The DPE checklist makes this process mandatory. The Manual provides advice on factors to consider for each stage and the broad process (such as MCA for feasibility and acceptability, but generally not for viability).	Council developed criteria to evaluate the feasibility of all management options, identified from diverse sources. Some options had previously been evaluated for feasibility in their source technical studies. The feasibility assessment outlined in Section xx provides a consistent evaluation process for all options. Council developed criteria to evaluate the value and cost of all feasible management options. The economic evaluation is outlined in **Section 3.5** and outcomes are in **Section 5**. In all evaluation processes, Council has been cognisant of the high value and community expectations around protecting the health of coastal systems and supporting community access, enjoyment and amenity.
Step 4 – Business Plan and management pathways	The business plan is developed in a separate document (**Appendix 4** of the CMP)

1.1 Mandatory requirements

DPE has distilled the requirements of the CM Act and Mandatory requirements set out in Part A f the Manual into a checklist of matters that must be addressed in a CMP and/or its supporting documentation.

Table 1.2 outlines Mandatory Requirements from the checklist.

Table 1.2 Mandatory requirements for option identification and evaluation, from the DPE Checklist

MR#	Mandatory Requirement	Where this is addressed
MR6(iii)	During preparation of a CMP, a council is to: • evaluate and select coastal management options	Section xx
MR7(i)	A council may choose not to repeat steps (or parts of steps) in subparagraphs (ii) or (iii) of mandatory requirement 6 for the area the subject of the proposed CMP (or parts of that area) if those tasks have already been undertaken for the coastal management of that area, provided that council first considers: • whether the existing assessment of coastal risks, vulnerabilities and opportunities, or **the existing evaluation of coastal management options, that council proposes to rely on enables council to prepare the CMP in accordance with mandatory requirement 8 below and sections 14 and 15 of the Coastal Management Act 2016**.	Council may rely on a previous option evaluation process, but only if it can **demonstrate that the evaluation process is consistent with all the requirements of MR8**. An analysis of the previous evaluation of management options brought forward from the CZMP is in **Appendix 3**.

MR#	Mandatory Requirement	Where this is addressed
MR7 (ii)	A council may choose not to repeat steps (or parts of steps) in subparagraphs (ii) or (iii) of mandatory requirement 6 for the area the subject of the proposed CMP (or parts of that area) if those tasks have already been undertaken for the coastal management of that area, provided that council first considers: • **the effectiveness of the existing coastal management of that area**	This review was conducted in Stage 1 and is not repeated here.
MR7(iii)	A council may choose not to repeat steps (or parts of steps) in subparagraphs (ii) or (iii) of mandatory requirement 6 for the area the subject of the proposed CMP (or parts of that area) if those tasks have already been undertaken for the coastal management of that area, provided that a council first considers: • **whether any circumstances concerning the coastal management of that area have changed**	Council reviewed the strategic context in Stage 1 and has reviewed and updated it in Stage 3 (see **Section 3.1**).
MR8(i)	A CMP must: • describe how the objects of the Coastal Management Act 2016 have been **considered and promoted** in preparing the CMP	A key criterion in the feasibility evaluation is the extent to which options are consistent with the objects of the CM Act. (see **Section 4.0**)
MR8(ii)	A CMP must: • describe how the objectives of the coastal management areas covered by the CMP have been **given effect** to in preparing the CMP.	The feasibility evaluation process identifies the coastal management area to which each action applies.
MR8(iii)	A CMP must: • identify **the key coastal management issues affecting the areas to which the CMP is to apply and how these have been considered.**	This was completed during Stage 1 and was reviewed in the feasibility evaluation to ensure that all management options were linked to a priority management theme (based on risks from hazards and threats) and management issue. (See **Section 3.4**).
MR8(iv)	A CMP must: • identify any **coastal management actions required to address those key coastal management issues in an integrated and strategic manner**	As above.
MR8(v)	A CMP must: • identify how the coastal management actions in (iv) have been **considered and evaluated (including, without limitation, how the council has evaluated the coastal management actions in light of the functions and responsibilities council has under legislation other than the Coastal Management Act 2016).**	Relevant legislation here may include the CLM Act, Local Government Act, MEM Act, Biodiversity Conservation Act, NPW Act, FM Act. Council has considered statutory drivers for action in the evaluation process (part of feasibility assessment in **Section 3.4** and **Section 4.0**).

MR#	Mandatory Requirement	Where this is addressed
MR8(vi)	A CMP must: • identify any environmental protection works, **on land identified as 'coastal wetlands' or 'littoral rainforests'** on the Coastal Wetlands and Littoral Rainforests Area Map under the State Environmental Planning Policy (Coastal Management) 2018, **that are proposed to be carried out by or on behalf of a public authority.**	The CM Act provides specifically for environmental management actions by public authorities in wetlands and littoral rainforests. Works that are proposed in wetlands or littoral rainforests will be carried out by Council.
MR8(vii)	A CMP must: • identify **any coastal protection works** that are proposed to be carried out **by or on behalf of a public authority.**	There are different requirements for coastal protection actions by a public authority and by private landholders. The CMP outlines both natural defences (e.g. on exposed lake shorelines) and engineered coastal protection structures (at Pelican), as relevant to the risk and hazard context. These works are on public land and are the responsibility of Council and/or public authorities.
MR8(viii)	A CMP must: • set out the **recommended timing** for the proposed coastal management actions	The CMP identifies programs of actions for issues affecting the coastline, lake and entrance channel. timeframes for all actions are noted in the economic value evaluation tables (**Appendix 4**).
MR8(ix)	A CMP must: • identify **a proposed monitoring, evaluation and reporting program** in relation to the CMP, including by **identifying key indicators, trigger points and thresholds relevant to the CMP**.	Monitoring actions to provide information, accountability and transparency are proposed in this CMP. The MER program and indicators and trigger points will provide the basis for moving from one type of response to another, over time.

1.2 Guidance in the Manual

1.2.1 Types of actions

Step 2 of Stage 3 of the Manual provides guidance on the types of management responses which may be appropriate for different levels of risk, in different coastal management areas and for different spatial scales or timeframes.

Lake Macquarie City Council has been actively managing its coastal zone for many years, so a further consideration in identifying potential management options is the evidence about whether current management approaches are successfully reducing risks to the coastal environment or to community values, in the context of trends in drivers of coastal change.

Broadly, the types of actions that can be considered are summarised in **Table 1.3**.

Table 1.3 Types of actions to be considered in a CMP

Type of response	Examples of actions	Is this currently being applied in the Lake Macquarie coastal zone?
Alert	Monitoring Identifying thresholds Research to improve knowledge Community awareness and education	Yes, Council has used all these types of management across all coastal management areas.
Avoid risk	Proactive land use planning for coastal hazard areas and to protect the values of public land in the coastal zone	Yes, Council works with other public land managers to provide consistent protection of the natural values of public land in the coastal zone. The Lake Macquarie LEP and DCP set building standards for new or renewed development on land that is affected by coastal hazards. the local adaptation Planning process for eastern Lake Macquarie is part of this risk avoidance and also transformative planning process.
Active intervention	Coastal protection works Riparian and wetland management – water levels, shoreline stability, invasive species management Construction of access and amenity facilities	Yes. Council continues to make significant investment in works to restore biodiversity and reduce catchment threats to the health of Lake Macquarie and to coastal dunes. Council has investigated coastal protection options for Swansea Channel and has implemented a program of natural protection for lake shorelines. Council has invested in public access infrastructure for pedestrians, bikes and small to large recreational vessels.
Planning for change	Actions to facilitate transformative change to natural systems and settlement patterns	Yes, Council has invested in studies of wetland adaptation. The local adaptation planning process has examined options for long term transformative land use planning.
Emergency response	Actions to address residual risk	Yes, as necessary.

1.2.2 Evaluate potential actions

The Manual sets up a three-stage evaluation process, which develops the rationale for the management program in the CMP.

The Manual does not specify how a council must conduct its evaluation process, noting that although there are some key requirements (such as supporting the objects of the CM Act), different criteria may be meaningful in different contexts.

Amongst matters to be considered in determining the scope and method of the evaluation process are:

- promote and achieve the objects of the CM Act and the management objectives for relevant coastal management areas
- the current and future exposure to coastal hazards, vulnerability and risks
- trends in local and regional population and the condition of the coastal environment
- detailed design, engagement and management requirements
- approval processes and statutory requirements that add complexity to a management pathway
- practicality and effectiveness and reliability, particularly for engineered structures, but also for natural defences and ecological management
- known benefits and evidence of past and ongoing achievement of objectives
- the level of unknowns and uncertainty
- costs of different actions, including costs for staff to manage the program and specific actions, capital costs, ongoing maintenance costs and costs for planning and operations
- how costs and benefits are distributed to the community and individuals
- alignment with local and state government priorities for the coastal zone.

Sections 3.4 and **3.5** outline how Council developed its evaluation criteria from this guidance.

1.3 From evaluation to program development

The Lake Macquarie CMP is for the whole of the coastal zone of the city, but comprises four interacting place-based sub programs (**Figure 1.1**). Within each subprogram is a series of issue-based management programs for the key issues that are relevant to that part of the coastal zone.

This program structure reflects the way in which the local community identifies with the coastal zone of Lake Macquarie, i.e. they identify with the coast (beaches and headlands), the channel (and the channel islands at the drop over) and the lake. The lake component includes the major estuarine tributaries such as Dora Creek, Wyee Creek, Stony Creek and Cockle Creek.

Table 1.4 shows how these place-based sub programs align with the coastal management areas defined in the CM Act and CM SEPP.

Table 1.4 Alignment of place-based subprograms and coastal management areas

Sub programs of the CMP	Coastal management areas included
Coastline (headlands, beaches and dunes)	The coastline is entirely within the **coastal environment area**. Some margins of urban development, such as at Swansea Heads, Caves Beach, Blacksmiths, Redhead and Dudley are within the **coastal use area**. Small areas at Swansea Heads are within the coastal wetlands and littoral rainforests management area, as well s the coastal environment area. Wetlands along Nine Mile Beach are just within the proximity area for **coastal wetlands and littoral rainforests area**. The coastal vulnerability area is not mapped, but beaches and dunes are affected by coastal hazards (erosion and coastal inundation). Some headlands are affected by cliff instability.
Channel, from entrance to drop-over	The channel and adjoining land are entirely within the **coastal environment area**. All of Swansea, Blacksmiths (other than a few houses) and Pelican are in the coastal environment area. The wetlands in the outer channel (Black Neds Bay) are mapped as coastal environment areas and **coastal wetlands and littoral rainforests area**. Wetlands along the inner channel are also within both the coastal wetlands and littoral rainforests area and the coastal environment area. Urban development and public reserves along both sides of the channel are within the **coastal use area**. The coastal vulnerability area is not mapped, but Council has completed studies to demonstrate the extent of risks associated with tidal inundation, and combined tidal/catchment inundation and shoreline erosion along the channel.
Estuary, Lake Macquarie and its estuarine tributaries. The sub program also includes actions for the catchment of these tributaries where the actions address significant risks to the health of the estuary	The entire estuary and land within 500 metres of the shoreline is within the **coastal environment area**. The coastal environment area extends upstream along the tributary creeks and their floodplains to 500m upstream of the tidal limit. This means that Eraring Power Station is outside the coastal zone, as is most of the infrastructure for Vales Point Power Station. Lakeside suburbs in western, southern, and eastern Lake Macquarie are within the coastal environment area of the estuary. Parts of the densely settled suburbs of northern lake Macquarie are in the coastal environment area, but much of this development and associated stormwater systems is outside the coastal environment area. The **coastal use area** covers a small component of the urban development around Lake Macquarie than does the coastal environment area. **Coastal wetlands** are located at the heads of bays and along estuarine tributary creeks. Two patches of **littoral rainforest** are located at Green Point and further small patches are located along the south-eastern shores of the lake. The coastal vulnerability area is not mapped, but Council has completed flood studies for tributary creek systems which analyse the interaction of catchment and tidal inundation hazards and risks. Low lying parts of the shoreline of the main body of the lake will be affected by increasing tidal and flood inundation risks as sea level rises.

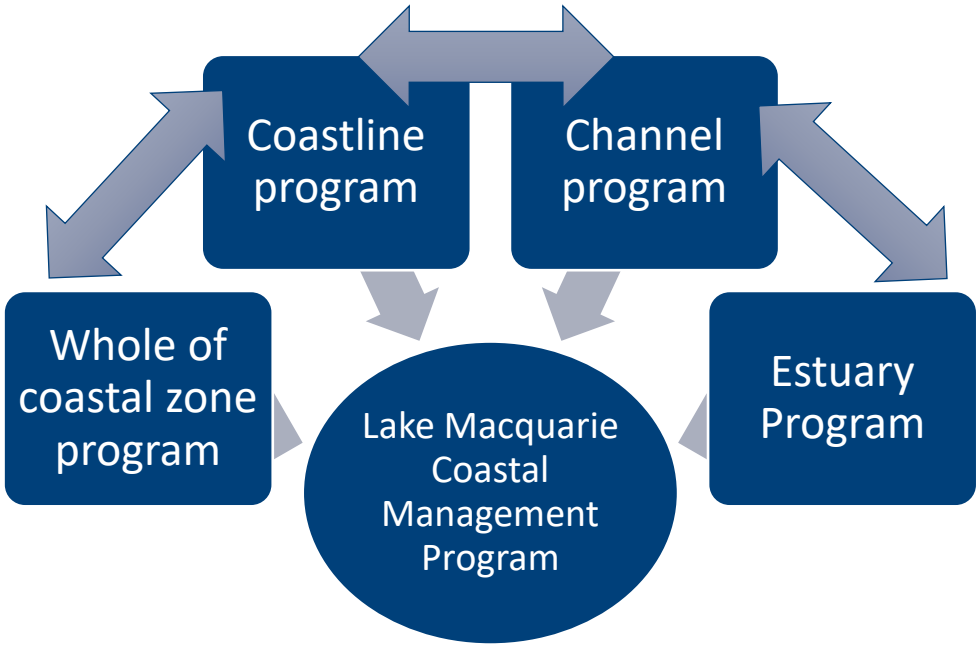


Figure 1.1 Lake Macquarie CMP and interacting subprograms

Figure 1.2 provides an overview of the process of option scoping, option evaluation and program development.

Figure 1.2 Structure of the evaluation of options to develop management programs

2.0 Identify Management Options

2.1 Actions as a structured program to address current and future risks

In Stage 1, Council identified four priority threats to the natural environment of its coastal zone and three priority threats to the social, cultural and economic (SCE) values of the coastal zone, over the period to 2050. The threats to the environment and to social and economic values are closely related. Key threats are summarised in **Table 2.1**.

Table 2.1 shows that the estuary is affected by all five risks, from either environmental or SCE value perspectives. The coastline and channel are not directly impacted by modification to catchment vegetation and the coastline is not highly affected by modifications to the morphology of the estuary or channel.

The impacts of climate change on the natural systems of the coastal zone, on the maintenance of settlement structure and infrastructure and on safe public access are identified as the highest risk for estuary, channel and coastline.

The actions in the CMP address these key threats and risks. Actions are organised in relation to specific issues associated with the key threats and risks.

Table 2.1 Key threats to the values of Lake Macquarie's coastal zone

Threat	Environment values	Social, cultural and economic values (SCE)	Estuary	Coastline	Channel
Impacts of climate change and coastal hazards	Yes	Yes	Extreme – Environment Extreme SCE	Extreme – Environment. High - SCE	High environment Extreme SCE
Impacts on water quality	Yes	Yes	High – Environment High SCE	High SCE	High SCE
Modification of catchment vegetation	Yes	n/a	High - Environment	n/a	n/a
Modification of the waterway	Yes	n/a	High - Environment	n/a	High - Environment
Access to the marine estate	Yes	Yes	High - SCE	High - SCE	High - SCE

2.2 Sources of options

Council's starting point for developing the program of actions for the coastal zone was the collation of a wide range of possible responses to mitigate risks in the coastal zone. These responses include:

- actions brought forward from the existing CZMP, either commenced and ongoing, or not commenced

- actions brought forward for implementation from recent technical studies, such as the LAP and LAS and State of the Estuary Report
- new actions identified by Council staff, based on recent evidence or experience
- new actions suggested by public authorities based on recent experience or evidence, or to address specific objectives of each organisation
- new actions suggested by the Lake Macquarie Community. Some of these actions were proposed in workshops or consultation meetings, others in correspondence to Council.

A long list of options was discussed during on-line workshops with agency and community representatives in late 2021.

The types of actions identified from these various sources are shown in **Figure 2.1** and the alignment of these management responses with the broad types of actions noted in the Manual is shown in **Table 2.2**.

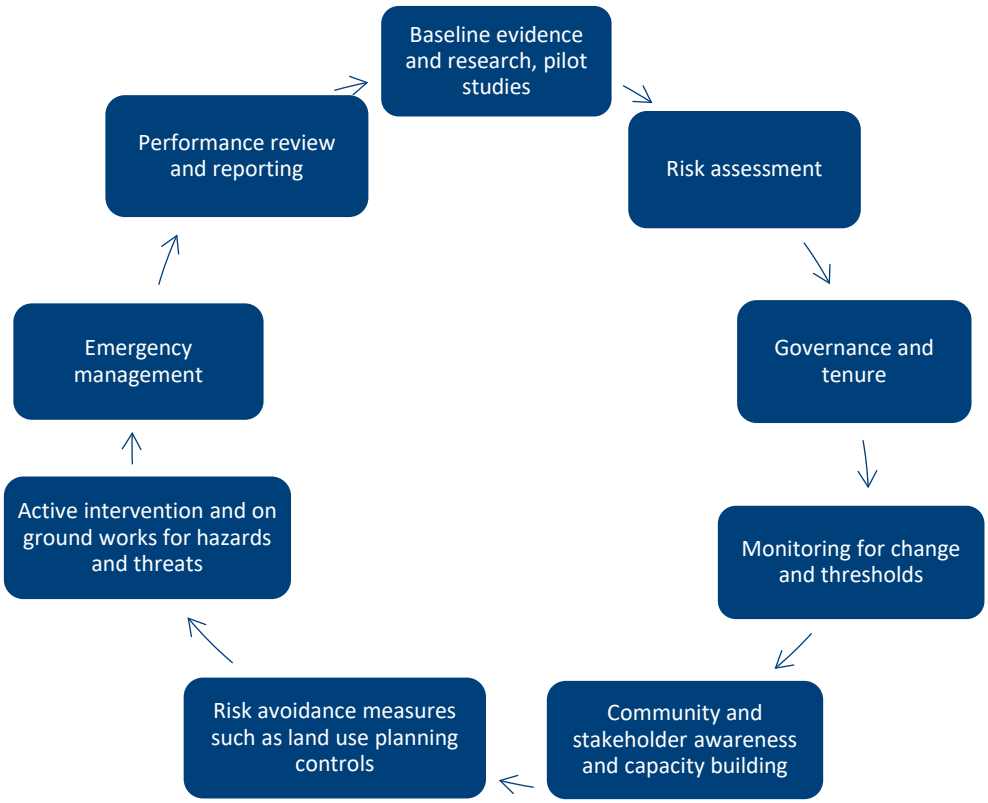


Figure 2.1 Types of actions to be incorporated in the adaptive coastal management program

Table 2.2 Alignment of types of management response

From Manual	In CMP
Alert	Baseline evidence and research, pilot studies Risk assessment Monitoring for change and thresholds Performance review and monitoring Community and stakeholder awareness and capacity building Governance and land tenure
Avoid risk	Risk avoidance measures such as land use controls
Active intervention	Active intervention and on ground works for hazards and threats
Planning for change	Community and stakeholder awareness and capacity building Research and pilot studies Governance and tenure
Emergency Management	Emergency management

Council reviewed and consolidated actions previously identified from all sources. The CMP team conducted internal individual consultation and workshops with Council staff, to identify and integrate coastal management actions across the full scope of Council's responsibilities. Council conducted workshops with external stakeholders, including public authorities and community representatives to review previous management options and to identify additional options from stakeholder and community perspectives.

As discussed in **Section 2.3**, these option scoping workshops were conducted in October 2021.

The full list of options identified from all sources is included in the feasibility evaluation tables, which are in **Appendix 1** of this report.

2.3 Engagement during Stage 3

Engagement in Stage 3 is part of Council's overall CMP engagement strategy (developed in Stage 1) and addresses different objectives for different stakeholder groups:

- **Council stakeholders**: Successful implementation of the CMP will require that the CMP and Council's Community Strategic Plan and other key environment and community strategies fit together. It requires that managers and coordinators across different sections of Council align their delivery priorities with those set out in the CMP. The CMP team has conducted several internal briefings and consultation sessions at coordinator, senior manager and Councillor level. This is partly to discuss the strategic purpose of the CMP, to identify any gaps in the alignment of programs, and any issues with the timing and budget for implementation. It has also served to alert decision makers to issues (such as funding, resourcing and state agency relationships) that need to be addressed to ensure the CMP can be adopted, certified and implemented.

- **Community stakeholders**: Council has a commitment to inclusive and collaborative engagement on issues of concern to the community. For Stage 3, Council invited community representatives to participate in workshops to review issues and scope potential responses. Council also invited community input through its Coast and Estuary Committee membership and membership of the Aquatic Services Committee. Council received written submissions from some community organisations. This initial Stage 3 engagement was intended to provide an opportunity to comment on actions that could form a program for any of the high priority issues. It also provided a further indication of community expectations about the level of performance on some of these issues. in this CMP Council will continue to implement a major program of investment in restoring the health of coastal ecological communities in partnership with the community, through Landcare. Council will continue detailed planning about spatial priorities with Landcare coordinators. Long term funding of CMP implementation will require new sources of funding, beyond council's current revenue base and grant programs. in Stage 4, Council will engage with the community about the acceptability of potential funding arrangements, such as a new levy, or reprioritisation of council expenditure.

- **Other councils and public authorities**: The CM Act requires that Council engages with other councils (in this case Central Coast Council) and public authorities where proposed actions are their responsibility or are on their land. During Stage 3, Council's team met with DPE (BCD), Crown Lands, EPA, DPI Fisheries, TfNSW and Newcastle and Wyong Councils about feasible management options. The initial engagement involved the involvement of regional representatives of these organisations in workshops to review priority themes and issues and to scope all potential responses to priority issues.

  After preparing the feasibility assessment, Council went back to regional representatives to discuss commitment, willingness to fund actions and capacity to deliver actions within the proposed timeframes, which would contribute to the efficient delivery of the program.

2.3.1 Option scoping workshops

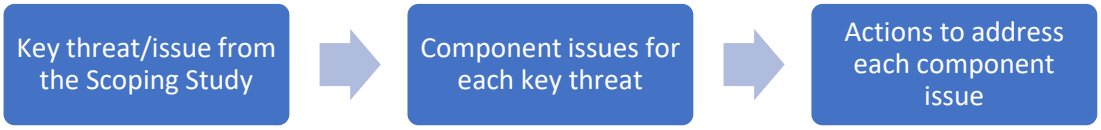
Council conducted separate workshops sessions, focusing on the open coast, channel and Lake Macquarie estuary, in October 2021. Fifty-three agency, local council and community (including business) representatives were invited to participate and approximately 80% of invitees joined at least one workshop session. The workshops were conducted on-line. Information provided to workshop participants is included in **Appendix 2**.

Participants in each workshop were asked to review lists of actions compiled from the various sources and organised to align with the key issues identified from Stage 1. Participants had the opportunity to identify:

- other issues that in their view had not been adequately captured, and explain why these issues are important
- additional actions that should be considered in the CMP
- actions that, in their view, do not need to be included in this CMP
- organisations that should be involved in detailed action planning and delivery.

Following each workshop, participants received an updated version of the options table for the relevant part of the coastal zone, which included issues and actions proposed by participants. Participants were also able to contact Council to nominate issues or actions that had not been highlighted during the workshops.

Action tables were structured as follows, and also highlighted actions brought forward from the Local Adaptation Plan and Lake Activation Strategy.



The status of the action lists following the workshops is shown in **Appendix 1**.

2.4 LMCC Sustainability Policy and ESSAP

Council has committed to making an equitable contribution to all aspects of sustainability for its operations across the city. Council's policy refers to the four pillars of sustainability (**Table 2.3**).

Table 2.3 Pillars of Sustainability

Environmental	**Social**
Environmental sustainability and sustainable ecosystems: Energy, air pollution, GHG emissions, waste management, potable water and sanitation. Wise use of resources to enhance the quality of our natural landscapes.	Social equity, quality of life (health, vigour, wellbeing and ability to flourish); inclusive, resilient, connected, engaged.
Economic	**Governance**
Financial prosperity, competitive productivity; cost effective delivery of works and services; maintenance and renewal of our asset base.	Adaptive innovation, cultural sustainability; fairness, ethical practices, accountability; effective partnerships.

The Environmental Sustainability Strategy and Action Plan (ESSAP) includes four strategic themes, and objectives and targets to achieve for each by 2027. These include: 20% increase in lake and waterway health compared to 2007 baseline; climate change risk reduction strategies in place for 100% of the city's high and extreme risks.

The CMP reflects these commitments. It continues the program of works for lake health that Council has been implementing with community and agency partners for more than two decades. It addresses risk avoidance and risk mitigation for areas affected by one or more of the coastal hazards, at a high-risk level.

It maintains monitoring programs for the coastal zone which provide data against which the ESSAP targets can be assessed.

3.0 Option Evaluation Framework

This section outlines how Council has evaluated management options which have been proposed for hazards, threats and risks and to enable opportunities in all coastal management areas and in the three broad management zones within the Lake Macquarie coastal zone.

3.1 Review strategic approach

In Stage 1, Council reviewed the environmental, social and economic context of its coastal zone and identified priority issues and objectives for the future. The strategic approach frames council's thinking about important issues and appropriate responses.

From these objectives, Council's strategic approach to managing the coast:

- Recognises that the city's coastal zone is a mix of urban and natural spaces; management of access and land/waterway use conflicts across these valued spaces is important.
- Is evidence based, including using innovative science and monitoring techniques.
- Is collaborative.
- Identifies priorities based on risks across all coastal management areas. Climate change is a key driver of coastal risks.
- Water quality impacts are seen as a key driver of both environmental and socioeconomic risks.
- Is structured to adapt to change.
- Allows for testing of new management techniques within that structured, adaptive framework.

At the commencement of Stage 3, Council considered whether these elements continued to describe its strategic approach to managing the coastal zone. The review included recent Council publications about decision making and sustainability, community satisfaction with Council's environment management, strategic planning for the long-term future of the city and recent strategies for use and enjoyment of the coastal zone and for economic activation.

For Stage 3, Council's strategic approach is updated to include this strategic context. Key elements of the strategic approach are:

- Is risk based – address high risk issues first
- Is evidence based and adaptive – use the right tools to collect data that inform adaptive decisions and action at the right time. i.e., on ground works must be supported by the right data, clear thresholds for action, a high likelihood of beneficial outcomes and a high level of collaboration
- Continues successful strategic approaches to protecting and strengthening the health and resilience of natural coastal systems; this includes a focus on stormwater and catchment management, community involvement in on ground works, and natural defences for coastal protection

- Is collaborative – with public authorities and the community, including sharing costs fairly
- Values risk avoidance – use land tenure, the land use planning system and clear guidance on process, decision making and design, to demonstrate due diligence, avoid increasing coastal hazard risks and maintain funding and protections for Council
- Values best practice and innovation – to be seen as leaders
- Protect values to offer intergenerational equity in coastal condition and lifestyle

3.2 Three stages of evaluation for the Lake Macquarie CMP

Council has identified a structured program of actions for sustainable management of its coastal zone.

Appendix 1 and **Appendix 4** show how the full list of potential actions has been evaluated, to identify actions which are feasible, affordable, provide value for money and satisfy community objectives.

3.3 Feasibility criteria and application

Four groups of feasibility evaluation criteria have been identified, based on the guidance in the Manual and Council's previous experience in evaluating management options for the coastal zone: alignment with statutory and policy objectives, effective and adaptive, practical and contribute new knowledge through testing new or innovative opportunities. These are shown in **Figure 3.1**.

In **Table 3.1**, Council has distilled six feasibility criteria across the four themes. **Table 3.1** shows how Council applied these criteria to understand the feasibility of actions and the reasons why some actions may not be feasible.

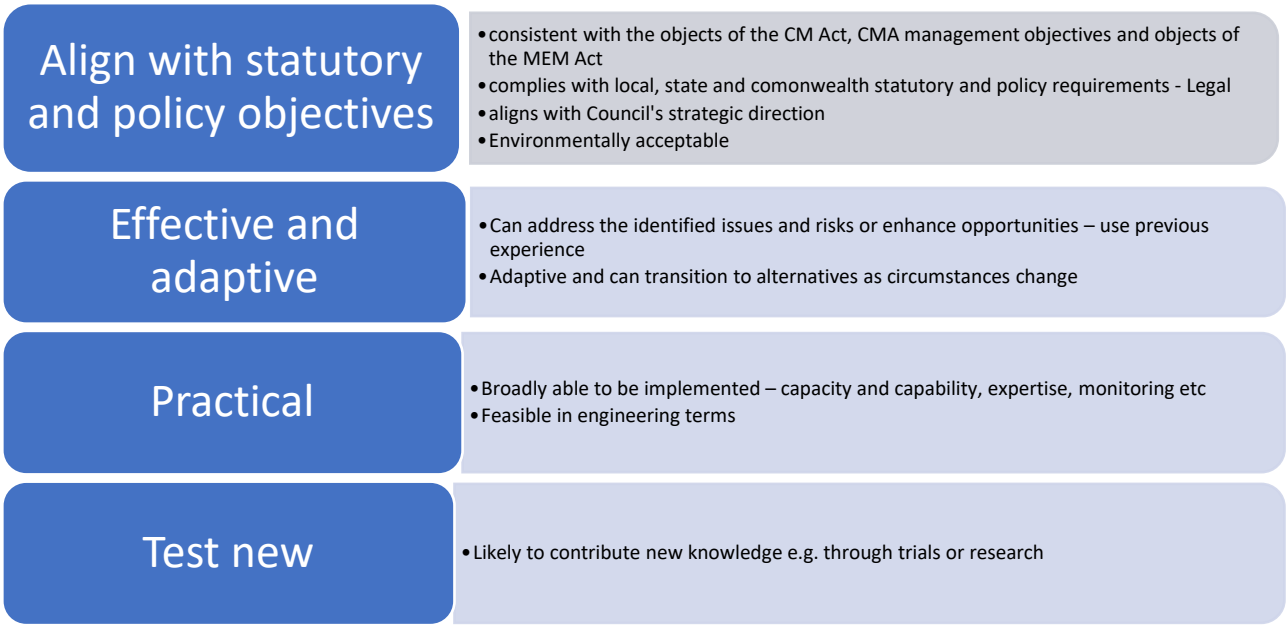


Figure 3.1 Elements of feasibility

In **Table 3.1**, alignment with relevant statutory objectives is identified as an essential criterion. Three scale points are defined for each criterion, a simple 'traffic light' scoring system. In the feasibility assessment, Council has considered each possible action against the six criteria.

The overview score for each possible action is also based on a traffic light system. a 'green', strongly feasible assessment, is obtained when:

- the essential criterion (consistent with the objects of the CM Act, which are listed in the table) is scored as green, and
- at least three of the other five criteria also score green.

Table 3.1 Feasibility criteria

List of actions for evaluation	Consistent with, promotes and gives effect to the objects of the Act, and objectives of relevant CMA (ESSENTIAL)	Other statutory and policy requirements can be managed	Is known to be an effective response for the threat/risk involved, with no major unintended side effects (e.g. impacts on other aspects of environment or amenity)	Can be adapted, or is a component of an adaptive approach	Is broadly practical and can be implemented. If the action relates to a structure, it is also feasible in engineering terms	Likely to contribute new knowledge	Overview
Identify each action in this column	Green: strongly consistent with multiple objects Meets some objects and management objectives Has limited or no alignment with the objects and relevant management objectives of the CM Act Cross reference a list of Objects	Yes or No (provide brief reasons)	Yes – strong evidence Yes – uncertain or equivocal or short-term evidence No Provide reasons	Yes Yes, but the process is complex No Provide brief explanation	Clear evidence of practicality Some limitations to practicality Not practical Feasible engineering Explain why or why not practical	Yes – purpose of the action Yes, as an ancillary benefit No Explain which knowledge gap is being addressed	Green: must be Green in (1) and at least 3 of the other 5 columns.

Objects of the CM Act

The objects of this Act are to 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, and in particular—

a. to protect and enhance natural coastal processes and coastal environmental values including natural character, scenic value, biological diversity and ecosystem integrity and resilience, and

b. to support the social and cultural values of the coastal zone and maintain public access, amenity, use and safety, and

c. to acknowledge Aboriginal peoples' spiritual, social, customary and economic use of the coastal zone, and

d. to recognise the coastal zone as a vital economic zone and to support sustainable coastal economies, and

e. to facilitate ecologically sustainable development in the coastal zone and promote sustainable land use planning decision-making, and

f. to mitigate current and future risks from coastal hazards, taking into account the effects of climate change, and

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, and

h. to promote integrated and co-ordinated coastal planning, management and reporting, and

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, and

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, and

k. to support public participation in coastal management and planning and greater public awareness, education and understanding of coastal processes and management actions, and

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, and

m. to support the objects of the *Marine Estate Management Act 2014*.

3.4 Economic evaluation criteria

The aim of the economic evaluation is to determine if strategic actions offer good value for money. Where an action is being modified from a previous management response, the evaluation should show how the new option offers better value for money than the earlier approach.

The scope and detail of an economic assessment should be proportionate to the nature and scale of the issues and decisions being made.

Council has reviewed the guidance in the Manual about choosing an approach to economic evaluation. This guidance considers the complexity of management decisions and the risks and impacts of those decisions.

Table 3.2 shows how Council has considered these factors to set the scope for the economic evaluation for the CMP.

This analysis indicates that the economic evaluation for the actions in the Lake Macquarie CMP is best conducted at the intermediate level.

The Lake Macquarie coastal zone is a large and complex area and has a population of 210,000 which is growing. The coastal zone has very high community values. Risks associated with coastal hazards are not currently extreme, but Council and the community understand that risks will increase as sea level rises and that ecological communities, natural shoreline character, recreational opportunities and settlement patterns will be affected. People in the most vulnerable communities are aware of the potential for increasing and high to extreme risks in the long term and of the need to take action now to avoid or mitigate risk. Risks to the health of the estuary are related to catchment development and urban runoff as well as coastal processes. A mix of qualitative and quantitative data is available to evaluate costs and benefits.

Table 3.2 Selecting the right level of economic evaluation

	Low complexity Limited number of stakeholders Little or no quantitative data	**High complexity** Disagreement or conflicting views among stakeholders difficulty defining beneficiaries or apportioning costs Good quantitative data
Low risks and impacts Limited spatial scale Low risk and low impact	**Simple Economic Assessment** A large number of stakeholders and a large urban community are engaged in decision making and implementation. The scale is the whole coastal zone, including a large and complex lake system, headlands, beaches and contentious entrance channel Costing data are good for up to 4 years, but qualitative beyond that time.	**Intermediate Level Assessment** Spatial scale and community scale are both large. There is broad community support for Council's strategic approach, which supports a valued community lifestyle. The CMP addresses issues that will be high risk and high impact over time, and is restoring/maintaining waterway health that has previously been poor. Risks will increase over time.

	Values are well understood but not well quantified **The CMP actions are not suitable for a simple assessment**	Values are well understood but not well quantified **Prepare intermediate level economic assessment**
High risks and impacts Addressing high or extreme risks An option involves major investment (>$10million)	**Intermediate Level Assessment** Coastal protection works proposed at Pelican have a cost in the $10 million range. These have already been subject to a full quantified CBA. Risks are high to extreme in the long term (increasing over time), but not over the life of this CMP. **Prepare Intermediate level economic assessment**	**Detailed Cost benefit Analysis** Council has identified some risks, principally related to tidal inundation, as high or extreme in the medium to long term, as sea level rises. Short to mid-term (up to ten years) risks are not extreme. Coastal protection works proposed at Pelican have a cost in the $10million range. These have already been subject to a full quantified CBA. **A detailed CBA is not justified for the strategic CMP**

3.4.1 What is the base case for Lake Macquarie coastal zone?

A key part of any economic assessment is to understand the base case (current management activities), so that new actions can be compared – do they offer better value in terms of costs and benefits for environmental, social and economic values?

Council prepared detailed base case assessments for the detailed cost benefit assessments it prepared for the Swansea blacksmith Pelican Local Adaptation Plan and for the Pelican foreshore protection works evaluation.

These base cases illustrate the scope of work that is already in place to protect and maintain the values of the coastal zone of the city. The base case includes land use planning measures, community engagement measures, monitoring, reporting, asset and infrastructure management, stormwater management, ecological projects, foreshore management, access and amenity projects and other plan making and on ground works.

In Stage 1 of the CMP, Council reviewed actions that had been in place as part of its review of current and future risk management.

Rather than document the scope and economics of a base case for the whole of the coastal zone of Lake Macquarie, Council has identified in the economic viability tables (**Appendix 4**) whether each potential CMP action is:

- existing and continuing – an action commenced previously, but which needs to be continued. Some of these may have a minor change of scope or focus
- new (included in the CZMP, and not commenced and revised for inclusion in the CMP
- new, a recommendation or an option from other recent studies in the coastal zone

- new, suggested by Council staff, or agency staff or members of the community.

This allows Council to differentiate between actions that were already part of the framework for coastal management in the city, and those which have been added through the current CMP process.

3.4.2 Factors considered in the economic evaluation

The economic evaluation tables identify for each potential action (organised by issue):

- Whether the action is considered part of the 'base case' as an existing and continuing action.
- A qualitative description of the anticipated benefits of the action and when those benefits may be experienced. This is the rationale for implementing the action. The benefit statements draw on data from Council's ongoing management and monitoring of the condition of the coastal zone, previous management performance reviews and data from Council's community satisfaction surveys.
- Council's proposed timing – when implementation of the action will commence.
- Whether the action is the responsibility of Council or a public authority.
- The type of action – one off or ongoing, and whether it is capital, maintenance or operational.
- Indicative costs for actions in capital, maintenance and operational categories (excluding staff resources).
- Indicative staff resources required to support implementation (including planning, project management and actions that will be done by Council staff). Council currently has 6.0 EFT staff in its environmental strategy, natural assets, adaptation planning and sustainability engineering teams who have responsibilities for coastal zone management. These responsibilities include research and monitoring, project planning, project management and administration, reporting, and other communications.
- Whether Council expects that grant funds will be available. together with the information about which organisation would lead actions, the availability of grant funds helps Council to plan budgets for managing its coastal zone. Grants may be available from diverse programs, not only the Coast and Estuary Grants Program.

The economic evaluation does not attempt to sum the costs and benefits of individual actions or groups of actions. Council has not calculated net present values or benefit cost ratios for the actions in the CMP. The inputs to the economic evaluation do not provide sufficient quantitative data for these calculations to be made.

The two detailed cost benefit assessments that have been completed for works to protect the community and community assets from coastal hazards (options for Swansea Blacksmiths and Pelican local adaptation, and options for shoreline protection at Pelican (CIE 2019 and 2020)) do include these quantitative calculations, but are based on significant assumptions for both costs and benefits.

3.4.3 Distribution of costs and benefits

The NSW Government invests in coastal management for the benefit of the people of NSW. Lake Macquarie City Council invests in coastal management for the benefit of the people of the city. Together these government investment priorities mean that the NSW government and Council do not give priority to investments of public money which lead primarily to private benefits, unless there is a clear equity or environmental reason to do so.

Examples of public investment which may directly or indirectly benefit private landholders or businesses include:

- government funding of construction of coastal protection works which primarily protect private property, and at the same time may be detrimental to public access and amenity, by either removing public access to beaches and foreshores, or making access unsafe
- construction of beach accessways that are accessible to only a few private land-owners.

The distribution of public and private costs and benefits is discussed in the business plan for the CMP.

Key points that are relevant here are:

- Almost the entire open coastline of Lake Macquarie is in public ownership.
- Of 170 km of foreshore around Lake Macquarie, councils (Lake Macquarie and Central Cast), NPWS and Crown Lands manage approximately 100 km.
- Council's focus is on this public land and on achieving benefits for the natural environment and community lifestyle of the city.
- Where the CMP includes actions that are relevant to private land holders on the estuary shoreline, the focus is on increasing awareness and capacity of waterfront property owners to use sustainable foreshore protection measures; or to manage foreshore gardens to reduce pollutant loads in runoff to the lake; or to protect foreshore and riparian vegetation including wetlands; or to avoid mitigate long term risks from sea level rise. These actions all have a public benefit in terms of the health of the coastal environment and opportunities to maintain public access to beaches and foreshores.
- Council is directly responsible for about 25% of the actions in the CMP, and will lead a further 50%, in partnership with other public authorities. Council will implement these actions on behalf of the people of Lake Macquarie.

3.5 Acceptability criteria

The Manual highlights several factors which may be considered in relation to acceptability, i.e., whether the community and stakeholders accept that the program of actions is well targeted, and they are willing to support or contribute to its implementation.

The acceptability of proposed coastal management actions may be assessed in terms of:

- public interest and wider public benefit (distribution of benefits)

- sustainability (see Council's policy)
- fairness and equity (beneficiaries, but also capacity to pay), now and intergenerational (see Council's policy)
- community cohesion and resilience (see Council's policy)
- potential impacts and their distribution (assessed as part of Feasibility, but also an equity piece in distribution)
- effectiveness in reducing risks and threats (assessed as part of Feasibility)
- whether the action is proportional to the level of risk (assessed as part of Feasibility)
- consistency with the objectives of the CM Act and Council's long-term strategic direction (assessed as part of Feasibility)
- timeliness (assessed as part of Feasibility)
- value for money and efficient use of resources (assessed as part of economic Viability).

Of these, the ones which would not have been considered in the feasibility and economic evaluation are about proportionality, sustainability, timeliness and fairness/equity.

As noted above, Council's sustainability policy (ESSAP) and pillars address these and provide an established process for Council to evaluate its actions.

To assess acceptability Council is relying on evidence from:

- previous feedback to Council on the value for money offered by coastal management actions and input to previous option evaluations for local adaptation plans and the Lake Activation Strategy
- recent community satisfaction surveys
- input received during the preparation of the CMP
- responses received during the exhibition of the CMP
- discussions with public authorities and confirmation correspondence from public authorities about their willingness to work with Council to achieve coordinated delivery of management actions that are on their land or are their responsibility.

Based on the evidence available so far, Council believes that all actions that are proposed to be included in the CMP are acceptable to the community and other stakeholders. Council will update this assessment after the draft CMP is exhibited for community comments and formal correspondence is received from public authorities.

4.0 Feasibility Evaluation Outcomes

The feasibility evaluation tables for actions for the coastline, channel and Lake Macquarie estuary are included in **Appendix 1**.

The tables show:

- actions previously evaluated as feasible (in other studies) using a process that is consistent with the current requirements
- evaluation for all other actions against the six criteria, with explanation of scores as necessary.
- overall feasibility outcomes for all potential actions.

The feasibility assessment tables show that feasibility is not a key constraint to implementation of the actions that Council is considering for the CMP.

This can be attributed to:

- Council and community experience in managing the coastal zone and adapting to coastal change
- most actions for the Lake Macquarie coastal zone are operational measures, in the 'no regrets' category, which means they have few practical limitations.

For the **coastline**:

- most actions score 'green' on all criteria
- approximately 10% of options had yellow scores against one or two criteria (most often on practicality or adaptability), but are still considered feasible overall
- only one potential response was scored 'red' for any options. This resulted in a 'yellow' overall score for the action.

For the **channel**:

- Many actions were brought forward from previous strategies and plans where detailed feasibility and economic evaluation had been conducted. These plans were developed with local communities through collaborative processes, have been adopted by Council, and the actions within them are considered to be both feasible and economically viable. However, these actions have not yet been implemented.
- The remaining new initiatives support these previously evaluated actions.

For the **Lake Macquarie estuary**:

- the proposed actions are a mix of new actions and previously evaluated actions brought forward from plans and strategies which have not yet been implemented
- approximately 5% to 10% of options have a 'yellow' score against one or two criteria; one option has a 'yellow' score against three criteria, leading to a 'yellow' overall score.

Following the feasibility assessment, all management options continued in the evaluation process. Council slightly rationalised the wording of a small number of options between the feasibility and economic viability evaluation, accepting feedback on opportunities for improve clarity or focus. These minor changes to wording do not change the intent of the actions.

5.0 Economic Evaluation Outcomes

The economic evaluation tables in **Appendix 4** include a benefit statement for each proposed action. These benefit statements provide an overview of how the action will add value at a local or regional scale.

The benefit statements reiterate that the value of proposed actions lies in:

- providing new information about important coastal systems, to support improved management responses
- a focus on the management of public land and public benefits
- a continuing balance between community expectations of quality, safe access and amenity to Lake Macquarie, its foreshores, the channel, and the city's beaches and headlands, and measures to protect and restore the health of coastal systems across all coastal management areas
- ongoing engagement with and involvement of the local community in management decisions that affect them
- continuing projects and programs which have a demonstrated positive outcome for the environment and communities of the coastal zone, consistent with the objects of the CM Act and the relevant coastal management areas.

The economic evaluation demonstrates the central role of Council in managing the coastal zone of the city. Approximately 29% of actions in the CMP will be delivered by Council alone, and overall, Council is the lead for approximately 80% of actions.

The majority of the actions which have been evaluated are operational or management actions; that is, they are consistent with the well-established management of the coastal zone and with an approach based on protection and restoration of natural assets, natural hazard risk avoidance, and preparation for the mitigation of future risks. The management actions including the monitoring, reporting, engagement and governance arrangements necessary for effective and transparent management of coastal issues.

There are few capital works projects in this CMP. Rather the focus of the CMP is ongoing planning, operational and maintenance works, compliance, monitoring, reporting, communications and engagement. These are actions which will maintain community interest in and value of the city's coastal zone.

On the open coast, future capital works are foreshadowed, but not part of the program of works over the next decade. These capital works will include relocation of Redhead surf club to reduce risks from coastal erosion and coastal inundation, and the construction/renewal of an accessible and safe coastal walking path from Caves Beach, through Wallarah National Park and Munmorah State Conservation Area. The walking track route will require detailed studies and planning which are part of the current CMP. Both of these projects are consistent with the high community value of beach access and with council's strategic direction – to enable safe public access and amenity to the coastal zone, to support diversification of the economy of the city.

Capital works projects are proposed in Swansea Channel (Pelican), to stabilise eroding foreshores. The source of this erosion by current scour and undercutting of the bank is not within the capacity of current managers to control. The foreshore protection works at Pelican are on public land and are to maintain the public recreational benefits of safe foreshore recreational access. Council has previously prepared a detailed cost benefit analysis for these works. Council will seek grant funds from the NSW Government to share the funding of these works.

For the estuary component of the CMP, investment in capital works is proposed to improve and extend the performance of the network of stormwater devices (SQIDs) which protect water quality in Lake Macquarie. Given the high value that the community places on good water quality and the social and economic benefits that depend on good water quality and healthy ecological communities, there is a strong economic case for continuing to invest in infrastructure which has demonstrably benefitted these outcomes.

6.0 Acceptability

In addition to the technical evidence of benefits, outlined in **Section 5** and **Appendix 4**, Council's community satisfaction survey results provide evidence that investment in projects that protect, restore and enhance the natural environment is highly regarded by the community.

Coastal zone management (lake, foreshore, coastline) is identified as a very important service, with high levels of satisfaction. this management protects one of the most valued reasons for living in Lake Macquarie.

By identifying environmental concerns as a priority for the next decade, the community has recognised that there are significant challenges for the coastal zone and that ongoing investment in the health of coastal systems and the benefits they provide for the community, is important and supported.

Highest rated services/facilities – Importance Road maintenance **Lake/foreshore/coastal management** Parks and playgrounds Footpaths/cycleways/shared paths Long term planning for the city	**Highest rated services/facilities – Satisfaction** Overall appearance of the city ovals and sporting facilities **Lake/foreshore/coastal management** Swimming pools Swimming pool programs and activities
Most valued aspects of living in Lake Macquarie **Natural environment – beaches and lakes 48%** Location – proximity to cities, services, facilities and family Lifestyle – relaxed, quiet, rural	**Priority issues over the next 10 years** Roads – potholes, supporting infrastructure, maintenance Traffic management – congestion, traffic lights **Environmental concerns**

The community responses indicated that residents believe council has delivered a good performance for:

- adapting to climate change and
- balancing development and maintaining the environment
- planning for natural disasters
- public jetties and boat ramps
- visitor and tourism services.

Community comments about the most valued aspects of living in Lake Macquarie include:

- The natural environment (beaches, lakes) scored more highly in 2021 (48%) than in 2020 (45%), with qualitative comments such as:
    - the lake and the space
    - environmental aspects – local waterways, rivers, lakes

- perfect balance with access to services and facilities but not overpopulated
- relaxed area and the lake is beautiful.

Council's 2021 survey identified the following statements as most agreed upon by the people of Lake Macquarie. These statements are all directly relevant to investment in managing the natural spaces of the coastal zone.

In addition to these, 70-85% of people agreed with the statement 'our natural environment is protected and enhanced'.

The analysis in the 2021 survey also highlights the key importance of 'shared decision making' as a driver of satisfaction with council's performance. This strengthens the case for including actions in the CMP which provide information for the community, engage them in decisions and promote and provide support for collaborative approaches.

It follows from these findings that actions assessed as acceptable to the community will be those that:

- protect the health of natural coastal systems, particularly Lake Macquarie, its foreshores, and the city's beaches and headlands
- protect the environmental condition of public waterfront land
- provide quality access and amenity facilities to beaches and foreshores, while maintaining the naturalness of those areas
- continue to support community awareness and appreciation of the city's heritage
- help residents understand future pressures and adapt to ongoing change.

These are the specific priorities of the CMP.

6.1 Acceptance by public authorities

As noted in **Section 2.3**, Council has been engaging with relevant public authorities since preparation of the CMP commenced.

Formal responses from public authorities, accepting responsibility for certain actions, are not yet available to Council.

Council will continue to engage with representatives of the public authorities in the coming weeks, to provide clarity about roles and responsibilities, capacity (staff resources and budget) to implement actions in a timely manner and willingness to work as partners in the coordinated implementation of the CMP.

7.0 Prioritisation

This is the final step in Stage 3. The Manual positions the development of a program of actions as part of adaptive management. The concept of a program means that councils can identify actions that will be implemented first (in the 1 year or 2 to 5-year timeframes). These actions may continue in future iterations of the CMP, or may be replaced by other actions when agreed thresholds have been met.

The program developed for the CMP should also include the management elements necessary for adaptive management to be implemented.

Section 1.2.1 outlines the types of actions which can be drawn into the subprograms of the CMP.

Depending on the information that is already available, the complexity of the issue, the rate and likelihood of change and community and stakeholder capacity, the CMP may include a combination of any or all of the actions in **Section 1.2.1**.

For each of the high-risk issues/threats, the CMP includes:

- actions to collect good baseline data, if there is currently insufficient information to support strong decision making and/or
- actions that test thresholds where a threshold has been identified for a change of approach (e.g. from community awareness raising and monitoring, to more intensive on ground intervention), and/or
- risk avoidance measures such as planning and management controls, to prevent the risk from increasing; and/or
- on ground works such as dune management, coastal protection works, wetland rehabilitation to reduce threats and hazards, if the evidence indicates that direct action is warranted. The CM Act directs that natural defences (dune management, wetland management) should be used in the first instance to manage coastal hazard risks, stepping up to more structural protection if it is clear that the natural defences cannot deliver the agreed objective; and/or
- emergency management provisions where coastal hazards present high risks to assets and life that cannot be controlled by other measures; and/or
- a process for monitoring, evaluating and reporting progress.

The full programs of actions proposed for the coastline, channel and estuary are included in **Section 4.4** of the CMP.

Tables 7.1, 7.2 and **7.3** provide examples of how the subprograms for each of the key coastal issues are being structured. The examples illustrate how the structured approach to different issues results in different timing of actions.

Coastal dune stability and management of the natural defences offered by stable vegetated dunes is typical of the programs of actions for the Lake Macquarie coastline, recognising that the coast is almost entirely in public ownership, and natural. In this context, many actions in **Table 7.1** are in ongoing monitoring, maintenance and communication categories, and continue over the life of the CMP. However, the program

does include actions to further investigate more intensive sand management schemes, to prepare for actions which could be needed in the future to maintain amenity and to prevent coastal inundation.

Table 7.2 illustrates a channel program where major coastal protection works have been identified as the necessary management response through detailed studies and cost benefit analysis. The focus of this program is in years 2 to 5, with intensive construction works for areas A, B, C and D of the Pelican foreshore. Council cannot fund these capital works alone, so the first year of the program includes an action to confirm the timing and quantum of funding support from the NSW government.

Management of diffuse sources of water pollution from urban areas is an important issue for the health of Lake Macquarie. **Table 7.3** shows that the program of actions to better manage diffuse source water pollutants and their impact on estuary health comprises multiple ongoing actions. council already has a clear understanding of the benefits of the SQID infrastructure and upgrades and extensions will commence in year 1, funded by Council.

Table 7.1 Example of program development – Coastline subprogram, coastal dune stability

Extreme or high-risk issue: Ecosystem impacts from climate change and coastal hazards **Coastal dune stability is threatened by coastal erosion, disturbance and unplanned access.**			
Action	**Short term (commence in 1 year)**	**Medium term (commence in 2 to 5 years)**	**Longer term (commence in 5 to 10 years), or beyond**
Governance			
Investigate transfer of private land along the coast from MHW in immediate hazard zone to public tenure	Yes	Only if not resolved	
Knowledge, pilots, awareness and capacity building			
Investigate the feasibility of a sand slug configuration placement for future dredging campaigns; including trials, monitoring, stakeholder awareness and preferences.	Yes – awareness and design	Yes – continuing trials and evaluation	
Encourage community stewardship of natural areas	Yes - ongoing	Yes - ongoing	Yes - ongoing
Continue community activity programs focusing on coastal protection and environment issues	Yes - ongoing	Yes - ongoing	Yes - ongoing
Provide community information about poor water quality and causes, in small coastal creeks and lagoons	Yes – urgent need to raise awareness and generate support for controls	May be required if conditions do not improve (subject to monitoring outcomes below)	
Avoid risks with land use and land management plans			
Consider the development of a concept design and detailed design for a sand transfer scheme at Swansea Heads		Commence design works (following feasibility studies)	Yes – detailed design and Approval process

Extreme or high-risk issue: Ecosystem impacts from climate change and coastal hazards Coastal dune stability is threatened by coastal erosion, disturbance and unplanned access.			
Develop and implement dune management plans for priority areas	Yes – highest priority	Yes, continuing priorities	
Review and improve permit issuing practices to manage numbers in BWSP; regulate waste dumping	Yes – urgent need to manage numbers	Yes – review management outcomes	
Prepare creek management and water quality improvement plans for small creeks and lagoons used for recreational swimming/splashing	Yes – Nine Mile Beach	Yes – other creeks and lagoons	
On ground works and active intervention			
Conduct beach management works to revegetate, reshape and increase dune volume recovery	If necessary (note dune management plan is needed first)	Yes – ongoing, subject to dune management plans	Yes – ongoing, subject to dune management plans
Raise and reinforce low points in dunes	Where already approved	Subject to dune management plan	Subject to dune management plans
Performance monitoring, review and reporting			
Coordinate monitoring and management efforts by state and local government relating to water quality and dune management	Yes – develop consistent and shared monitoring and reporting protocols	Yes	Yes

Table 7.2 Example of subprogram development – Channel, Stabilisation of Pelican foreshore

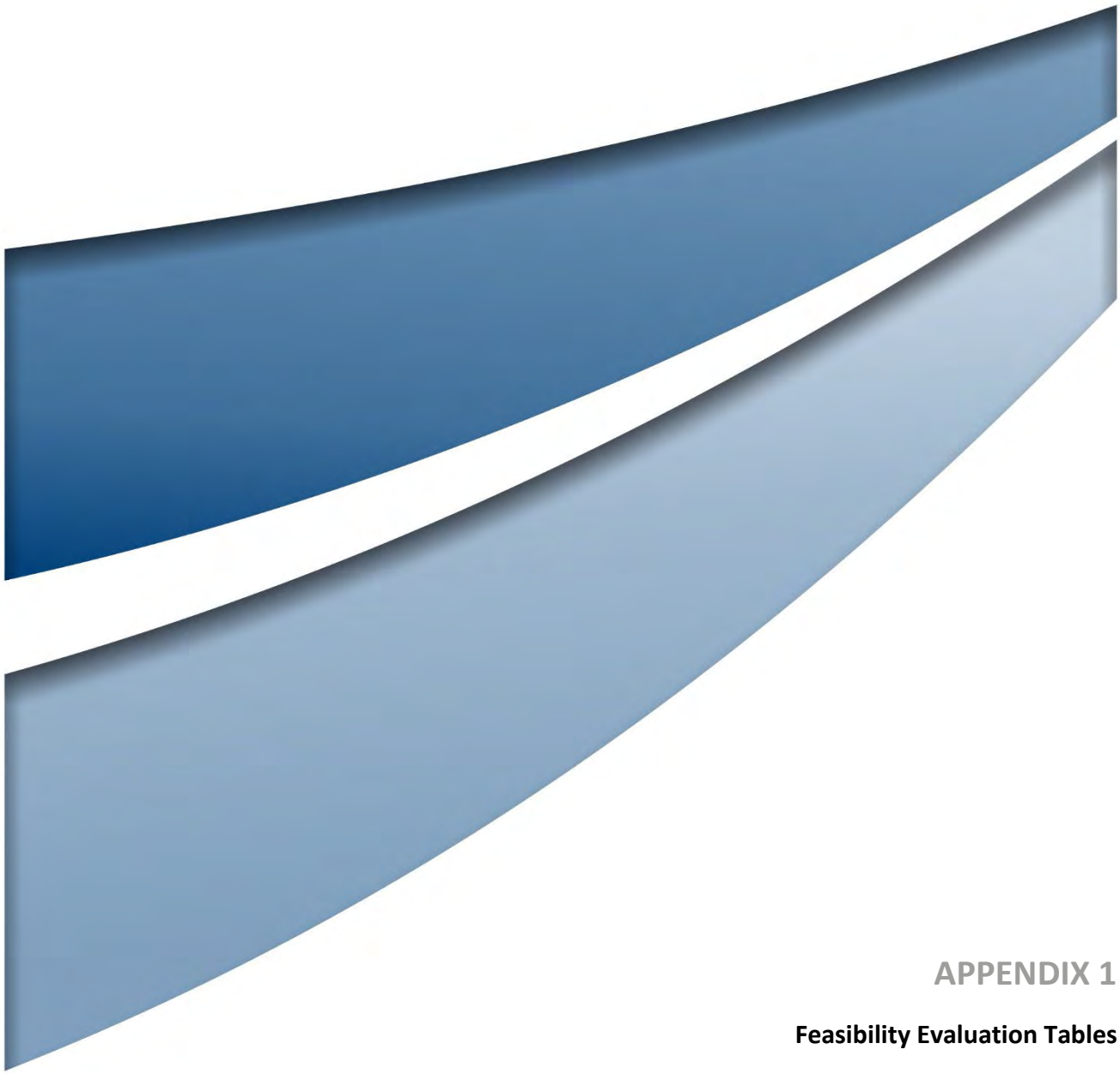
Extreme or high-risk issue: Existing and future coastal hazards impact on social and economic values Erosion along the Pelican foreshore threatens public recreation space and safety			
Action	Short term (commence in year 1)	Medium term commence in 2 to 5 years)	Longer term (commence in 5 to 10 years), or beyond
Investigations, modelling, option development and cost benefit analysis of options have been completed for the Pelican foreshore, as actions arising from the previous CZMP and local adaptation planning. Actions in the CMP are about the implementation of agreed coastal protection works.			
Governance			
Secure funds to and implement recommendations of the Pelican foreshore design report	Yes. Council will engage in further discussion with public authorities and apply for grants to enable implementation.	Yes. Ongoing negotiation of funding arrangements is likely to be necessary. Total capital cost required for precincts A to D is $11.47 million.	Yes. Ongoing negotiation of funding arrangements is likely to be necessary

Extreme or high-risk issue: Existing and future coastal hazards impact on social and economic values Erosion along the Pelican foreshore threatens public recreation space and safety			
On ground works and active intervention - coastal protection works to mitigate risks and create social and economic opportunity			
Stabilise Pelican foreshore – Precinct A (using scheme B approach identified in the Pelican Foreshore Design Project); Incorporate environmentally friendly design principles.		Yes. Works are proposed to commence for Precinct A in years 2 to 5, provided funding commitments are in place. Capital cost $4.67 million	
Stabilise Pelican foreshore – Precinct B (using Scheme B approach identified in Pelican Foreshore Design Project); incorporate environmentally friendly design principles		Yes. Works are proposed to commence for Precinct A in years 2 to 5, provided funding commitments are in place. Capital cost $2.1 million	
Stabilise Pelican Foreshore Precinct C (using Scheme B approach identified in Pelican Foreshore Design Project); incorporate environmentally friendly principles		Yes. Works are proposed to commence for Precinct A in years 2 to 5, provided funding commitments are in place. capital cost $3.75 million	
Stabilise Pelican Foreshore Precinct D (using Scheme B approach identified in Pelican Foreshore Design Project); incorporate environmentally friendly principles		Yes. Works are proposed to commence for Precinct A in years 2 to 5, provided funding commitments are in place. Capital cost $950,000.	
Maintain the Pelican Foreshore stabilisation works		Yes	Yes
Performance monitoring, review and reporting			
Monitor the Pelican foreshore – foreshore position, bathymetry and stability, and report publicly	Yes. This action is essential for understanding channel dynamics and communicating stability issues, safety and navigability to waterway users	Yes. This action is essential for understanding channel dynamics and communicating stability issues, safety and navigability to waterway users	Yes. This action is essential for understanding channel dynamics and communicating stability issues, safety and navigability to waterway users

Table 7.3 Example of subprogram development – Estuary – protecting lake health from impacts of urban stormwater

High or extreme risk – catchment impacts on the health of aquatic systems			
Action	Short term (commence in year 1)	Medium term commence in 2 to 5 years)	Longer term (commence in 5 to 10 years), or beyond
Council has installed multiple stormwater quality devices (SQIDs) on urban drains and minor drainage lines around which contribute sediment and other pollutants directly to Lake Macquarie. These actions are about continual improvement to the water quality protection works.			
Performance monitoring and review – sources, controls and receiving waters			
Identify sediment and nutrient generation hotspots using spatially intensive, short term monitoring programs undertaken during a major rainfall event		Yes Understand priority sources	
Monitor performance of GPT type SQIDs and review to inform the maintenance schedule, considering available sensors and other technology and modelling	Yes This actions focuses on the water quality improvements from existing SQIDs	Yes Ongoing	Yes Ongoing
Conduct monitoring of recreational swimming areas – monitoring bacterial counts to improve management of sewage and stormwater systems	Yes This action provides evidence of the benefits of managing stormwater sources	Yes Ongoing	Yes Ongoing
Continue to monitor lake health, identifying areas for partnering with industry	Yes This action provides evidence of the benefits of improved lake water quality	Yes Ongoing	Yes Ongoing
Prepare a list of SQIDs in the city, identifying their roles – water quality or flood mitigation	Yes Improve record keeping	Yes Update as necessary	Yes Update as necessary
Avoid or mitigate risks with improved policy settings and planning			
Minimise the use of machinery by adopting a bush regeneration approach to maintenance of vegetated SQIDs	Yes	Yes Ongoing	Yes Ongoing
Review council's water cycle development controls for all new development	Yes		
Identify prioritised strategies to minimise erosion losses from unconsolidated road verges, building sites and other streetscape generation hotspots		Yes Source controls	
Active intervention and on ground works to reduce risks to estuary water quality			
Implement recommendations from '*Effects based assessment of wastewater overflows in Lake Macquarie catchment*'		Yes To reduce impacts of diffuse source pathogens (focus on Cockle Creek catchment)	Yes Ongoing

High or extreme risk – catchment impacts on the health of aquatic systems			
Retrofit upgrades to existing SQIDs to improve asset performance, targeting catchments contributing high concentrations of nutrients and/or high sediment loads to sensitive parts of the lake	Yes	Yes Ongoing	Yes Ongoing
Install and maintain WSUD devices to reduce sediment and nutrient load, maximising pollutant removal efficiencies and prioritising catchments contributing high concentrations of nutrients and/or high sediment loads to sensitive parts of the lake	Yes	Yes Ongoing	Yes Ongoing
Continue compliance and education programs for the construction industry and residential property owners to promote best practice stormwater management	Yes	Yes Ongoing	Yes Ongoing



APPENDIX 1

Feasibility Evaluation Tables

Many actions were brought forward from previous feasibility evaluation – potential Swansea channel management responses

Action	Consistent with, promotes and gives effect to the objects of the CM Act and relevant coastal management areas	Other statutory or policy requirements can be managed (i.e. aligns with government priorities and a clear approval pathway)	Effective and sustainable: Is known to be an effective response for the threat/risk involved, with no major unintended side effects (environment or social)	Can be adapted, or is a component of an adaptive approach	Is practical and can be implemented, including engineering feasibility for structures	Likely to contribute new knowledge	Other comments
Social and economic impacts from climate change and costal hazards **There are high value assets (including entrance training walls and channel protection works) at risk from sea level rise and climate change** **The collaborative framework for management across multiple agencies needs to be clearer and stronger**							
C1 Maintain the entrance breakwaters in accordance with TfNSW asset management framework; considering sea level rise and climate change							This action is brought forward from the CZMP with minor wording change, but intent is maintained. Considered feasible in the CZMP.
C2 Conduct further investigations of sites or structures in the channel, assessed as high erosion risk, and clarify responsibilities of agencies, to understand future management responsibilities and partnerships		Yes	This action is about information and clarifying roles and responsibilities, so that risks are effectively managed. environmental and social consequences may be part of the investigation	Clear roles and responsibilities for management of high-risk sites and assets is a precursor of adaptive management	Further investigations may include coastal engineering studies	Yes, depending on the nature of the investigations	From the CZMP, but with a different intent. Previous action (assessed as feasible) focused on an audit of assets, including **ownership**, condition, effectiveness and expected functional life.

Action	Consistent with, promotes and gives effect to the objects of the CM Act and relevant coastal management areas	Other statutory or policy requirements can be managed (i.e. aligns with government priorities and a clear approval pathway)	Effective and sustainable: Is known to be an effective response for the threat/risk involved, with no major unintended side effects (environment or social)	Can be adapted, or is a component of an adaptive approach	Is practical and can be implemented, including engineering feasibility for structures	Likely to contribute new knowledge	Other comments
C3 Develop interagency infrastructure design criteria for current and future coastal hazards							From CZMP, with minor change to wording and intent; previously assessed as feasible with a broader scope.
C4 Asset management plans – consider coastal hazards and risks when planning major public infrastructure	Directly relevant to objects about coastal processes and risk mitigation	Yes. The relevance of various statutory and policy requirements will depend on the specific infrastructure	Yes. This action will contribute to sustainable designs and investment and will enable consideration of environmental and social factors	Yes. By considering coastal hazards (and how they are impacted by climate change), an adaptive approach is implicit	Yes. The coastal hazard risks will be clarified by coastal engineering studies and infrastructure plans will be informed by risk	Possibly. Existing public infrastructure may not be designed or managed in a way that is consistent with hazards and risks	Brought forward from the CZMP, but with changed wording and updated intent.
C5 Construct or retrofit coastal protection works by public land holders, in accordance with the CM SEPP; incorporate environmentally friendly designs for all seawalls or revetments		The action implies that works will be conducted in accordance with legislation and policy.	State guidance promotes environmentally friendly sea wall designs as a more sustainable approach	If constructed in accordance with the CM Act and CM SEPP, an adaptive approach isa design criterion	Yes. If constructed in accordance with the requirements of the CM Act and CM SEPP, sea walls will be required to demonstrate engineering	Possibly – this is not a key objective of the action. May demonstrate how environmental features such as habitat can be	New

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					feasibility and effectiveness.	incorporated into sea wall designs – providing examples for private structures.	
C6 Investigate expanding the pilot tidal gates project to other sites (Swansea urban areas, Black Neds Bay, Blacksmiths behind northern revetment)							New, From LAP. LAP actions have been assessed through a multicriteria feasibility assessment and CBA. Further feasibility assessment is not required.
C7 Support LAP actions implementation relating to future inundation and/or pilots on public land							From LAP All actions in the LAP have been evaluated through a multi criteria feasibility assessment and full CBA. No further evaluation is necessary.

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Erosion along the Pelican foreshore threatens public recreation space and safety							
F1 Fund and implement recommendations of the Pelican foreshore design report. Stabilise Pelican foreshore – Precinct A (Naru Point to south side Pelican airport), using scheme B approach identified in the Pelican Foreshore Design Project. Incorporate environmentally friendly design principles.							From Pelican foreshore CBA (and MCA for feasibility). No further evaluation for feasibility is required.
F2 Stabilise Pelican foreshore – Precinct B (south side airport to south side public jetty at Soldiers Road) (using Scheme B approach identified in Pelican foreshore design project);							From Pelican foreshore MCA and CBA. No further evaluation required

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incorporate environmentally friendly design principles							
F3 Stabilise Pelican Foreshore Precinct C (public jetty to boat ramp) (Scheme B approach); incorporate environmentally friendly principles							From Pelican foreshore MCA and CBA. No further feasibility assessment is required
F4 Monitor the Pelican foreshore – foreshore position, bathymetry and stability							From Pelican foreshore MCA and CBA. No further feasibility assessment is required
Private property is threatened by tidal inundation							
P2 Implement priority actions of the Eastlakes LAPs; explore resilience planning							From LAP all actions have previously been evaluated using an MCA for feasibility and full CBA. no further feasibility evaluation is required.
Access to the marine estate (social issues)							

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Navigability of Swansea channel needs to be balanced with environmental and resilience impacts							
N1 Implement dredging and sand placement in accordance with the Sustainable Framework for Navigation in Swansea Channel (Crown Lands 2011). Small episodes of navigation dredging may be required at other locations such as the entrances to Black Neds Bay and Swan Bay/Village Bay	The concept of the SFNSC is consistent with the aim and objects of the CM Act, particularly recognising the necessary balance between economic and social values of safe boating access to coastal waterways for a range of craft, and the risks to lake ecology and inundation patterns from a channel that conveys more tidal flows into the lake. It recognises and responds to the dynamic nature	Yes	See N4. The sustainable navigation strategy was based on coastal engineering studies which have now been supplemented with new knowledge which shows that environmental impacts are likely to be greater than originally anticipated. The navigation strategy is intended to deliver sustainable access to the waterway for diverse users, cost effectively. dredged sand is intended to be used for beach/dune nourishment.	Yes. The SFNSC was intended to be regularly reviewed and adapted. The review proposed in N4 foreshadows adaptive changes to the strategy, to respond to new knowledge about channel and lake hydrodynamic processes	The navigation dredging is technically feasible, but has been shown to generally offer only a short term solution, depending on other processes such as lake floods.	Not a primary objective, but ongoing monitoring of the channel condition and response to dredging will contribute to knowledge of effective management of a dynamic system	From CZMP and Sustainable Framework for Navigation. Previously assessed as feasible in the study and strategic framework prepared by Crown Lands in 2011. This will be updated within the life of the new CMP.

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	of the coastal zone.						
N2 Conduct regular hydrosurvey of Swansea Channel in accordance with SFNSC	Yes. This action is about monitoring to understand how the coastal processes in the channel respond to various drivers.	Yes No statutory approvals required	Yes. This is critical information for managing the values of the channel	Yes	Yes	Yes.	This is a monitoring action. From CZMP and SFNSC. Feasibility assessment previously prepared in the SFNSC
N3 Update the SFNSC to include channel evolution and impact of dredging on the natural environment. This may influence the appropriate frequency of dredging, improved monitoring, including tidal processes and impacts on the lake.	Yes. The aim of the update is to better align the navigation strategy with coastal processes and the social and economic values of the lake and channel.	Yes. Safe and sustainable recreational boating is a state priority. Approval pathways will be part of the update.	Yes. The purpose of the update is to address environmental and social consequences, taking into account new information from performance over the last decade and new hydrodynamic data and modelling. It can also accommodate recent trends in	Yes. The purpose of the review and update is to adapt the approach to new knowledge	Yes. The review and update will consider lessons learnt from implementing the SFNSC over the last decade and may incorporate new engineering studies	Yes. the update will incorporate new knowledge and set up the framework for continuing monitoring and review	New

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			boating on Lake Macquarie				
N4 Utilise dredged sand for nourishment at priority locations and in accordance with dune management plans. Consider transport costs (including at planning stage)							Action brought forward from CZMP but with change of intent. **Should be re-evaluated**.
N5 Investigate the feasibility of a west channel diversion to reconfigure and train the navigation channel via the Airforce Channel, to address scour, navigation and maintenance issues.	Yes – as a study of coastal process management	Yes, this will be part of the feasibility study	Yes. This is the purpose of the feasibility assessment – to understand if the Airforce channel offers a more sustainable navigation option. a change in channel alignment would only be implemented if the feasibility study shows significant	Position this action as part of an adaptive approach, by reviewing navigation options with new evidence.	This action will involve coastal engineering studies and modelling		New.

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			benefits and reduced costs.				
Swansea channel is a major recreation and tourism asset for Lake Macquarie; some assets are not aligned with the potential							
LA1 Support the implementation of actions to enhance recreation activation along Swansea Channel, as identified in the Lake Activation Strategy							From Lake Activation Strategy, adopted by Council in September 2021. Council has already committed to these actions, after public exhibition. No need for further feasibility assessment
Review Swansea Heads Plan of Management (See Coastline Actions)							
Environmental impacts from climate change and coastal hazards (NOTE – not listed as a key threat in Stage 1, but identified as a priority issue in the State of the Estuary report)							
Estuary wetlands are vulnerable to sea level rise and climate change							
W1 Research best practice approach for enabling landward movement of saltmarsh **in the estuary**							From CZMP (and LAP). Intended to include both wetlands around Swansea Channel and Belmont wetlands, and others.

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							Possible MEMS project. Further evaluation of feasibility not required.
W2 undertake pilot projects for re-establishing estuarine wetland communities such as saltmarsh and seagrass, which will be affected by higher lake levels (where they occur along the channel)							From Swansea LAP Previously included in MCA feasibility assessment and full CBA. No further feasibility evaluation is necessary.
W3 Monitor wetlands to evaluate the performance of protection activities and/or pilot projects for re-establishing estuarine wetland communities (where they occur along the channel)							From Swansea LAP. Previously included in MCA feasibility assessment and full CBA. No further feasibility evaluation is necessary.
W4 Conduct wetland rehabilitation works							Brought forward from the CZMP,

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							including a list of priority sites in the channel.
W5 Work with existing or establish a formal Landcare program to undertake rehabilitation in priority areas as they relate to the channel, noting Landcare is also key to land management works around the estuary and on coastal dunes and headlands.							This is referring to Salts Bay, brought forward from the CZMP.
W6 Protect roosting, feeding and nesting habitat for migratory shorebirds (sand placement and fencing)							Brought forward from CZMP, but with change to approach and potentially locations. Focus is Sand islands near the bridge and Naru sand island. Previous action referred to vehicle and dog exclusion.

Action	Consistent with, promotes and gives effect to the objects of the CM Act and relevant coastal management areas	Other statutory or policy requirements can be managed (i.e. aligns with government priorities and a clear approval pathway)	Effective and sustainable: Is known to be an effective response for the threat/risk involved, with no major unintended side effects (environment or social)	Can be adapted, or is a component of an adaptive approach	Is practical and can be implemented, including engineering feasibility for structures	Likely to contribute new knowledge	Other comments
							Re-evaluate
Strengthen evidence of tidal inundation patterns and levels							
T1 Monitor frequency, depth and spatial extent of storm inundation, tidal inundation and lake flooding events. Monitor and analyse data from tidal gauges to assess local trends in sea and lake levels.							From CZMP and also in the Swansea LAP. Intended to ground truth models. Included in previous feasibility and CBA assessments. No further feasibility evaluation required.
Other management process actions							
Clarity about land tenure is needed to enable management							
L1 Appoint Council as the Crown land manager for reserves 88033 and 88883 (Swansea Heads)	Not inconsistent with objects.	Yes	This is a governance action, to clarify roles and responsibilities for public open space. clarifying tenure and responsibility is fundamental.	The action is about governance rather than process, but is consistent with an adaptive approach	Yes No engineering involved.	n/a	New
L2 Formalise ownership arrangements and responsibilities for							From CZMP, with wording change, but intent remains the same. Largely about determining which

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public assets in Swansea Channel.							coastal protection works in Swansea Channel are Crown Lands or TfNSW or Council responsibility. No further feasibility assessment required.
Engage community stakeholders							
EK1 Consult with Awabakal Traditional Owners and relevant Local Aboriginal Land Council when undertaking works or engagement activities							From CZMP and is current practice. no further evaluation of feasibility is required
EK2 Support community stewardship of natural areas through ongoing support for Landcare							From CZMP, but with changed wording and intent. now similar to Landcare support actions for other parts of the coastal zone. Could be consolidated. No need for further evaluation of feasibility

Feasibility assessment for actions not previously assessed

List new actions	**Consistent with, promotes and gives effect to the objects of the Act, and objectives of relevant CMA (ESSENTIAL)**	**Other statutory and policy requirements can be managed**	**Is known to be an effective response for the threat/risk involved, with no major unintended side effects (e.g. impacts on other aspects of environment or amenity)**	**Can be adapted, or is a component of an adaptive approach**	**Is broadly practical and can be implemented. If the action relates to a structure, it is also feasible in engineering terms**	**Likely to contribute new knowledge**	**Overview**
Traffic light scoring system	Green: strongly consistent with multiple objects and management objectives for relevant CMA Aligns with and supports some objects and relevant management objectives Has limited or no alignment with the objects and relevant management objectives of the CM Act Cross reference a list of Objects	Yes or No (provide brief reasons)	Yes – strong evidence Yes – uncertain or equivocal or short-term evidence No Provide reasons	Yes Yes, but the process is complex No Provide brief explanation	Clear evidence of practicality Some limitations to practicality Not practical Explain practical – what do we mean here? Feasible engineering	Yes – purpose of the action Yes, as an ancillary benefit No Explain which knowledge gap is being addressed	Green: must be Green in (1) and at least 3 of the other 5 columns.

Objects of the CM Act

The objects of this Act are to 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, and in particular—

a) to protect and enhance natural coastal processes and coastal environmental values including natural character, scenic value, biological diversity and ecosystem integrity and resilience, and

b) to support the social and cultural values of the coastal zone and maintain public access, amenity, use and safety, and

c) to acknowledge Aboriginal peoples' spiritual, social, customary and economic use of the coastal zone, and

d) to recognise the coastal zone as a vital economic zone and to support sustainable coastal economies, and
e) to facilitate ecologically sustainable development in the coastal zone and promote sustainable land use planning decision-making, and
f) to mitigate current and future risks from coastal hazards, taking into account the effects of climate change, and
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, and
h) to promote integrated and co-ordinated coastal planning, management and reporting, and
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, and
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, and
k) to support public participation in coastal management and planning and greater public awareness, education and understanding of coastal processes and management actions, and
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, and
m) to support the objects of the *Marine Estate Management Act 2014*.

Proposed Coastline Actions - Feasibility

Action	Consistent with, promotes and gives effect to the objects of the CM Act and relevant coastal management areas	Other statutory or policy requirements can be managed (i.e. aligns with government priorities and a clear approval pathway)	Effective and sustainable: Is known to be an effective response for the threat/risk involved, with no major unintended side effects (environment or social)	Can be adapted, or is a component of an adaptive approach	Is practical and can be implemented, including engineering feasibility for structures	Likely to contribute new knowledge	Other comments, plus overall feasibility outcome
Coastline Actions							
Increase understanding of coastal risks							
C1 Conduct further analysis of the interactions of lake sourced inundation, coastal recession and marine inundation from overtopping, to clarify combined risks and constraints to land use (potential retreat required?)	The proposed action is a necessary foundation for addressing several objects in the CMA, particularly Objects (f), (g), (h) and (i) but also including (a), (b), (d), (e), (j), (k), and (l).	No statutory criteria or approval required and generally aligned with government policy priorities.	Yes - Strong evidence that responses are most effective when underpinned by adequate information and analysis (evidence), particularly in relation to new emerging risks.	Yes - Research and analysis is the basis for, and a component of, an adaptive approach.	Yes - Similar in magnitude and methodology to previous studies undertaken by council.	Yes - This is the inherent purpose of the action.	Revised CZMP action, previously evaluated
C2 Encourage further research on the behaviour of dunes in pocket and long barrier coastal sediment compartments, as climate changes and sea level rises	The proposed action would initiate further actions that would provide the necessary foundation for addressing a number of objects in the	No statutory criteria or approval required and generally aligned with government policy priorities.	Strong evidence that responses are most effective when underpinned by adequate research and analysis, particularly in relation to the	Same as above	Same as above	The purpose of the action is to encourage contribution of new knowledge and build on current understanding	Revised from CZMP feasibility assessment based on CZMP

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	CMA, particularly Objects (f), (g), (h) and (i) but also including (a), (b), (d), (e), (j), (k), and (l).		ongoing effects of climate change and sea level rise.				
C4 Continue to adopt use of technology to support management of the coastline (from CZMP)	Various technologies can be used to increase understanding and provide information to inform each of the Objects of the CMA	Certain technology use may require approval/ licences to establish and/or operate.	Yes	Yes	Use of technology to support monitoring and management is established practice and generally able to be implemented.	The purpose of the action is to adopt use of technology to contribute new knowledge and build on current understanding	
C3 Expand beach camera network and connect with the need to monitor coastal change (prioritise dune erosion sites)	Use of this technology could provide information that could underpin each Object of the CMA.	A beach camera network has functioned for some time, so adapting it to this purpose should not present any new regulatory challenges.	Technology has been in use for some time. Its effectiveness is well established, and should be easy to apply to the stated purpose.	This technology is readily adaptable to multiple purposes, including monitoring dune erosion.	This action would require identification of appropriate sites, development of a monitoring system, and installation of equipment. These are all well within council's capacity.	The purpose of the action is to expand and adapt established technology to contribute to new knowledge and build on current understanding.	
Adaptive approach to managing coastal hazards needs to be strengthened							

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A1(A) consider coastal hazards in future asset planning							From CZMP and considered feasible
A1(B) determine trigger points for commencing detailed planning for protecting or relocating surf clubs							From CZMP and considered feasible
A4A Ensure consistent and coordinated implementation of the CMP and existing Local Adaptation Plan actions	Such an approach is strongly consistent with multiple objects of the CMA	No statutory criteria or approval required and generally aligned with government policy priorities.	Evidence suggests an adaptive approach is an effective and necessary response to managing coastal threats and risk in the context of climate change	Yes	Existing LAPs have been developed to strengthen the local response to climate change and help communities understand when major changes to land use or housing stock will be necessary as part of adaptation. These actions feed back into the CMP	Such an approach is based on the best available knowledge, and both produces and responds to new knowledge.	New
A4B Undertake further climate adaptation and resilience planning in priority areas	Yes, aligns with Object (g) in particular	Other specific legislation and policy will depend on the specific context, but likely to include EP&A	The purpose of the LAP process is to develop sustainable land use plans that adapt to climate	Yes	Yes, Council has a track record of delivering adaptation plans with local communities	Yes	New – but continues a process that has been completed with communities in low lying areas in

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		Act and the Design and Place SEPP	change impacts on communities in the coastal zone				eastern Lake Macquarie
A5 Hunter Water Corporation to consult with LMCC and DPIE through detailed design of the desalination plant on Nine Mile Beach	Such consultation would align with and support a number of the Objects of the CMA and relevant coastal management areas, particularly those for coastal vulnerability, environment and use areas.	The Belmont desalination plant was approved 23 July 2021 (SSI-8896).	Interagency consultation is normal with such projects and is generally recognised as highly desirable (and often formally required). Evaluation of case-specific effectiveness will depend on the outcomes of the consultation processes.	Interagency consultation was a component of the planning and assessment of the project and should be extended to the detailed design and implementation phases.	Consultation on technical and other design, planning and assessment matters are within the capacities of Council, DPIE and HWC	Given that this is the first desalination plant in the Hunter region, the consultation process associated with this project may provide valuable new knowledge.	New
A6 ensure that long term coastal hazards (erosion and wave overtopping in this instance) are addressed in Desalination plant	Strongly consistent with multiple objects of the CMA	The project has approval, but there will be a number of detailed plans required under planning,	The aim of the desalination plant is to provide sustainable water security. This action is to	The Desalination plant is part of an adaptive approach to water security. This action is to support adaptive design and siting, if	Yes, detailed assessment of the project has been completed	Yes	New

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final design and installation		environmental and cultural heritage legislation in the final design and construction phases	ensure that the final designs and operation are consistent with the then known coastal hazard context	more information about hazard context becomes available.			
Coastal dune stability is threatened by coastal erosion, disturbance and unplanned access							
D1 Encourage community stewardship of natural areas through ongoing support of Landcare and increased awareness raising activities (including social media)							From CZMP, previously considered feasible, no need for further feasibility assessment
D3(A) Maintain and improve access to beaches, install fencing and matting on beach access ways to protect dune vegetation and habitats							From CZMP and considered feasible

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D3 (B) Include signage and other education material regarding domestic animals and 4WD access	Directly addresses some objects of the CMA and is not inconsistent with others.	Action is consistent with relevant statutory and policy requirements and has a recognised approval pathway	Yes	Yes	Yes	Yes	New, an additional awareness raising action at 4WD access points – mostly on Nine Mile and Redhead Beach, but there is also illegal off road vehicle access around Catherine Hill Bay.
D4 Fence and formalise access to the beach at Belmont WWTW and Pony Club	Aligns with and supports some objects of the CMA and relevant management objectives and is not inconsistent with others.	Action is consistent with relevant statutory and policy requirements and has a recognised approval pathway	Formalised public access may have unintended side effects, such as greater use, increasing risk to safety and dune stability.	Yes	Yes	Action is likely to contribute to community knowledge of relevant locations and conditions of access.	New
D5 Develop and implement dune management plans for priority areas (Blacksmiths, Redhead, Nine Mile,							From CZMP and considered feasible

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Caves Beach and Catherine Hill Bay)							
D6A BWSP – Review and improve permit issuing practices to manage numbers during peak periods (note BWSP already has limits on the numbers of vehicles that can enter the park and drive on the beach). Potential for integrated management of all access points	Aligns with and supports some objects of the CMA and relevant management objectives and is not inconsistent with others.	Action would be implemented under the Crown Lands Management Act 2016	May create community backlash or divisions over control of access and potentially conflicting values Enforcement methods and capacity will need to be considered	Yes	Implementation and enforcement have practicality implications	The review itself, and the post-implementation evaluation will likely contribute new knowledge	From CZMP but changed intent
D6B BWSP. Review measures to control waste dumping (including contaminated waste and building/demolition waste) in the State Park, including education, participation (e.g.	Generally consistent with coastal and other environmental legislation and policy	Generally consistent with coastal and other environmental legislation and policy. Approvals not required for regulatory approach.	Enforcement and compliance is effective but can be very resource intensive when the problem is spatially dispersed. To be managed along with other	Yes	Does not rely on engineering studies. Practicality is lined to resourcing and appropriate disposal/recycling options.	Not the primary purpose of this action.	Identified as an issue in the Plan of Management for BWSP. Waste dumping is also an issue in other 'remote' bushland along the lake Macquarie coast, which can be accessed by 4WD

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clean up days) stronger compliance and enforcement			antisocial behaviours in near urban bushland				vehicle (e.g. in national park) and in other bushland outside the coastal zone.
D7 Assess vehicle use of other areas of Nine Mile Beach and which organisations have regulatory responsibilities	Aligns with some objects of the CMA and is not inconsistent with others.	No statutory criteria or approval required. Outcomes may have statutory and regulatory implications.	Yes	Yes	Yes	Yes	From CZMP but changed intent
D8 Raise and reinforce low points in the dunes							Evaluated in Wave overtopping assessment, considered feasible
D9(A) Investigate the feasibility of a sand slug configuration placement for future dredging campaigns.	Aligns with some objects of the CMA and is not inconsistent with others	Investigations into the feasibility will identify any relevant statutory criteria or approval requirements	Yes - wave action is a known potential risk to beach stability, and this will need to be a core part of the feasibility investigation.	Yes. Feasibility investigation should include relevant criteria and method for evaluating success.	Investigation of the feasibility of applying such technology is well within council's capacity.	Yes	From surfing amenity assessment

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D9(B) If feasible, undertake monitored trials of configuration placement of sand slugs as sand becomes available (see technology), To evaluate effectiveness in terms of improved surfing amenity, include data collection on beach usage and interviews with stakeholders	Aligns with some objects of the CMA and is not inconsistent with others.	See above D9(A) Trials would need approval in relation to sand placement	Yes, subject to resolving potential conflicts between use of sand for dune nourishment and use of sand for improving surfing amenity.	Yes Note that there are previous CMP actions and actions in the sustainable dredging strategy which promote use of dredged sand to increase dune height and volume, to protect development at Blacksmiths.	Yes	Yes	From surfing amenity assessment

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D9 (C) Conduct community awareness program on the terminology of sand placement, intended outcomes and how it would be implemented	Yes	No statutory criteria or approval required.	Yes	Yes	Yes	Yes	From surfing amenity assessment. This action would be part of the set up of a trial placement and should be part of the assessment and approval work for any sand placement to modify a public beach.
D10 Develop a concept design and detailed design for a sand transfer scheme and consider surfing amenity in any breakwater alterations at Blacksmiths or Swansea Heads	Yes	See above D9(A) Approvals would be required to implement a sand transfer scheme.	Yes	Yes	Yes	Yes	From Surfing amenity assessment, if testing shows positive results

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D11 (see D5) (implement plans) Conduct beach management works to revegetate, reshape and increase dune volume recovery after storms, and to control weeds							From CZMP and considered feasible
D12 Investigate transfer of private land along the coast from MHW in the immediate coastal hazard zone to public tenure. Land owned by Belmont Golf Club, extending onto Nine Mile Beach, is an example, and other sites as identified	Such investigation directly addresses some objects of the CMA and is not inconsistent with others.	Investigations have no statutory criteria or approval required.	Potentially complex environmental, cultural, social, economic and financial implications	Yes	Complex process to investigate such an approach	Yes	From CZMP, but previously ranked as low priority, pending a policy. Review for action

Action	Consistent with, promotes and gives effect to the objects of the CM Act and relevant coastal management areas	Other statutory or policy requirements can be managed (i.e. aligns with government priorities and a clear approval pathway)	Effective and sustainable: Is known to be an effective response for the threat/risk involved, with no major unintended side effects (environment or social)	Can be adapted, or is a component of an adaptive approach	Is practical and can be implemented, including engineering feasibility for structures	Likely to contribute new knowledge	Other comments, plus overall feasibility outcome
D13(A) Prepare creek management and water quality improvement plans for small coastal creeks and lagoons, used for recreational swimming/splashing . Initiate recreational water quality monitoring.	Yes Water quality, recreational safety and amenity are all objects of the CM Act and the action is not inconsistent with other objects	No statutory criteria or approval required and generally aligned with government policy priorities, including MEMS key theme (improving water quality and reducing litter).	Yes The development of water quality plans is intended to provide a clear framework and guidance for beach users on the safety of small coastal waterways	Yes	Yes The monitoring process is straightforward. Main challenge is in resourcing multiple monitoring programs. opportunity for some of the small creeks and lagoons to involve volunteers (e.g. Landcare and Crown Lands, Surf Clubs)	Yes	New
D13(B) Provide community information about poor water quality (e.g. in First and Second Creek at Redhead)	As above	No statutory criteria or approval required to report monitoring outcomes to the community.	Yes	Yes	Yes	Yes	New

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D14 Coordinate monitoring and management efforts relating to aquatic ecosystem health and public health water quality monitoring and improvements at beaches and waterways	Aligns with and supports some Objects of the CMA and relevant coastal management areas, particularly those for coastal vulnerability, environment and use areas.	No statutory criteria or approval required. Water quality is a focus area of MEMS	Yes Coordinated monitoring and reporting in a well-structured program provides efficiency and effectiveness	Yes	Yes The main focus of this action is to develop a coordinated approach, to deliver quality data, relevant to estuary health and community use, accessing and aligning monitoring programs by different organisations – also applies to estuary and Swansea channel	Yes	New Link to state programs (recreational and ecological water quality
Habitat for migratory shorebirds is threatened by coastal processes and recreational use							
M1 Research the impacts of sea level rise on migratory shorebirds	Yes. This is about understanding coastal process interactions and consequences	No statutory criteria or approval required. Migratory shorebirds are protected under State and Commonwealth legislation, subject to international agreements.	Yes	Yes the research will provide knowledge to support adaptation	Yes Can be implemented through research grants to universities, or MEMS projects.	Yes Habitat for shorebirds will be transformed as sea level rises. This research will help to predict the most vulnerable locations and options for alternative habitat	New

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M2 Raise awareness of the importance of migratory shorebirds, including signage about species etc in key locations and other options	Yes, as above.	No statutory criteria or approval required. As noted above, many of these species are protected by international agreements and national and state legislation.	Yes Part of a multi component approach to protecting shorebirds and their habitat	Yes	Yes Multiple local councils already do this e.g. for Little Terns. see Mid Coast Council 'Share the Shore' brochure and media releases. https://www.midcoast.nsw.gov.au/Council-Projects/Share-the-Shore Council already has some information to assist people to identify waders – this could be updated and/or made more interactive file:///C:/Users/PDean-Jones/Downloads/Species-of-Concern-in-Lake-Macquarie-waterbirds-SUS-21736.pdf	Yes. These species feed, nest and roost in complex and dynamic geomorphic areas, so raising awareness also has the potential to bring in new observations and information – although not the primary goal.	New
M3(A) Protect little tern and pied oystercatcher nesting and feeding areas on Nine Mile Beach and dunes, using fencing and vehicle access controls							From CZMP and previously considered feasible

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M3(B) Control domestic animal access to sensitive areas Domestic dogs is the highest priority	Consistent with protecting the natural values, processes and systems of the coast	Action is consistent with relevant statutory and policy requirements and has a regulatory pathway	Yes	Yes	Approaches, methods and enforcement present challenges and some limits to practicality.	Yes	From CZMP and previously considered feasible
D2 Continue community activity programs focusing on coastline protection and key environment issues e.g. summer activities around migratory shorebirds, plastics on beaches	Strongly consistent with multiple objects of the CMA	No statutory criteria or approval required.	Yes	Yes	Yes	Yes	New (introducing some new topics to the program), but continues work that has been ongoing

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Recreational and conservation values of headlands and rock platforms need to be managed							
H1(A) Headland management – review opportunities for improved management (conduct a risk assessment) (vegetation, cultural, tourism) at Swansea Heads	Directly addresses some objects of the CMA and relevant coastal management areas, particularly those for coastal vulnerability, environment and use areas.	No statutory criteria or approval required, but a risk management approach is promoted by NSW Government for management of public land and assets e.g. in CM Act and CLM Act.	Yes	Yes	Yes Council is familiar with a risk-based approach to asset management and has applied it in other contexts.	Yes	New
H1(B) Review and update the Plan of Management (PoM) for Swansea Heads reserve. Identify priority works in the reserve, in conjunction with Bahtabah LALC and Marine rescue	Same as above H1(A)	No statutory criteria or approval required and generally aligned with government policy priorities. Swansea Heads has high Aboriginal, natural heritage and historic heritage values, making it an important Place.	Yes The Plan of Management provides a framework and guidance on values, approach and priorities for managing an important place in the City. Principal challenge is in funding for implementation	Yes	Yes	Yes A review of the existing Plan of Management will provide new information on what can be done better.	New

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H1(C) Implement on ground works in accordance with the PoM to provide good access, protect and interpret values	Same as above. Note CM Act obligation on state agencies to consider certified CMPs when preparing and implementing their PoM	Yes. Approvals (AHIP) under NPW Act likely to be required for any works.	Yes, but must be implemented in consultation with Aboriginal community	Yes	Yes	Not the primary purpose of this action, although monitoring during implementation will provide some practical information on effectiveness.	New
H1D From the channel actions list - equivalent **L1** Appoint Council as the Crown land manager for reserves 88033 and 88883 (Swansea Heads)	Yes – although this is primarily a governance action	Governance arrangements to be consistent with Crown Lands Management Act and Local Government Act, plus potential implications for Native Title Act and Aboriginal Land Rights Act.	Clear and consistent land tenure will support effective and sustainable land management	Consistent with an adaptive approach – in that consolidated governance streamlines review and adaptation	Yes, subject to agreement on roles and responsibilities for Council and Crown Lands	Not the primary purpose of this action n/a	To provide consistent management approach to Swansea Heads, given its significant geological, Aboriginal and historic heritage values, high levels of use and disturbance.

H2 Identify and promote a Marine Protected Area (Aquatic Reserve) conservation status for the intertidal area – Swansea Heads rock platform	Directly addresses some Objects of the CMA and relevant coastal management areas, particularly those for coastal vulnerability, environment and use areas.	No statutory criteria, other than demonstrating that Swansea Heads rock platform would meet the requirements for an MPA. There is no formal process to nominate new MPAs, so need to demonstrate strong community support and convince the relevant ministers that this is a beneficial move for managing the values of the place. Once a Marine Reserve is gazetted, there are controls on use, including fishing closures and limits.	Yes If protected for geo-heritage and biodiversity values, there may be additional controls on access and use. Swansea Heads rock platform is a popular area with locals and visitors.	Yes	Yes MPAs (Aquatic reserves) exist at 12 sites in NSW, 10 of which are in Greater Sydney (Hawkesbury Shelf Marine Bioregion). The only 2 outside Sydney at Bass Point (Shellharbour) and Cook Island (Tweed Heads). Wybong Head in Central Coast Council is identified by MEMA as a potential MPA, but no sites in Lake Macquarie or Newcastle.	Yes Documenting the values of the rock platform will generate new knowledge about its conservation values. It will raise community awareness of the values of the place and may also create new knowledge for the managers of the marine Estate Management Strategy about the values of this place. Note that the place also has Important Aboriginal heritage and historic heritage values – at local scale as a minimum.	New.
H3 Review awareness raising and enforcement activities for protecting rock platform biodiversity (e.g. hotline, signs, info at fishing shops)							From CZMP and previously assessed as feasible

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H4 Continue with community activity programs focusing on coastline protection and key environmental issues for cliffs and rock platforms (note that this could also apply to other parts of the coastal zone). Note that swimming safety on rock platforms is included in H5	Directly addresses some Objects of the CMA and relevant coastal management areas.	No statutory criteria or approval required and generally aligned with government policy priorities. The aim would be to reinforce coastal conservation priorities with the community	Yes	Yes	Yes – the action is already being implemented for some topics	Yes, and support greater community awareness of coastal processes and natural values. Feedback from the community on these programs will help tailor future information and awareness raising.	From CZMP, but with changed scope and intent (re-evaluate)
H5 Conduct a community awareness program about rock platform safety	Directly addresses some Objects of the CMA and relevant coastal management areas, particularly those for coastal vulnerability, environment and use areas.	No statutory criteria or approval required and generally aligned with government policy priorities.	Yes Safety on rock platforms is known to be a significant risk on the Lake Macquarie coast, although some of highest risk locations are in National Park	Yes	Yes Unlikely that coastal engineering studies are required to support a community awareness program. However, as an example of science supporting safety management, see reports on the Figure 8 pools in Royal National Park. https://www.nationalparks.nsw.gov.au/things-to-do/lookouts/figure-eight-pools	Yes	New

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H6 Review and upgrade the coastal walking path from Caves Beach to Catherine Hill Bay and Munmorah SCA.	Directly addresses some Objects of the CMA and relevant coastal management areas, particularly those for coastal vulnerability, environment and use areas.	Action is consistent with relevant statutory and policy requirements and has a recognised approval pathway	Yes	Yes	Yes	Yes	New
H6(A) Prepare a track condition and risk assessment (with NPWS)	Same as above H6	No approvals required for a risk assessment	Yes. This is key information to the development and maintenance of a safe pathway along spectacular coastline, in multiple tenures.	First step in an adaptive approach, to understand the scope of issues	Yes. Condition and risk assessment will involve desktop review, field inspection and risk proforma	Yes. This is fundamental input to the development of a safe coastal walk in Lake Macquarie	New

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H6(B) Prepare a works proposal for track and safety measures, with NPWS	Same as above H6	No approvals required to prepare the proposal, but on ground track works will require approvals under NPW Act, EP&A Act and others	Yes	Yes	Yes. This is the action to address issues identified in the risk assessment. Proposal will need to provide clear guidance on tenure, roles and responsibilities, funding model.	Will reflect new information from the track condition and risk assessment	New
H6(C) conduct works to upgrade the track – likely to include erosion control, vehicle exclusion, repair/rebuild stairs and fencing	Same as above H6	Action is consistent with relevant statutory and policy requirements and has a recognised approval pathway	Yes	Yes	Yes, but will require close collaboration across several land tenures (council, NPWS, Crown Land and private land), and cost sharing arrangements.	Not the primary purpose of this action. May enable studies of the effectiveness of creating better access.	New
H7 Investigate stormwater impacts on headlands and rock platforms (erosion, water quality and litter – e.g. Caves)	Directly consistent with some Objects of the CMA and supports relevant coastal management areas, particularly those for coastal vulnerability, environment and use areas.	No statutory criteria or approval required and generally aligned with government policy priorities around diffuse source pollution and impacts in the coastal zone.	Yes. This information will allow Council and other stakeholders to assess the risk of stormwater on the Lake Macquarie coastline	Yes	Yes. Council and partners such as HWC have capacity to implement detailed catchment-based studies.	Yes	New

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Manage (mitigate) risks to beach access and safety infrastructure							
S1 Refurbish revetment and add wave return wall at Redhead surf club	Directly addresses some Objects of the CMA and relevant coastal management areas, particularly those for coastal vulnerability, environment and use areas.	Action is consistent with relevant statutory and policy requirements and has a recognised approval pathway	Yes, will provide short to medium term protection for a range of storm conditions	Yes. More intensive responses (such as relocating the surf club) are available if the refurbished revetment is not competent in the mid term	Yes See Wave Overtopping study. The action is feasible in engineering terms, but will need detailed design.	Not the primary purpose of this action	From Wave overtopping assessment check feasibility
S2 Relocate Redhead surf club building landward	Directly addresses some Objects of the CMA and relevant coastal management areas, particularly those for coastal vulnerability, environment and use areas.	Action is consistent with relevant statutory and policy requirements and has a recognised approval pathway	Yes, relocating the surf club will avoid long term risks from coastal hazards (wave overtopping and erosion)	Yes – a higher level response than monitoring, refurbishing the revetment or beach nourishment	Yes, but limitations to practicality and timing considerations. Land is available for a new site further landward in the carpark, outside the immediate hazard zone	No – more of a response to new knowledge	From Wave overtopping assessment check feasibility

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Cultural management actions							
L1 Translate educational material (about coastal processes and hazards, habitats and protected species) into community languages that reflect visitor profiles (add QR code to materials)	Directly addresses some Objects of the CMA and relevant coastal management areas, particularly those for coastal vulnerability, environment and use areas.	No statutory criteria or approval required and generally aligned with government policy priorities.	Yes	Yes – to any number of relevant community languages and on any relevant topic	Yes – may have some practicality implications; need to build relationships with translation services relevant to the languages of people who live in or visit Lake Macquarie coastline	Will increase community awareness by making it easier to share coastal information. May facilitate up-sharing of local cultural knowledge, but not the primary purpose.	New

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L2 Engage effectively with Aboriginal groups and Land Councils when planning works or developing PoMs for the coastal zone. See Connecting with Country guidelines from DPE/GANSW	Such consultation would align with and support several Objects of the CM Act and relevant coastal management areas, particularly those for coastal vulnerability, environment and use areas.	Consultation with Aboriginal groups and Land Councils is NSW Government policy and is expected (required) in the preparation of Plans of Management for public land. Note also the presence of some Aboriginal Places in the coastal zone and required management plans to protect cultural values	Yes – depending on the level and type of consultation. Evaluation of case-specific effectiveness will depend on the outcomes of the consultation processes. Note the success of joint management of several coastal national parks (but none as yet in Lake Macquarie)	Yes	Yes	Yes	New

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L3 Investigate pathways and feasibility for achieving co-management of coastal Country in LMCC. This action relates to BWSP, Lake Macquarie State Conservation Area, Munmorah State Conservation Area, Pulbah Island Nature Reserve, Wallarah National Park.	Directly addresses some Objects of the CMA and relevant coastal management areas.	Such investigations have no statutory criteria or approval required and generally aligned with government policy priorities. Formal contractual and statutory processes to be followed.	Yes. part of the aim of this action is to empower local Aboriginal people (who are Traditional Owners) to be directly involved in looking after Country and to promote the cultural value of Lake Macquarie's coastline.	Yes	Yes, following successful examples in other national parks. However, it will be important to confirm if Traditional Owners must be identified and accepted before joint management can proceed. Aboriginal joint management of parks | NSW Environment, Energy and Science	Not the primary focus of this action, but co-management is likely to introduce different approaches to managing land and water in these reserves.	New NPWS would have primary role in this. Feasibility is likely to depend on formal identification and agreements with Traditional Owners.
L4 Continue to build awareness of cultural values and sensitivity for council construction staff (inductions for outdoor staff and site workers)	Aligns with and supports some Objects of the CMA.	No statutory criteria or approval required and generally aligned with government policy priorities.	Yes - ongoing and integrated cultural awareness and sensitivity programs are considered effective and are already implemented in multiple industries.	Yes	Yes	Yes	New

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L5 Include cultural awareness programs, developed with the Aboriginal community, in community activities in the coastal zone	Yes	No statutory approvals required, but does require close collaboration with the Aboriginal community	Positive benefits for management and for reconciliation	Yes	council already has programs to bring forward Aboriginal knowledge and culture (e.g. yapang), so this action to promote cultural values of the coastal zone of the city is well within its capability	Yes, will create opportunities to share Awabakal cultural knowledge and increase knowledge and capacity amongst people using the coast.	New Complements other environmental and cultural education and awareness actions

Feasibility evaluation – potential estuary management responses

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Ecosystem impacts from climate change and coastal hazards - Hazard assessment and management need to be updated with new information to provide the best direction on management processes and priorities							
E1 Identify actively eroding creek bank sites on public land							From CZMP and previously evaluated as feasible
E2 Review existing flood studies and floodplain risk management studies and plans							From CZMP, updated to review rather than prepare. Not necessary to re-evaluate feasibility
E3 Conduct condition assessment of existing lake foreshore erosion treatment sites on public land							From CZMP and previously evaluated as feasible

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Social and economic impacts of climate change and coastal hazards – ongoing community engagement is needed to support a resilient community with an adaptive balance between planning to avoid risk, coastal protection works and other actions							
S1 (see E2) Review existing flood studies and floodplain risk management studies and plans							From CZMP, with change from prepare to review. As above, it is not necessary to re-evaluate feasibility
S2 Use planning controls to require implementation of best practice hazard risk avoidance for new development on high risk sites							Combines three previous CZMP actions, with same intent. Previously evaluated as feasible.
S3 Continue the foreshore stabilisation program	Directly addresses some Objects of the CMA and relevant coastal management areas, particularly those for coastal vulnerability, environment and use areas.	Existing program. No statutory criteria or approval required and generally aligned with government policy priorities.	Yes	Yes	Yes – Is already being implemented	Yes	Continuing

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S5 Continue adaptation conversations and planning with affected communities. Consider a resilience planning approach to future plans							From CZMP and previously evaluated as feasible.

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Water quality impacts – threats to estuary health – Targeted studies and controls are needed to fill management gaps							
W1 Update policy and guidelines for fish habitat conservation and management	Aligns with and supports some Objects of the CMA and relevant coastal management areas.	No statutory criteria or approval required and generally aligned with government policy priorities, e.g. MEMS priority outcomes – improving water quality and reducing litter, reducing impacts on threatened and protected species, and Ensuring sustainable fishing and aquaculture	Yes Information for proponents and community is fundamental to effective management	Yes, as new information becomes available	Yes Will require collaboration between Council and DPI Fisheries	Yes, although not the primary focus – the aim is to provide better information to waterway managers	New
W2 Review Council's water cycle development controls for all new development							From CZMP, with only minor wording changes. Previously evaluated as feasible

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W3 Investigate hydrological characteristics and water quality of Muddy Lake and develop a suitable management approach	Aligns with and supports some Objects of the CMA and relevant coastal management areas.	No statutory criteria or approval required and generally aligned with government policy priorities	Yes. Understanding of hydrodynamic and ecological processes in Muddy Lake was identified as a gap in the management of Lake Macquarie, so an investigation is the first step to establishing a baseline of condition, issues and risks	Yes	Yes, the action is similar in magnitude and methodology to previous studies and management undertaken by council.	Yes, it is the purpose of the action	New
W4 Seek funding to implement the LT Creek Dredging Plan to address historic sediment deposits in the upper tidal reaches and improve aquatic ecosystem health	Aligns with and supports some Objects of the CMA and relevant coastal management areas.	Eligibility of some grant funding programs is linked to certified CMPs (Coast and Estuary Grants Program) or other management plans.	Yes. This action is only about the funding arrangements for maintenance dredging for estuary health and local recreational navigation.	Yes, in the sense that dredging locations can be adapted as the creek morphology and catchment load adjust	Yes	No – not the purpose of the action.	From CZMP, but with changed intent. Action is currently about funding opportunities.

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W5 If funding is available, implement the LT Creek Dredging Plan	Aligns with and supports some Objects of the CMA and relevant coastal management areas, but also has risks because of the nature of the sediment. Dredging in LT Creek is supported by the local community.	Action is consistent with relevant statutory and policy requirements and has a formal regulatory/approvals pathway. A Part 5 approval will be required for dredging works. Similar approvals have been issued in other estuaries.	Maintenance dredging is a regularly used method of removing excess accumulations of sediment from around stormwater drains and deltas of catchment creeks. The aim here is to improve estuary health and amenity by restoring a more natural bed and bank profile and removing accumulated sediment. Will need careful controls – which should be documented in the dredging plan	Yes, the dredging plan may be adapted based on evidence of the outcomes of implementing the current plan	Yes. Removal of sediment, nutrients, organics and possible contaminants from LT creek is practical in the sense that it is a regularly used practice in urban estuaries.	Yes, monitoring conducted during and after dredging will provide further information about the nature of the sediments and the capacity of the creek system to recover when the excess sediment is removed.	New (subject to W4 funding). Process and outcomes will need careful monitoring

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			and in an approval for the works.				
Urban development continues to impact on lake water quality and estuary health							
U1A Monitor performance of GPT type SQIDs and review to inform the maintenance schedule, considering available sensors and other technology and modelling							From the CZMP and the State of the Estuary report. Previously evaluated as feasible (for vegetated SQIDs, rather than GPTs), and same logic applies
U1B Update the list (register) of SQIDs in the city, identifying their primary purpose – water quality or flood mitigation	The proposed action underpins further actions that would provide the necessary foundation for addressing a number of objects in the CMA	No statutory criteria or approval required and generally aligned with government policy priorities, e.g. improve water quality and reduce litter in MEMS	Yes. As a preliminary measure to gain better understanding of stormwater quality systems	Yes	Yes	Yes	New

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U2 Prepare and implement a maintenance guideline for vegetated SQIDs, applying bush regeneration principles	Aligns with and supports some Objects of the CMA and relevant coastal management areas.	No statutory criteria or approval required	Yes	Yes	Yes	Yes - adopting new, less environmentally harmful, approaches to maintenance around SQIDs will contribute to new knowledge and guide best practice	Was previously in the CZMP, but this version has a changed intent. **Review feasibility**
U3 Retrofit upgrades to existing SQIDs to improve asset performance, targeting catchments contributing high concentrations of nutrients and/or high sediment loads to sensitive parts of the lake							From CZMP and State of the Estuary Report, with slight wording change but intent is the same. Priority catchment areas are identified in the State of the Estuary Report

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U4 Install and maintain WSUD devices to reduce sediment and nutrient load, maximising pollutant removal efficiencies and prioritising catchments contributing high concentrations of nutrients and/or high sediment loads to sensitive parts of the lake							From CZMP and reiterated in the State of the Estuary Report. Slight wording change, but no change to intent. Priority catchments are listed in State of the Estuary report
U5 Continue education programs for the construction industry and residential property owners to promote best practice stormwater management							From CZMP, with no changes. Previously evaluated as feasible

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U6 Identify sediment and nutrient generation hotspots using spatially intensive, short term monitoring programs undertaken during major rainfall events	Aligns with and supports some Objects of the CMA and relevant coastal management areas. The proposed action would also underpin further actions that would provide the necessary foundation for addressing a number of objects in the CMA	No statutory criteria or approval required	Yes. Experience from other estuaries has demonstrated the value of event-based monitoring to ground truth models of catchment sediment and nutrient yield especially where there are sensitive receiving waters.	Yes	Yes DPE and Council to collaborate on this action to provide technical capacity and draw on experience from other systems	Yes - This type of intensive event-based monitoring is valuable to identify the most important sub-catchments for treatment and to avoid unsuitable new development	New – From State of the Estuary Report. requires input from DPE EES

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U7 Identify and implement priority strategies to minimise erosion losses from unconsolidated road verges, building sites and other streetscape generation hotspots	Aligns with and supports some Objects of the CMA and relevant coastal management areas. The proposed action would also underpin further actions that would provide the necessary foundation for addressing a number of objects in the CMA	No statutory criteria or approval required	Yes The strategy is the step between data/evidence gathering and implementation	Yes	Yes	These strategies will in the first instance, respond to knowledge gained from monitoring programs. The strategies will include ongoing monitoring of performance of different approaches to erosion control in urban catchments	New, from State of the Estuary report. an important component of stormwater pollution management in urban areas. In Lake Macquarie, road verge erosion also applies to more rural catchments

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U8 Encourage the community to reduce use of domestic cleaners and fertilisers at home and switch to environmentally friendly products	Aligns with and supports some Objects of the CMA and relevant coastal management areas.	No statutory criteria or approval required. Consistent with NSW Government programs to improve sustainability in residential contexts and to improve the quality of urban stormwater entering estuaries.	Yes – effectiveness of the action would depend on how it is encouraged and the level of community uptake.	Yes, based on feedback from the community and effectiveness of behaviour change in reducing pressures on water quality	Yes this is one of several actions that will build community awareness and capacity to act to protect the lake 'at the heart of the City'	The purpose of this action is to increase community knowledge and change behaviours. Contributing new management knowledge is not its primary purpose, but it will subsequently provide feedback on effective campaigns around chemical and fertiliser use.	New, From State of the Estuary report. Assume this is referring to outdoor use of these chemicals
Ongoing monitoring is necessary to track changes in seagrass response to estuary processes, water quality and lake use							

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H1 Review seagrass mapping responsibilities and develop an integrated mapping and monitoring program involving all relevant stakeholders. This will include monitoring of seagrass health adjacent to boat ramps (RB1)	Strongly consistent with multiple objects of the CMA and relevant coastal management areas.	No statutory criteria or approval required. Some industries (power generation) have historically had conditions on their Environment Protection Licence requiring monitoring of seagrass area and condition	Yes. Seagrass extent and health varies with several different factors. Ongoing monitoring is required to provide adequate data to discern trends	Yes	Yes There is an existing seagrass monitoring program, this action is about streamlining the way that data are collected, analysed and reported	Yes, this is the purpose of an ongoing monitoring program	From CZMP and previously evaluated as feasible.

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H2 Continue to monitor lake health, identifying areas for partnering with industry	Strongly consistent with multiple objects of the CMA and relevant coastal management areas.	No statutory criteria or approval required for an estuary health monitoring program, noting that NSW government has some referred indicators of estuary health, including N, P, suspended sediment and chlorophyll-a, but also mangrove health, seagrass health, sediment quality and extent of hydrodynamic modification (see NSW Government estuary health report cards)	Yes Ongoing data on the health of the estuary is essential for effective management. Industry has contributed to estuary monitoring in the past, including power stations, coal mines, Hunter Water Corporation. Other potential partners may come from the land development industry – targeting specific locations and parameters.	Yes	Yes See existing estuary health report card https://www.environment.nsw.gov.au/news/report-cards-for-estuaries-along-nsw-coast	Yes	From CZMP, with minor wording changes (about industry partners) but intent is the same.

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RB1 See also monitoring of seagrass health adjacent to boat launching ramps;	See H1	No statutory criteria or approval required	Yes	Yes	Yes	Yes	New, but is a subset of H1 (this component is identified in the Lake Activation Strategy, to inform management controls around intensively used ramps)
H3 Facilitate successful migration of saltmarsh and other wetland species by removing potential barriers posed by natural and constructed features around wetland margins	Aligns with and supports several Objects of the CMA and relevant coastal management areas.	Unlikely to trigger any statutory criteria or approval requirements	Yes – uncertain of the outcomes of the action	Yes Successful migration may require several iterative management actions, learning from successes and failures.	Yes	Yes	From CZMP (changing from prioritise to implement) and also in the Swansea LAP

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H4 Investigate opportunities to protect and enhance seagrass communities, as they act as a critical buffer which will offset acidification	In principle the action is strongly consistent with multiple objects of the CMA and relevant coastal management areas.	Seagrass is protected under both the FM Act and the CM Act (as coastal wetland). Approvals may be required for projects that are intended for environmental improvement if the process disturbs existing sea grass	Dependent on how and where it is targeted. the action will identify ways in which Council can support the protection of seagrass in Lake Macquarie	Yes	The practicality of implementation would depend on what methods were used to provide protection and enhancement and how they would interact with other uses and constraints. The action will include a review of partnerships that are needed to protect seagrass in Lake Macquarie	Yes	New – From State of the Estuary Report

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H5 Prioritise on ground works to reduce nutrient (e.g. DIN) and sediment loads in urban stormwater discharging to Cockle Creek, Warners Bay and tributaries of Fennell Bay	Directly consistent with objects of the CM Act and not inconsistent with other objects	Refer to NSW Diffuse source water pollution policy (in preparation) The approvals required will depend on the mechanisms used to reduce sediment and nutrient loads, but likely control processes are all approvable in the right land use and/or environmental context.	Sediment and nutrient loads are well established threats to the health of lake Macquarie and other urban estuaries, and these sub catchments have been identified as key threats	Yes	There are several known methods of reducing nutrient and sediment loads, which would be practical in Lake Macquarie (e.g. some noted above), so this outcome is considered to be practical – there are known land management and water engineering or urban planning options. However, more information about specific actions is needed to provide clarity about practicality	Yes – likely to require and to generate new information	New, from State of the Estuary Report.
H6 Identify and implement priority actions to reduce sediment loads in diffuse	As above. Note that the catchments of Cockle Creek and Dora Creek are	Yes Refer to NSW Diffuse source water pollution	Reducing diffuse source sediment load is a useful approach to reducing threats	Yes, subject to monitoring of outcomes	This action will help focus investment in catchment works, by providing more	Yes	New, From State of the Estuary Report.

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flows from the large catchments of Dora Creek and Cockle Creek	outside the coastal zone, but contribute directly to the health of the coastal environment area.	policy (in preparation). Water quality in the marine estate is a key focus area for MEMS. Sediment loads from catchments are identified as a key threat to water quality in HCRLLS strategic plan	to estuarine waterways. Projects should include a monitoring program to track how different controls contribute to reduced sediment loads, in the short term and longer term and in different weather conditions.		information on the most effective actions (and locations) in these large catchments to reduce diffuse source pollution, noting that these catchments tend to be more rural/forested.		
Coal fired power stations continue to operate in the immediate lake catchment and discharge pollutants (including metals and thermal pollution) to the waterway. A review of environmental risk and performance is needed.							
P1 Conduct and publish a study of surface water around Lake Macquarie's coal fired power stations and associated coal ash dams, and their potential	Aligns with objects (a), (d) and (e), and (j) of the CM Act, recognising the economic importance of power generation, but also the fundamental importance of	Statutory responsibility of the EPA and licensed heavy industry.	Yes, as for groundwater, this is key information to understand cumulative impacts on the lake and to provide robust evidence for the community	Yes	Yes, but requires strong technical skills.	Yes	New in the CMP. This actions is from the Parliamentary Inquiry on Coal Ash. It is included here to support the connection between licensing or heavy industry

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impacts on the surrounding environment	protecting natural systems and supporting ESD – and that agencies work together to use their roles and responsibilities in a way that delivers these outcomes						and the health of the estuary. Also gives effect to action in the State of the Estuary Report
P2 Conduct and publish a study of groundwater around Lake Macquarie's coal fired power stations and associated coal ash dams, and their potential impacts on the surrounding environment	As for P1	Statutory responsibility of the EPA and licensed heavy industry	Yes, this is key information to understand any cumulative impacts of power generation activities on Lake Macquarie, and to provide robust evidence for the community	Yes	Yes, but will require strong technical skills	Yes	New in the CMP. This actions is from the Parliamentary Inquiry on Coal Ash. It is included here to support the connection between licensing or heavy industry and the health of the estuary. Also gives effect to action in the State of the Estuary Report

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P3 Establish air and groundwater monitoring sites surrounding all power station and coal ash dams. publish current, real time and historical data from these and other existing monitoring sites online.	Supports Object 9k), but is really about the broader issue of licensing transparency	Statutory responsibility of the EPA and licensed premises	Yes, assuming sites are targeted to specific issues and managed accordingly	Yes, monitoring sites and the types of data collected can be modified subject to results and the program of closure of coal fired power stations over the coming decade.	Yes, sites to monitor air quality and water quality around Lake Macquarie already exist (or have done in the past)	Yes	New in CMP. This action is from the Parliamentary Inquiry on Coal Ash. Included here to support a link between work of the EPA and the health of the estuary.
P4 Review surface water, groundwater, water temperature, air quality and other relevant monitoring data and use this information to inform ongoing reviews of EPA licence conditions for power stations	Object (h) – integrated planning, management and reporting, to demonstrate how EPA is exercising its role in a way that supports the sustainable management of coastal systems	Statutory responsibility of the EPA	Yes	Yes, anticipate that the monitoring program and review of data will be modified as coal fired power stations are closed over the coming decade.	Yes, this action is part of the ongoing responsibility of the EPA to improve licensing and environmental outcomes	Yes	Existing and ongoing action by the EPA

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P5 Improve the usability of EPA licence monitoring data by establishing an easy to use data portal website and making the data available in spreadsheet format for use by researchers, other agencies and the community	Object (k), but is really about the broader transparency of regulation	Part of the transparency and evidence-based decision-making requirements for industry licensing	Yes, addresses key transparency and community engagement aspects of sustainability	Yes	Yes. This action is about sharing data sets that are relevant to the health of the estuary	Yes, and will make information more readily available to the community and stakeholders	New, linked to recommendations of the Parliamentary Inquiry into Coal Ash

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Water quality impacts – Social Values. The impact of stormwater and wastewater overflows on recreational water quality is not clear, in the context of increasing demand for primary contact recreation							
R1 Conduct monitoring of recreational swimming areas – specifically bacterial counts as per national guidelines, to inform improvements to sewage and stormwater systems							New, from Lake Activation Strategy. Already evaluated and adopted by Council in the LAS. Further feasibility assessment not required
R2 Develop and implement actions to respond to the conclusions of the study '*Effects based assessment of wastewater overflows in Lake Macquarie catchment*' Prepared by DPE EES for HWC	Broadly aligns with objects (a), (f) and (h), with public authorities working together to support the health of the estuary	EPL requirements on HWC, in relation to wet weather overflows, note that the first conclusion of the study is that the ecological health risks from wastewater overflows are		Yes	Strategic improvements to sewerage networks is a practical approach and will deal with the highest priority issues. Based on the EBA report, this will lead to a focus in the Cockle Creek	Yes, if the actions include monitoring of effectiveness	New. The EBA report does not identify specific actions but notes where the impacts of pathogens from the sewerage system can be detected, so this would be a focus of detailed action

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Final conclusion is 'management risks could be dealt with by strategic improvements to sewerage networks to reduce overflow occurrence in key sub catchments (Cockle Creek), the use of models to develop real time risk warning or a combination. The report also promotes urgent investigation f temporal and spatial dynamics of pathogen profiles and sources from diffuse sources.		negligible compared to impacts of diffuse flows from the catchment. There are some potential human health risks, but they are spatially and temporally complex – so responses need to be carefully targeted.			catchment, making Cockle Creek a focus for diffuse source pollution controls and wastewater system overflows. Further studies may also clarify non overflow sources of pathogens and the full extent of risks to human health from uses of the lake.		planning. It also notes an urgent need to better understand diffuse source pathogen dynamics.

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Catchment and foreshore vegetation modification – riparian vegetation around lake Macquarie is extensively modified (or removed) affecting nutrient loads, foreshore stability and habitat							
V1 Continue streambank, riparian corridor and wetland rehabilitation program							From CZMP and State of the Estuary Report. Previously evaluated and considered feasible. Only change is focus on funding for the on-ground works and monitoring/mapping protocols

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V2 Support community stewardship of natural areas through ongoing support of Landcare (Resources are available for Landcare to implement on-ground works)							New, from State of the Estuary Report. Note: this is not really changing the previous action, rather clarifying why funding for Landcare is important. No further feasibility assessment required

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V4 Stabilise and remediate eroding bed and banks of high-risk sub catchments Target streams that are contributing high sediment loads to more sensitive parts of the lake.	Aligns with and supports several Objects of the CMA and relevant coastal management areas	Statutory requirements will depend on the specific actions/works that are proposed and their locations. Approvals likely to be required under Water Management Act, Fisheries Management Act, potentially NPW Act. Part 5 REF and approvals.	In general remediation of eroding bed and banks is an effective way to control sediment load from the catchment, especially in areas with dispersive catchment soils or creek bank sediments. Long term benefits (resilience of management) are less well defined	Yes	Likely to be practical, but this will depend on the location and severity of existing channel degradation. engineering feasibility also depends on the works required and the scale – such as height and length of eroding bank, depth of water, catchment size etc.	Yes, through monitoring of the effectiveness of different treatments	New, From State of the Estuary Report.
V5 Continue with 'soft engineering' approaches to stabilise and protect the lake shoreline. These include 'natural defences' erosion	Aligns with and supports several Objects of the CMA and relevant coastal management areas. Note CVA management	Existing approach. Generally aligned with government policy priorities – natural defences and then environmentally friendly seawalls if necessary.	Yes. Experience over the last 5 years suggests this is an effective approach for some shorelines around Lake Macquarie. further review of	Yes	Yes, this continues a program of works that has been demonstrated to be practical and technically feasible	Yes	Ongoing, recommended in the State of the Estuary Report.

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management sites such as cobble foreshores.	objective about applying natural defences first, before considering structural protection.	For the existing coarse gravel beaches, will need approvals related to CM Act, potentially land holders consent and also approvals from Fisheries	performance is needed				
Vigilance is necessary to protect Lake Macquarie from invasive aquatic species							
AV1 Strategically manage new outbreaks of aquatic weeds and pests. There are ongoing programs for several marine pests and requirements for vigilance and managing any new invasive species	Aligns with and supports several Objects of the CMA and relevant coastal management areas	May be required by the FM Act and approvals may be required if the works disturb protected habitat such as seagrass, saltmarsh or mangrove.	Early detection and control is consistent with a sustainable approach, as is a risk based approach that targets the more critical invasive species.	Yes	In principle it would be a practical approach – especially with early detection of outbreaks, but its practicality and feasibility would depend on how and where the action is implemented	Yes	Continuing Action, with a more strategic focus

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AV2 Explore opportunities to establish an aquatic weed and pests surveillance program	Aligns with and supports several Objects of the CMA and relevant coastal management areas	No statutory criteria or approval required	Yes	Yes	Yes - Similar in magnitude and methodology to previous surveillance and management programs undertaken by council. Will require collaboration with DPI Fisheries and potentially NPWS, LLS and Crown Lands	Yes	New, Part of the action above.
AV3 Continue to evaluate opportunities for biocontrol applications for managing weeds, with a focus on Salvinia in Muddy Lake	Aligns with and supports several Objects of the CMA and relevant coastal management areas	No statutory criteria or approval required and generally aligned with government policy priorities.	Yes – evaluation can underpin effective and sustainable biocontrol approaches to managing weeds. Biocontrol can have complex and unintended consequences and	Yes	Needs further information about specific bio controls before determining practicality	Yes	New

Action	Consistent with, promotes and gives effect to the objects of the CM Act and relevant coastal management areas	Other statutory or policy requirements can be managed (i.e., aligns with government priorities and a clear approval pathway)	Effective and sustainable: Is known to be an effective response for the threat/risk involved, with no major unintended side effects (environment or social)	Can be adapted, or is a component of an adaptive approach	Is practical and can be implemented, including engineering feasibility for structures	Likely to contribute new knowledge	Other comments
			can be difficult to reverse.				
AV4 Develop an awareness raising, education and safety risk management program for razor clams, noting changes to the dispersal of the species around the lake and the risk to community safety	Aligns with and supports several Objects of the CMA and relevant coastal management areas	No statutory criteria or approval required for awareness raising, but if managing safety involves removing the species from shallow seagrass beds, this would require approval from DPI Fisheries.	There is ongoing community concern about razor clams in Lake Macquarie, although there have previously been scientific studies and communication about the results.	Yes New program will need to respond to ongoing community concerns and gaps in outcomes from previous programs	Yes. Council has a demonstrated track record of conducting programs to raise awareness about aquatic species, including razor clams in the lake. There are not technical constraints to an awareness campaign.	Yes, in the sense that informing the community my require further research to provide better evidence of trends in populations and what affects their distribution	New, but there have been previous programs. May need to be site and community specific.
Waterway modification – residents will more readily adopt best practice with practical examples							
SW1 Pilot an environmentally friendly seawall (in a large tributary creek, or on a high energy shoreline with long fetch)	Aligns with and supports several Objects of the CMA and relevant coastal management areas	Action is consistent with relevant statutory and policy requirements and has a recognised approval pathway. however, approvals will be	A pilot project is a demonstrated useful approach to difficult design issues or where the community needs more confidence about how controls will	Yes	The pilot project would be designed to test engineering feasibility of different approaches and to demonstrate that robust protection	Yes	New

Action	Consistent with, promotes and gives effect to the objects of the CM Act and relevant coastal management areas	Other statutory or policy requirements can be managed (i.e., aligns with government priorities and a clear approval pathway)	Effective and sustainable: Is known to be an effective response for the threat/risk involved, with no major unintended side effects (environment or social)	Can be adapted, or is a component of an adaptive approach	Is practical and can be implemented, including engineering feasibility for structures	Likely to contribute new knowledge	Other comments
		required – with complexity depending on the site chosen for the pilot. Resolving approval issues is part of the pilot process	deliver both environmental and amenity outcomes. Lake Macquarie has extensive shorelines in exposed locations with long fetch and high wave energy.		works can be delivered in ways that also provide environmental benefits. There are examples of similar projects in other urban areas (Sydney Coastal Councils and NSW Government project about 10 years ago). https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Water/Coasts/environmentally-friendly-seawalls-090328.pdf Provides examples of good and bad design.		

Action	Consistent with, promotes and gives effect to the objects of the CM Act and relevant coastal management areas	Other statutory or policy requirements can be managed (i.e., aligns with government priorities and a clear approval pathway)	Effective and sustainable: Is known to be an effective response for the threat/risk involved, with no major unintended side effects (environment or social)	Can be adapted, or is a component of an adaptive approach	Is practical and can be implemented, including engineering feasibility for structures	Likely to contribute new knowledge	Other comments
Access to the marine estate – environmental issues. Recreational boating in Lake Macquarie damages seagrass beds							
RB1 Raise awareness of the impacts of boating on seagrass (focus on Posidonia, noting its protection status and slow recovery)							From CZMP and reiterated in the Lake Activation Strategy Also in State of the Estuary Report? Further feasibility evaluation not necessary
RB2 Generally raise awareness of the processes, functions and value of all seagrass communities and threats to seagrass health, vulnerability and other impacts e.g. runoff, nutrients, jetty construction, launching areas and moorings	Aligns with and supports several Objects of the CMA and relevant coastal management areas	No statutory criteria or approval required and generally aligned with government policy priorities.	Yes	Yes	Yes Awareness campaigns are core business of Lake Macquarie Council. The best result will require collaboration with TfNSW, DPI Fisheries, access to MEMS research and consultation with boat owners, yacht clubs	Yes	New

Action	Consistent with, promotes and gives effect to the objects of the CM Act and relevant coastal management areas	Other statutory or policy requirements can be managed (i.e., aligns with government priorities and a clear approval pathway)	Effective and sustainable: Is known to be an effective response for the threat/risk involved, with no major unintended side effects (environment or social)	Can be adapted, or is a component of an adaptive approach	Is practical and can be implemented, including engineering feasibility for structures	Likely to contribute new knowledge	Other comments
RB3 Review the Lake Macquarie Mooring Management Plan, **to require seagrass safe moorings in sea grass beds**	Aligns with and supports several Objects of the CMA and relevant coastal management areas	May have regulatory implications for boat owners, with requirements to comply – by a set date. Need to check how the requirement would be regulated and enforced	Yes Clear evidence that swing moorings damage seagrass and that other designs are less destructive, while still providing safe moorings for vessels	Yes	Yes Seagrass friendly moorings are already required in other estuaries with demonstrated benefits for seagrass health. This action would be led by TfNSW (Maritime). Important that the awareness work commences first	Not the purpose of the action. However, ongoing monitoring of the performance of new designs in higher energy locations and the recovery of damaged seagrass (Posidonia) will provide new information in the mid term.	New, From State of the Estuary Report and also noted in the Lake Activation Strategy
RB4 Use the Jetty Impact Assessment Tool when assessing new applications for (public and private) jetty construction and in redesign of existing public jetties to minimise impacts on	Aligns with and supports several Objects of the CMA and relevant coastal management areas	No statutory criteria or approval required and generally aligned with government policy priorities.	Yes	Yes	Yes	Yes	New, From the State of the Estuary Report.

Action	Consistent with, promotes and gives effect to the objects of the CM Act and relevant coastal management areas	Other statutory or policy requirements can be managed (i.e., aligns with government priorities and a clear approval pathway)	Effective and sustainable: Is known to be an effective response for the threat/risk involved, with no major unintended side effects (environment or social)	Can be adapted, or is a component of an adaptive approach	Is practical and can be implemented, including engineering feasibility for structures	Likely to contribute new knowledge	Other comments
adjacent seagrass beds.							
RB5 Establish marked approach corridors to high use jetties	Aligns with and supports several Objects of the CMA and relevant coastal management areas	For NSW (Maritime) approvals for placement and design of channel markers, which may also require approvals under the FM Act	Yes, the aim is to identify more resilient routes to existing jetties and ramps, which will contribute to more sustainable boating behaviours	Yes	Yes Will require bathymetric survey of approach corridors and of seagrass beds. Possible issue for practicality if there are jetties or ramps that are highly constrained by sensitive species of seagrass in all directions.	Yes – it would contribute to local awareness and knowledge of seagrass presence and its fragility.	New, from the State of the Estuary Report, and also noted in the Lake Activation Strategy (adopted by Council). LAS also noted that new jetties and ramps should be located outside sensitive seagrass areas as much as possible.

Action	Consistent with, promotes and gives effect to the objects of the CM Act and relevant coastal management areas	Other statutory or policy requirements can be managed (i.e., aligns with government priorities and a clear approval pathway)	Effective and sustainable: Is known to be an effective response for the threat/risk involved, with no major unintended side effects (environment or social)	Can be adapted, or is a component of an adaptive approach	Is practical and can be implemented, including engineering feasibility for structures	Likely to contribute new knowledge	Other comments
RB6 Educate the boating community about avoiding propellor and anchor damage in sea grass beds	Aligns with and supports biodiversity and natural systems objects of the CM Act, as well as encouraging appropriate recreational use	Would be supported by the FM Act	This action is about awareness and behaviour change. Recreational boating public is not always aware of the cumulative impacts of multiple small propellor scours, hull scraping in seagrass and anchor drag. Positive approach, highlighting the benefits and vulnerability of seagrass	Yes	Yes, an awareness program is easy to deliver, using a range of social media and face to face tools	Yes	New in CMP, but is a widespread action to protect seagrass in shallow estuaries.
Migratory shorebird and marine species habitat around lake Macquarie is impacted by recreational activities							
MB1 Review factors influencing the population and breeding success of migratory shore bird species which	Aligns with and supports several Objects of the CMA and relevant coastal management areas	No statutory criteria or approval required	Yes	Yes - a review of these factors could lead to adaptive management approaches	Yes - Similar in magnitude and methodology to previous studies and management undertaken by council.	Yes	From CZMP (where it referred specifically to little tern and pied oyster catchers, and off-road vehicles and

Action	Consistent with, promotes and gives effect to the objects of the CM Act and relevant coastal management areas	Other statutory or policy requirements can be managed (i.e., aligns with government priorities and a clear approval pathway)	Effective and sustainable: Is known to be an effective response for the threat/risk involved, with no major unintended side effects (environment or social)	Can be adapted, or is a component of an adaptive approach	Is practical and can be implemented, including engineering feasibility for structures	Likely to contribute new knowledge	Other comments
visit Lake Macquarie							dogs). In this context the action is about wetlands and shore platforms around the lake. changed intent, so re-evaluate
MB2 Raise community awareness of migratory and protected bird species using the lake shore and wetlands, and their vulnerability to disturbance. Focus is Sooty and Pied Oyster Catchers, but also consider other relevant species	Aligns with and supports several Objects of the CMA and relevant coastal management areas	No statutory criteria or approval required, but note that these species have statutory protection.	Yes	Yes	Yes	Yes	New Need to develop this action with similar actions for the coastline (beaches and rock platforms). They are all part of the same strategic response

Action	Consistent with, promotes and gives effect to the objects of the CM Act and relevant coastal management areas	Other statutory or policy requirements can be managed (i.e., aligns with government priorities and a clear approval pathway)	Effective and sustainable: Is known to be an effective response for the threat/risk involved, with no major unintended side effects (environment or social)	Can be adapted, or is a component of an adaptive approach	Is practical and can be implemented, including engineering feasibility for structures	Likely to contribute new knowledge	Other comments
MB3 Raise awareness of marine mammals and other protected species within the lake, such as seals, turtles, dolphins. Include advice on natural behaviours and appropriate interactions with people	Aligns with and supports several Objects of the CMA and relevant coastal management areas	No statutory criteria or approval required	Yes	Yes	Yes	Yes – the purpose of the action is to increase community knowledge of the diversity of species that occur in Lake Macquarie – and also of the changing mix of species	New
Access to the marine estate, Social issues. Key aspects of boating management need to be updated as recreational boating demand increases							
BM1 Update the Mooring Management Plan. The update should address larger vessels, increasing vessel ownership, as well as the importance of seagrass friendly moorings							Included in the CZMP, State of the Estuary Report and Lake Activation Strategy. Previously evaluated and considered feasible. Further evaluation not required.

Action	Consistent with, promotes and gives effect to the objects of the CM Act and relevant coastal management areas	Other statutory or policy requirements can be managed (i.e., aligns with government priorities and a clear approval pathway)	Effective and sustainable: Is known to be an effective response for the threat/risk involved, with no major unintended side effects (environment or social)	Can be adapted, or is a component of an adaptive approach	Is practical and can be implemented, including engineering feasibility for structures	Likely to contribute new knowledge	Other comments
or other boat storage (see RB3)							
BM2 Review Council's Dinghy Storage Policy to reduce public open space impacts of dinghies stored in foreshore reserves							From CZMP (where it was a trial of dinghy storage racks – now a change of policy), also in the adopted Lake Activation Strategy. Re-evaluation is not required. LAS refers to the issue as boat storage, not just dinghy storage – they are related

Action	Consistent with, promotes and gives effect to the objects of the CM Act and relevant coastal management areas	Other statutory or policy requirements can be managed (i.e., aligns with government priorities and a clear approval pathway)	Effective and sustainable: Is known to be an effective response for the threat/risk involved, with no major unintended side effects (environment or social)	Can be adapted, or is a component of an adaptive approach	Is practical and can be implemented, including engineering feasibility for structures	Likely to contribute new knowledge	Other comments
BM4 Implement equitable provision of boating facilities (ramps and jetties) to all Lake Macquarie communities. More useful will be engagement in the Part 5 assessment process for detailed site assessment for new infrastructure, to ensure lake health is properly considered							Specific aquatic infrastructure priorities are identified in the LAS. New, but recently adopted after public exhibition. Evaluation of the feasibility of the general approach not required.
BM3 Monitor community use of the lake and foreshore to provide up to date information on recreational use,							Included in the recently adopted Lake Activation Strategy, as a high priority action.

Action	Consistent with, promotes and gives effect to the objects of the CM Act and relevant coastal management areas	Other statutory or policy requirements can be managed (i.e., aligns with government priorities and a clear approval pathway)	Effective and sustainable: Is known to be an effective response for the threat/risk involved, with no major unintended side effects (environment or social)	Can be adapted, or is a component of an adaptive approach	Is practical and can be implemented, including engineering feasibility for structures	Likely to contribute new knowledge	Other comments
demand and patterns – consider technology applications such as QR codes and vehicle registration monitoring. See also other actions about using technology to monitor use (drone surveys, cameras?)							Does not need to be re-evaluated for feasibility

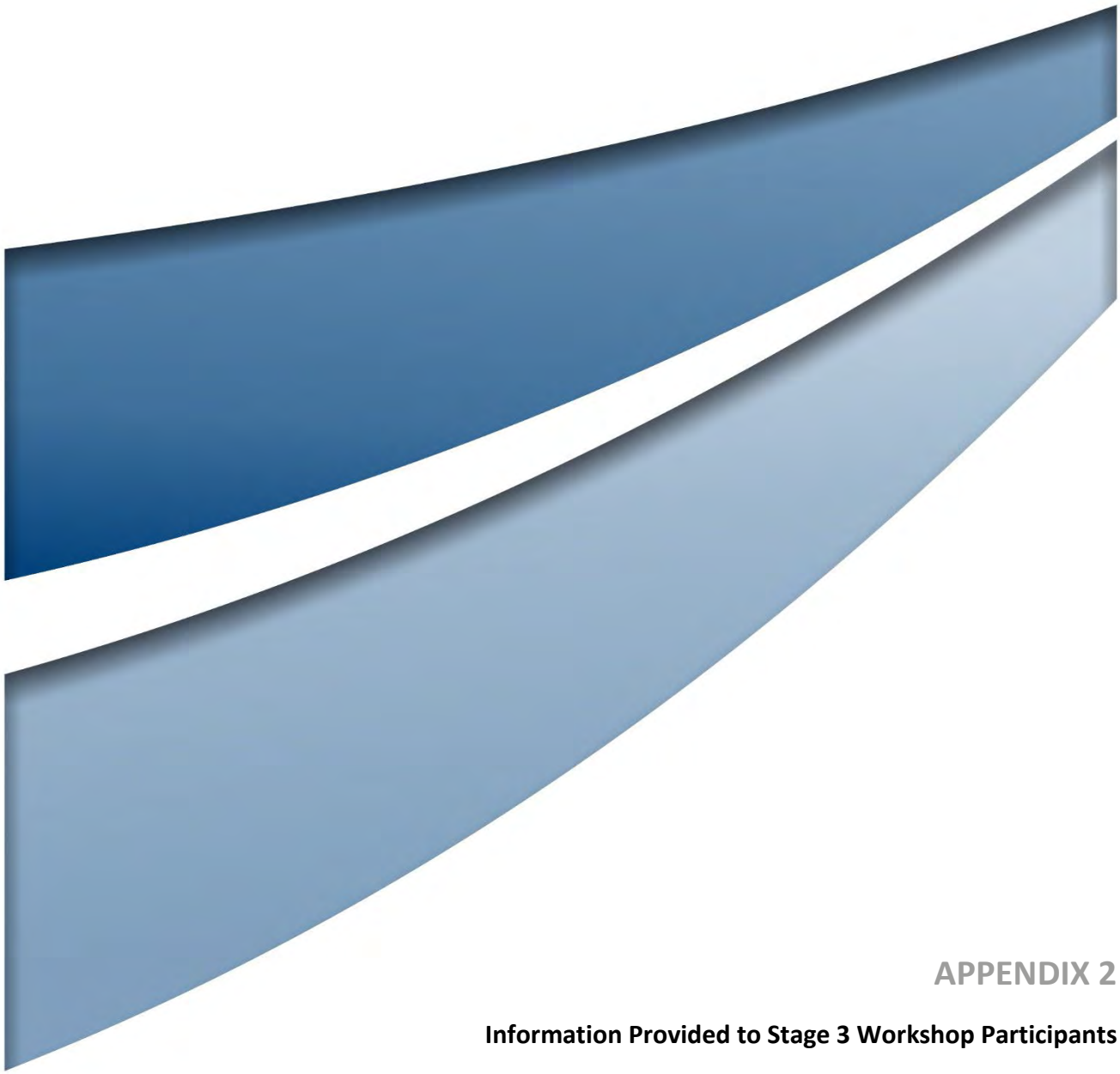
Action	Consistent with, promotes and gives effect to the objects of the CM Act and relevant coastal management areas	Other statutory or policy requirements can be managed (i.e., aligns with government priorities and a clear approval pathway)	Effective and sustainable: Is known to be an effective response for the threat/risk involved, with no major unintended side effects (environment or social)	Can be adapted, or is a component of an adaptive approach	Is practical and can be implemented, including engineering feasibility for structures	Likely to contribute new knowledge	Other comments
The foreshores and wetlands around Lake Macquarie are a passive recreation asset and will help meet public open space and natural area management objectives							
FW1 Enhance passive recreation access to the Toronto and Fennell Bay wetlands, including signage, path maintenance and new route options, construction of bird hides, seating and boardwalks	Aligns with and supports several Objects of the CMA and relevant coastal management areas	Action is consistent with relevant statutory and policy requirements and has a regulatory/approvals pathway	Yes – However, formalising and increasing accessibility can lead to increased pedestrian or cycle traffic and waste and other side effects of human interaction; a careful balance is required, and careful choices of track alignment, linked to sensitivity and risk	Yes	Yes This action will be more effective with community support and involvement, but requires resources beyond community volunteers. Practicality depends on council and community partnership	Not the specific purpose of this action, although it will enable more information about natural areas to be shared with the community and also there are potential lessons in terms of track design	New
FW2 Enhance passive recreation access to wetlands and foreshores on public land. Work with community to create new lake shore walking	Aligns with and supports several Objects of the CMA and relevant coastal management areas	Action is consistent with relevant statutory and policy requirements and has a regulatory/approvals pathway	Yes – same as above FW1	Yes	Yes	Yes	New

Action	Consistent with, promotes and gives effect to the objects of the CM Act and relevant coastal management areas	Other statutory or policy requirements can be managed (i.e., aligns with government priorities and a clear approval pathway)	Effective and sustainable: Is known to be an effective response for the threat/risk involved, with no major unintended side effects (environment or social)	Can be adapted, or is a component of an adaptive approach	Is practical and can be implemented, including engineering feasibility for structures	Likely to contribute new knowledge	Other comments
paths for enhanced community engagement and connection to the natural and cultural values of Lake Macquarie							
Other management process actions – Governance arrangements for coordinated management need to be strengthened							
G1 Establish an interdepartmental (interagency) coastal management working group to support CMP implementation							Clarifies and updates the action in the CZMP. Note, this is separate from the Coast and Estuary Committee and is intended to manage integration of actions by public authorities. Likely to involve regional director level staff. Feasibility assessment not required

Action	Consistent with, promotes and gives effect to the objects of the CM Act and relevant coastal management areas	Other statutory or policy requirements can be managed (i.e., aligns with government priorities and a clear approval pathway)	Effective and sustainable: Is known to be an effective response for the threat/risk involved, with no major unintended side effects (environment or social)	Can be adapted, or is a component of an adaptive approach	Is practical and can be implemented, including engineering feasibility for structures	Likely to contribute new knowledge	Other comments
G2 Maintain close liaison with State and Commonwealth agencies about Lake Macquarie issues and initiatives, to lay the groundwork for innovative management, planning, monitoring and reporting processes							New Could be more specific about what this will entail – attendance at Conferences to present the results of Lake Macquarie management projects? Joining state and national review processes to strengthen policy and programs? Part of effective management and feasibility evaluation not necessary

Action	Consistent with, promotes and gives effect to the objects of the CM Act and relevant coastal management areas	Other statutory or policy requirements can be managed (i.e., aligns with government priorities and a clear approval pathway)	Effective and sustainable: Is known to be an effective response for the threat/risk involved, with no major unintended side effects (environment or social)	Can be adapted, or is a component of an adaptive approach	Is practical and can be implemented, including engineering feasibility for structures	Likely to contribute new knowledge	Other comments
Council and community need ongoing feedback on performance and outcomes of lake management							
A1 Conduct an annual review of CMP action status							From CZMP, with minor wording update but no change of intent; this is part of the management process and does not require feasibility evaluation
A2 Continue the Lake Macquarie environmental attitudes survey (every 4 years)							From CZMP, with minor change of wording to specify frequency. Feasibility assessment not required.

Action	Consistent with, promotes and gives effect to the objects of the CM Act and relevant coastal management areas	Other statutory or policy requirements can be managed (i.e., aligns with government priorities and a clear approval pathway)	Effective and sustainable: Is known to be an effective response for the threat/risk involved, with no major unintended side effects (environment or social)	Can be adapted, or is a component of an adaptive approach	Is practical and can be implemented, including engineering feasibility for structures	Likely to contribute new knowledge	Other comments
Community needs open access to new information about lake systems and effective management – in a meaningful form							
F1 Share findings of research grant funded projects more widely with the community							From the CZMP. This could also apply to Marine Estate Management Strategy projects, which provide new information about estuary systems in Lake Macquarie. Feasibility evaluation not required
F2 Collaborate with University of Newcastle and other research institutions to bring research results into the community							From the CZMP. Feasibility evaluation not required.



APPENDIX 2

Information Provided to Stage 3 Workshop Participants

21604 R02 Appendix 2

Information for Stage 3 Workshop Participants

Agenda

Lake Macquarie City Council Coastal Management Program (CMP)

Stage 3 – Identify and evaluate management actions (Estuary)

Stakeholder workshops, Phase 1.

Agenda

Timing	Activity	Leading/involved
10 minutes	Acknowledgement of Country Welcome and introductions	Melissa Sawatske Pam Dean-Jones
10 minutes	Stage 3 overview and purpose Workshop task is to review the proposed actions and together suggest any others that need to be included in the CMP	Pam Dean-Jones
40 minutes	Actions review: in breakout groups, reporting back highlights of discussions to the main group Key questions: • Is everyone clear on what these issues and actions are about? • Are there important issues that you don't think are adequately captured? a. Why are they important? • For each issue, are there further actions that should be considered for inclusion in the CMP? a. Why are they needed? b. Are there any actions that you are surprised to see or that are not needed? • Apart from Council, what organisations should be involved in detailed planning and delivery of the actions?	Everyone Each group will have a facilitator and nominated scribe. Groups to nominate a reporter

10 minutes	Each group will provide brief feedback to everyone on the focus and outcomes of their discussion (nominate someone to speak on behalf of your group). Keep your verbal feedback to two or three main points. Group facilitators will email the written outcomes of each group discussion.	Break out group reporters. Use 'chat' to ask additional questions or make comments
5 minutes	Any other issues that participants would like to raise. You are also welcome to ask questions, or provide further feedback by email.	Everyone
5 minutes	What happens next? Phase 2 workshops: Deciding on action priorities, to construct a program of actions for the sustainable management of the coast.	Pam Dean-Jones Melissa Sawatske

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Melissa Sawatske msawatske@lakemac.nsw.gov.au

Symon Walpole swalpole@lakemac.nsw.gov.au

Workshop presentation

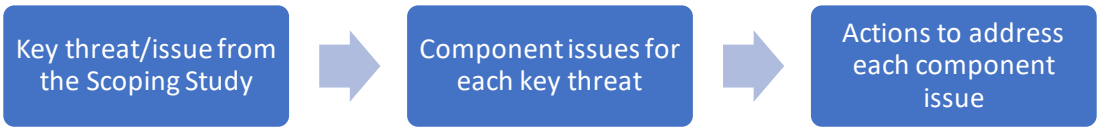
Stage 3 Actions and prioritisation_1.pptx (sharepoint.com)

Option lists

Participants at the three workshops were provided with a working draft copy of options for the coastline, channel and estuary, as a starting point for discussion. These early working draft option tables are not included here as they have been updated and edited to develop the options evaluated in the feasibility assessment (see **Appendix 1**)

Each of these working draft tables provided introductory information about the key threats, issues or risks previously identified as applying to that part of the coastal zone. The tables identified potential actions to address each of these key threats, issues or risks.

The tables were structured by threat, component issue and potential actions.



Actions included in recently adopted Council plans and strategies were identified:

	Local Adaptation Plan
	Lake Activation Strategy

These adopted actions were included for information. The priority of these actions in the LAP and LAS will be adopted in the CMP.

Other actions in the tables were:

- Brought forward from the CZMP. These actions were identified in the CZMP, but have not commenced, or are (or could be) ongoing.
- Proposed in other coastal planning studies
- Suggested by council or stakeholders

For the issues and actions identified in the table, participants were asked to consider:

- Are there other important issues to be addressed as part of future sustainable management of Swansea channel and surrounding lands?
- Are there other actions that should be considered for inclusion in the CMP, to contribute to long term and sustainable management of this part of the coastal zone?

Following the workshops, the working draft action tables were updated and circulated to participants.

Council also consulted internally and with public authorities in more detail, to test potential actions and identify others where relevant.

Lake Macquarie Coastal Management Program, Stage 3

Identify, evaluate and prioritise management responses

1

Acknowledgement of Country

We remember and respect the Ancestors who cared for and nurtured this Country.
Dhumaan ngayin ngarrakalu kirraanan barayidin.

It is in their footsteps that we travel these lands and waters.
Ngarrakalumba yuludaka bibayilin barayida baaduka.

Lake Macquarie City Council acknowledges the Awabakal people and Elders past, present and future.
Lake Macquarie City Council dhumaan Awabakala ngarrakal yalawaa, yalawan, yalawanan.

Wording by the Aboriginal Reference Group and translated by Miromaa Aboriginal Language and Technology Centre.

2

Some Teams functions to be aware of

SOUND – PLEASE MUTE

VIDEO – CAN BE SET ON OR OFF

CHAT – DURING THE MEETING, YOU CAN SEND MESSAGES OR QUESTIONS

REACTIONS – YOU CAN 'RAISE' YOUR HAND, AGREE, APPLAUD ETC. WITH AN ELECTRONIC SYMBOL

BREAK OUT GROUPS – YOU WILL MOVE TO YOUR GROUP ELECTRONICALLY AND RETURN TO THE MAIN GROUP ELECTRONICALLY

THE SESSION WILL BE RECORDED – THIS MAKES IT EASIER TO CHECK WE HAVE ALL THE COMMENTS DOCUMENTED

3

Agenda

- Welcome and introduction
- Stage 3 overview and purpose – a brief presentation
- Actions review – in breakout groups
  - An opportunity to review the proposed actions and together suggest any others that should be considered for inclusion in the CMP
- 5 minute break
- Report back on small group discussions
- Any other issues to consider in preparing the CMP?
- What happens next

4

Purpose of Stage 3

Our focus today

- **Confirm Strategic Direction**: does it reflect character, values, and objectives; vulnerability and risks; opportunities to enhance wellbeing
- **Identify management options** across all relevant coastal management areas, **focusing on high and extreme risks**
- **Evaluate options**: feasibility, viability and acceptability
- **Engage public authorities**
- **Develop an implementation pathway**, with timeframes that reflect **priorities**
- **Business plan for implementation** – why and how actions will be delivered and funded

5

Our challenge

A CMP is a long term strategy for the coordinated management of the coastal zone, managing risks for the benefit of the environment and community.

- **Confirm the actions to be included in the CMP (Workshop 1)**
  - Many of the options/actions which are being considered for inclusion in the CMP have been identified in other Council strategies and plans, or agency strategies and plans.
  - Are there other new actions which should be considered?
- How do we take a (long) list of suitable responses to coastal management issues and decide priorities to develop a **program? This is the prioritisation task (Workshop 2)**

6

Key risks for the Lake Macquarie coastal zone

Coastline threats	Estuary threats	Channel threats
• Ecosystem impacts from climate change and coastal hazards • Social and economic impacts of climate change and coastal hazards • Water quality impacts (social) • Access to the marine estate (social) • Extreme or High	• Ecosystem impacts from climate change and coastal hazards • Water quality impacts (environmental and social) • Catchment vegetation modification • Waterway modification • Social and economic impacts of climate change and coastal hazards • Access to the marine estate (environmental and social)	• Social and economic impacts from climate change and coastal hazards • Waterway modifications (environment) • Access to the marine estate (social) From Scoping Study 2020

7

How actions have been identified

Across the coastal zone

- Brought forward from CZMP (unimplemented and ongoing actions)
  - Pelican, Blacksmiths and Swansea LAP (and ongoing from Marks Point/Belmont South)
- Lake tributary flood studies
- Lake Activation Strategy
- Lake Macquarie Environmental Sustainability Strategy and Action Plan
- State of the Estuary Report
  - Stage 2 wave overtopping study – Blacksmiths
  - Blacksmiths surf beach amenity assessment
  - Belmont Wetlands State Park dune management actions
- Other actions suggested by community or Council or agencies

Types of Actions

LAP/CZMP
On ground works
Planning and development controls
Maintenance, monitoring and reporting
Piloting, research and innovation
Advocacy and engagement
Governance and funding
Risk assessment

8

Discussion

Group organisation

- Three break out groups
- Each group has a facilitator
- Nominate someone to keep notes and to report back
- From the previously circulated lists of actions, each group will be allocated one or two priority issues and related actions to be the focus of their discussion

The Task

Check the action lists for your group:

1. Is everyone clear on what these issues and actions are about?
2. Are there important issues that you don't think are adequately captured?
   a. Why are they important?
3. For each issue, are there further actions that should be considered for inclusion in the CMP?
   a. Why are they needed?
   b. Are there any actions that you are surprised to see or that should be described differently?
4. Apart from Council, what organisations should be involved in detailed planning and delivery of the actions?

9

Reporting back

Key points from each group discussion

- Did you identify any additional important issues for the coastline?
- Were there additional actions to be included?
- Any delivery partners that should be considered?

Next round of workshops - Prioritisation

10

Phase 2 Workshops

Prioritising actions

11

Lake Macquarie Coastal Management Program, Stage 3

Identify, evaluate and prioritise management responses

12

Acknowledgement of Country

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Wording by the Aboriginal Reference Group and translated by Miromaa Aboriginal Language and Technology Centre.

13

Agenda

- Welcome and introduction
- Overview of prioritisation framework
  - Strategic priorities for the coast

14

Council's strategic approach – from Stage 1, CSP and LAP

- **Risk based** – address high risk issues first
- **Evidence based and adaptive** – use the right tools to collect data that inform adaptive decisions and action at the right time
- **Collaborative**
- **Values risk avoidance** – use the land use planning system and clear guidance on process, decision making and design, to avoid risks and to demonstrate due diligence and maintain funding and protections for Council
- **Values best practice and innovation**
- **Protect values to offer intergenerational equity** in coastal condition (coast and estuary processes and health) and lifestyle
- **Balance natural and social-economic values** for an urbanised waterway

i.e. on-ground works should be supported by the right data, clear thresholds for action, a high likelihood of shared, long term beneficial outcomes and a high level of collaboration

15

NSW Government Strategic priorities

- Identified in the CM Act and Grant funding guidelines
- MEMS – priority risks and initiatives

- Consistent themes:
  - Manage key risks
  - Build resilience
  - Public assets (natural and built)
  - Aboriginal participation and cultural values
  - Water quality
  - Connecting healthy coasts, coastal open space and healthy communities (wellbeing)

16

What priority categories are we considering?

The CMP is a program of actions to be implemented over the next ten years.

Council's priorities are linked to timeframes for implementation:

- 1 year – in the next Operational Plan (High priority)
- 4 years – in the next Implementation Strategy (Moderate priority)
- 10 years – over a council strategic planning cycle and the life of the CMP (Lower priority)
- Ongoing: actions that need to start early and be repeated over the life of the plan

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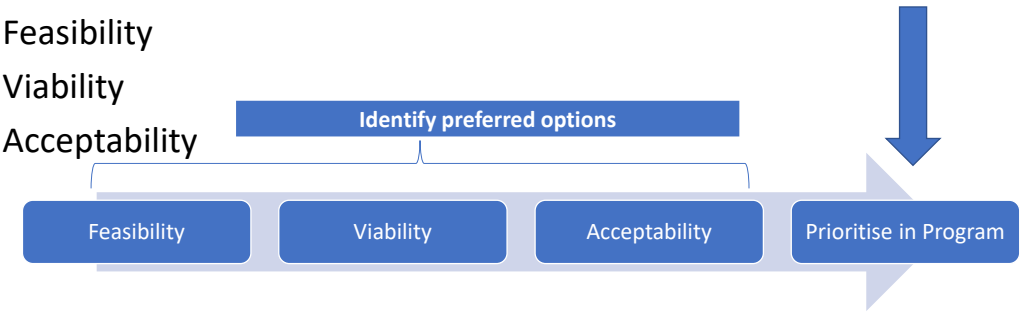
Option evaluation and action prioritisation

Coastal Manual

- Stepped evaluation to identify appropriate actions for implementation
- Feasibility
- Viability
- Acceptability

- Prioritisation – sequencing by timeframe (1 year, 4 year, 10 years): most beneficial initiatives first, within budget limitations



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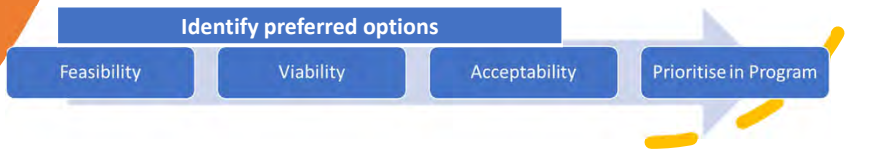
Which actions are we prioritising?

Group 1: Include in the CMP. These do not need to be re-evaluated

- Actions already committed to or in progress (in recently adopted strategies and plans, which have an evaluation process and have been exhibited). **Align priorities across strategies**.
- Framework actions that are ongoing and part of a well structured adaptive management process (e.g. monitoring). **No prioritisation required**

Group 2: Un-commenced or new actions – assess against prioritisation criteria

- Un-commenced actions brought forward from the CZMP
- Actions recommended as options in studies over the last 3 years
- Actions identified by council, agencies or community – over the last 3 years and during the current CMP planning process



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What builds a program? Priority is linked to 6 criteria

- Continue works already committed to and in progress
- Actions that deliver on clear, public and important strategic priorities
- Actions that are ready to go, have a strong business case and partners are lined up
- Actions that address existing or near-term unacceptable risk (beyond actions already in progress)
- Actions that are timely for mitigating future risks (i.e. steps with thresholds - don't act too soon)
- Actions that are essential to strengthen management targeting and certainty

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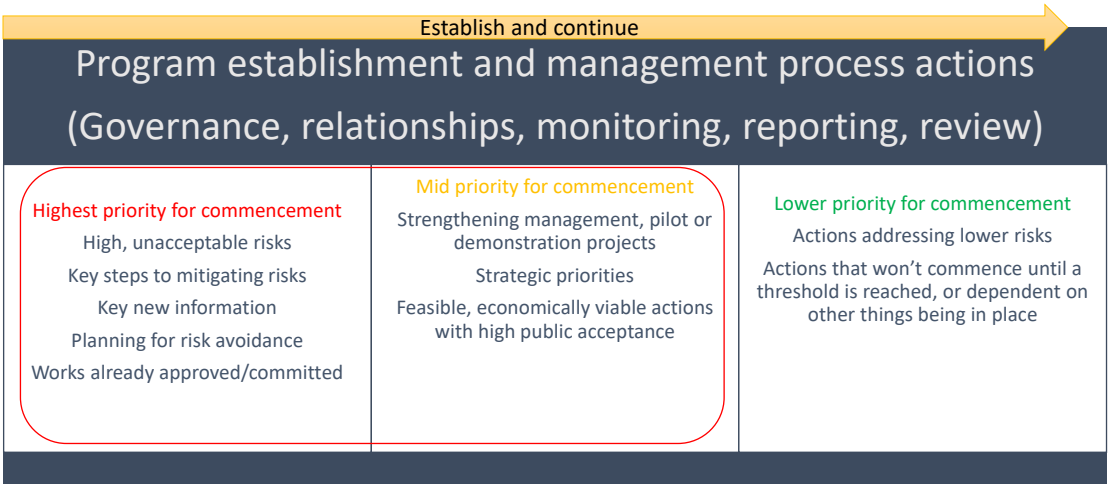
Framework for a management program



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- Level of public interest and public benefit
- Community support
- Address unmanaged or emerging priority risks
- Align with local and State strategic priorities
- Improving management
- Cost effective and value for money
- Ready to go

22

extras

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Council's vision: A healthy resilient coast

- What are the three most important things to get right when managing the Lake Macquarie coastal zone, to achieve this vision?
- Pick from the following list.

Communication and community engagement	
Stakeholder (agency) engagement and commitment	
Government and community working together	
Coastal science and engineering	
Manage the highest risks	
Data and monitoring	
Transparent decisions and evaluation	
Funding – the right amount of money/resource invest, given the risks	
Funding – costs are shared equitably	
Protecting natural values	
Balancing natural values and social/economic values	
Timing of responses	
Roles and responsibilities	
Responses that can adapt over time	
All of these	

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Long list actions – feasibility, viability and acceptability

- How do we know that actions to be prioritised have been evaluated in these ways?
  - Previously evaluated in the CZMP
  - Previously evaluated in the LAS or LAP, or another recent coast related strategy or plan – that has been exhibited and adopted by Council.
  - Evaluated by Council staff within the CMP preparation process

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What is Council's strategic approach to the coastal zone?

Objectives from Stage 1

- Analyse how currently available information would change actions and priorities from 2015
- **Adopt a risk management approach**
- **Adopt an adaptive management approach**
- **Involve the community (collaborative)**
- **Position council to use BAT and management approaches (innovative)**
- Present a clear strategic direction, with a fully justified schedule of actions
- A plan structure for easy use

Rationale from Stage 1 Business case

- **Avoids risks** by land use and infrastructure planning
- **Adaptation** to manage risks
- **Collaboration** – councils, agencies, community
- **Protect key community values**
- **Align with funding requirements** to enhance opportunities to improve services
- **Shared funding models** – understanding beneficiaries
- **Strong evidence base** to make defendable strategic decisions
- **Clear guidance** on current and future actions, including standardised processes, consistent and transparent

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How has Council identified priorities in other strategic plans? Is a consistent approach necessary?

- Example: Environmental Sustainability Strategy and Action Plan
- A qualitative reference to:
  - United Nations SDGs
  - **Four pillars of sustainability**: which combination of these does the action deliver on?

Environmental	Social
Environmental sustainability and sustainable ecosystems: Energy, air pollution, GHG emissions, waste management, potable water and sanitation	Social equity, quality of life (health, vigour, wellbeing and ability to flourish)
Economic	**Governance**
Financial prosperity, competitive productivity	Adaptive innovation, cultural sustainability

- Example Lake Activation Strategy
  - Place (environmental and social character and projections) and infrastructure alignment
  - Urgency – condition, safety risks, asset life
  - Sustainability – equity, public benefit, value for money, resource utilisation
- Example: Local Adaptation Plan
  - Applied Feasibility with multicriteria analysis, aligned with Manual
  - Viability - Detailed multi-option CBA, analysis and interpretation

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What's involved in prioritisation?

High priority actions:

- **Are ready to proceed** (are not subject to uncertainty due to complex and uncertain approval processes; complex roles, responsibilities or partnerships) (**Feasibility**)
- They make a significant contribution to local and state goals (or Commonwealth), with higher priority if the actions addresses **matters of significance and public interest at all levels** (**Feasibility and Acceptability**)
- Align with council (e.g. from CSP or Sustainability Plan, or CMP Stage 1) or state **strategic approach and priorities** (e.g. from Funding guidelines or MEMS) (**Feasibility**)
- **Strong benefits expected for the cost** (monetised or qualitative), including weighting (**Viability and Acceptability**); community support

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Feasibility

Align with statutory and policy objectives	• Consistent with the objects of CM Act, CMA management objectives and objects of MEM Act • Comply with local, state and commonwealth statutory and policy requirements – Legal • Council's strategic direction • Environmentally acceptable
Effective and adaptive	• Can address the identified issues and risks or enhance opportunities – use previous experience • Adaptive and can transition to alternatives as circumstances change
Practical	• Broadly able to be implemented – capacity and capability, expertise, monitoring etc • Feasible in engineering terms
Test new	• Likely to contribute new knowledge e.g. through trials or research

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Viability (economic evaluation) and acceptability

Economic evaluation

- Value of an action compared to the **base case** (continuing what is done now)
- Qualitative or quantitative evaluation of costs and benefits, depending on context – risks, costs, uncertainty, available data, complexity
- Equitable distribution of costs and benefits

Acceptability

Public interest and wider public benefit (distribution of benefits)

Sustainability (Council policy and UNSDGs)

Fairness and equity

Community resilience

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So what should be considered when developing our program?

Group 1: Include in the CMP. These do not need to be re-evaluated

- Actions already committed to or in progress (in recently adopted strategies and plans, which have an evaluation process and have been exhibited). **Align priorities across strategies**.
- Framework actions that are ongoing and part of a well structured adaptive management process (e.g. monitoring). No prioritisation required

Group 2 – Un-commenced or new actions – assess against the following to identify priorities

Level of public interest and public benefit Projects on public land or to protect public assets (including natural and built assets), reducing public liability **Community support** through an engagement or exhibition process	**Address unmanaged or emerging priority risks** (high or extreme, unacceptable). Include actions within threshold levels Lower risks have lower priority	**Align with local and State strategic priorities**: • Aboriginal involvement, cultural value • Water quality and litter • Climate change risks and resilience • Coastal community wellbeing • Collaborative governance and state/local or local/community partnerships	**Improving management** • Developing better evidence • Research and new data collection techniques • Innovation and test new management techniques • Improve targeting and certainty, refining thresholds • Inform the community	**Cost effective and value for money** – most positive benefit ratio **Ready to go** Funding is available, including from other public authorities, or shared funding through grant program

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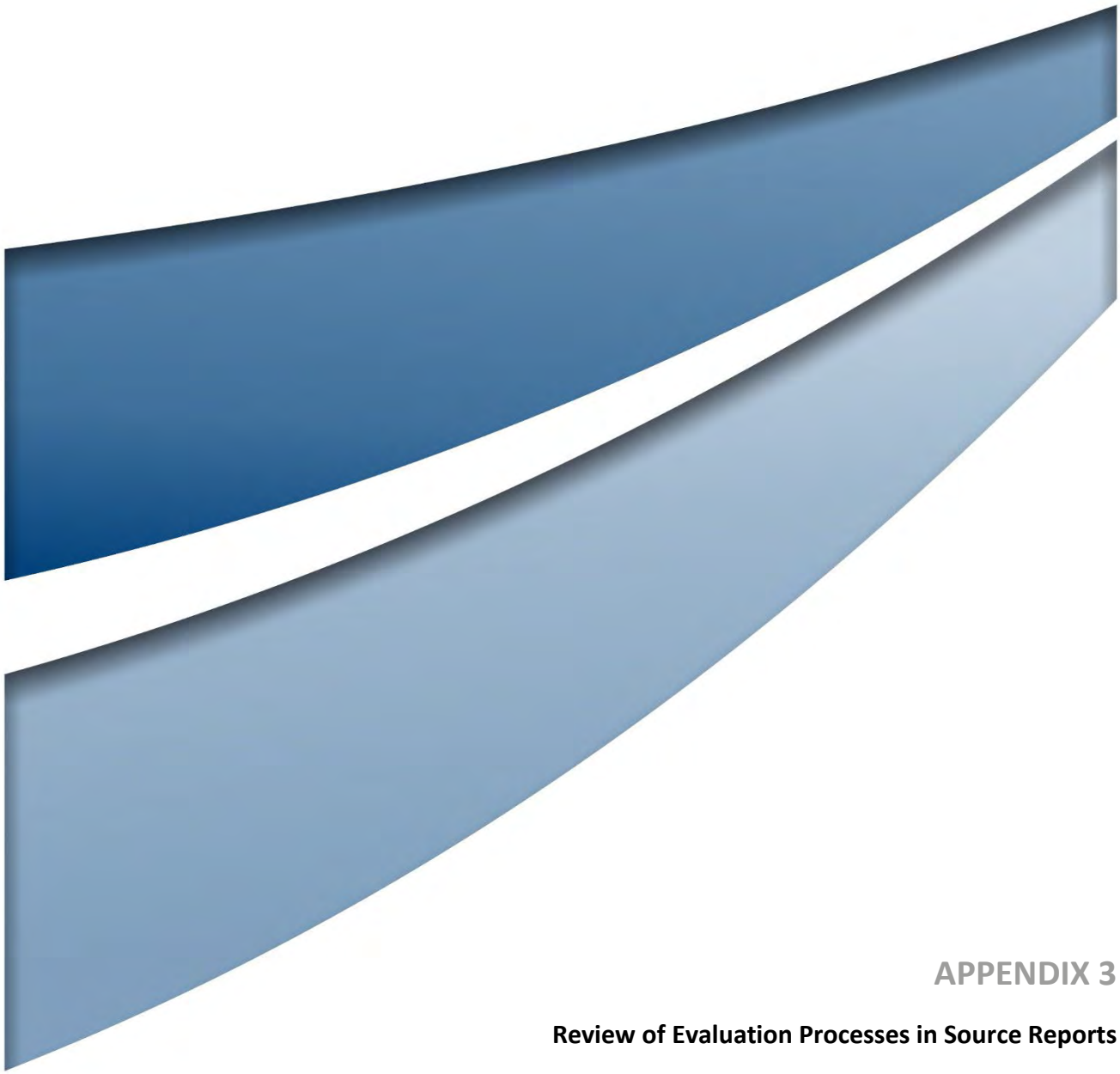


APPENDIX 3

Review of Evaluation Processes in Source Reports

Review of previous option evaluation in source studies

This section reviews how option evaluation was completed in a range of technical and management studies that are sources of management options in the CMP.

The aim of this review is twofold:

- to demonstrate that many actions have been evaluated for feasibility and economic value using processes that are sufficiently equivalent to the current requirements that the evaluation does not need to be repeated.
- to show that the evaluation process for actions evaluated by applying current criteria (developed from the Manual) produces equivalent results (not discarding actions that would otherwise have been included).

Information is provided about the evaluation process for eight previous studies or plans that are sources of actions for the CMP. In **Section 3.8.9**, the processes used in each of these source documents are compared to the option evaluation framework developed for the CMP, which is based on the Manual and checklist.

CZMP Part A – open coastline

Two evaluation questions, setting up nine criteria, were used to evaluate options for the coastline in CZMP Part A:

- Which options are important?
- Which options are feasible?

For each criterion, the CZMP provides descriptors on a traffic light system (see Page 74 of the CZMP, Part A, for the open coastline), where:

- Green indicated strong alignment or capacity to deliver this benefit
- Orange indicated moderate alignment or capacity to deliver this benefit
- Red indicated poor alignment and limited capacity to deliver the value

The nine criteria from CZMP Part A are summarised in **Table 3.1**, with those shaded in blue indicating criteria for importance and those shaded in yellow indicating criteria for feasibility.

Table 3.1 Criteria for importance and feasibility from CZMP Part A

Criteria	Indicators of strong alignment or performance
Importance	
1. Reduce high and extreme risk	Green: addresses extreme and high risks
2. Environmental effects	Green: has minimal environmental impact or a positive environmental benefit

Criteria	Indicators of strong alignment or performance
3. Framework for adaptive management	Green: Action has immediate benefits but also sets up future beneficial actions (e.g. measurable outcomes that can be monitored and reported)
4. Multiple benefits	Green: Action builds social, environmental and economic benefits
Feasibility	
5. Affordable budget	Green: Council has funds available within its current budget cycle or has already applied for and obtained grant funds; or action focuses on sourcing grant funds from diverse sources **Note: this criterion fits better with economic evaluation in the post reform framework**
6. Value for money	Green: Benefits greatly outweigh capital and maintenance costs **Note: this criterion fits better with economic evaluation in the post reform framework**
7. Organisational capacity	Green: Council staff and local communities have the skills and capacity now to implement this action
8. Community acceptance	Green: is supported by the local community; or builds community awareness, knowledge and resilience, so that local communities are better able to manage coastal process hazards affecting their properties and local community assets **Note: this criterion is now part of acceptability**, rather than feasibility, although community resistance or opposition certainly do affect the practicality of management actions.
9. Statutory requirements	Green: Actions can be implemented within existing statutory and policy frameworks

The highest priority actions were those which were both important responses to coastal issues and were relatively easy for Council to implement. The evaluation of options for the CZMP also considered implementation risks – the investment required, what could go wrong and the level of uncertainty about future conditions and/or the outcome.

This led to the development of a matrix of important and feasible actions, which provided indicative implementation priority.

		Constraints to feasibility	
		Less constraints	**More constraints**
Importance	**Higher importance**	**Category A – HIGH PRIORITY** Important and Easy **Take action NOW to reduce risk** These actions treat high priority risks and can be done with available funds, current legislation or policy and governance arrangements	**Category B – MODERATE PRIORITY** Important but tricky **Take action now to reduce barriers and enhance opportunities**. These actions are 'preparation' actions so that actions can move into the Important and Easy category when needed.
		Category C – MODERATE PRIORITY Not so important, but easy	**Category D – LOW PRIORITY** Too hard for now

	Lower importance	**Take action when opportunities present** – these actions are bonuses; schedule for implementation, but not urgently	**Take action to remove barriers and enhance opportunities when present**. Would require significant changes to organisational capacity, partnerships, funding sources or legislation, which would take time, and may not provide environmental, social or economic benefits to justify

Table 9.3 of Part A of the CZMP provides a qualitative description of the benefits and disadvantages of each action, plus criterion scores for each of the nine criteria and a category score. In terms of scaling of feasibility, Category A actions have at least 6 green scores against the criteria (and no red scores). Category D actions have mostly red scores and few green ones.

CZMP Part B Estuary – Evaluation Criteria

Table 5.1 of Part B shows the criteria for defining priority issues. It uses 'Important' and 'Urgent' as the framework for the matrix. Both are related to risk and future risk trajectory

Important	This issue is associated with high risk This issue affects many stakeholders and community users The issue affects major community infrastructure and Council or other stakeholder investment The issue has a major impact on the ecology of the lake The issue is relevant at all timescales
Urgent	The issue or threat has been assessed as high to extreme and intolerable risk (ISO 310000) If action is not taken immediately, the consequences will deteriorate rapidly If not addressed this issue will undermine progress on other issues.

These criteria lead to a four-way classification of issues/threats:

LOW IMPORTANCE; MAY BE URGENT • Interruptions - matters arising from time to time and are urgent (such as media coverage or a crisis), but otherwise not important issues	**HIGH IMPORTANCE; URGENT** • Critical tasks
LOW IMPORTANCE; NOT URGENT • Distractions – risks that are neither urgent nor important, but which may generate attention that distracts managers from key threats	**HIGH IMPORTANCE; NOT URGENT** • Important long-term goals, but not requiring significant effort immediately

Table 5.4 of Part B then presents three essential criteria and three desirable criteria for evaluating potential management options for the important/urgent issues – to identify options that are feasible and appropriate (See **Table 3.2** below). These criteria are based on evaluation analysis guidance prepared by Hunter Councils 2012.

Table 3.2 Action selection criteria from CZMP Part B

Minimum criteria for selected action	
Effective (equivalent to 1 and 2 above, Important))	Is the action likely to meet the primary objective? will it result in perverse outcomes in the longer term?
Proportional (equivalent to 3 and 4 above, Feasible)	Are the costs of the action likely to be in proportion to the expected benefits?
Compliant (equivalent to 8 above, Feasible)	Does the proposed action comply with existing legislation, policy and guidelines?
Desirable criteria for action selection	
No regrets/low regrets (partly equivalent to 5 above, Feasible)	Is the proposed action something that should be done anyway?
Acceptable (equivalent to 6 (Feasible) and 9 (Important) above)	Is the option culturally, socially, environmentally and politically acceptable? Will there be a major backlash?
Flexible (equivalent to 7 above, Important)	Can the option be adjusted (adapted)? Does it allow for incremental/staged implementation? Does it allow alternative options to be implemented in the future?

CZMP Part C – Swansea Channel (BMT)

The CZMP Part C option evaluation, which was described as 'first pass', used a multicriteria assessment approach, with seven criteria.

Criteria:

- Capital and recurrent cost, with 'high' to 'low' limit values based upon an order of magnitude difference in expenditure, which would require investigations and approvals by Council before proceeding.
- Environmental and social impact, to identify where the option may have trade-offs on the surrounding environment, including beach amenity and access.
- Community acceptability, which is informed also by community feedback during exhibition.
- The ability for the option to be reversible or adaptable in the future, especially when there is considerable uncertainty or long-time frames for a future impact.
- Effectiveness over time – is the option a long-term solution or a short-term solution that would require additional action or upgrades in the future.
- Legal/approval risk (is it consistent with legislation), aligned with government priorities.
- Technical viability/feasibility (can it be done, or other practical constraints).

For each of these seven criteria, Part C provides qualitative descriptors at three levels (Go, Slow or Stop).

It provides a summary table with 13 simplified actions, the seven criteria, and colour coded evaluation. 'Stop' assessments related to only two criteria - high capital cost and reversible/adaptable. 'Stop' assessments were applied to two types of action – planned retreat (especially in developed areas) and revetments and groynes (major engineering works).

The Management Action Plan provides some time frames and some triggers. Some actions are linked to precursor actions (e.g., beach nourishment to maintenance dredging of the channel).

Swansea/Blacksmiths/Pelican LAP

The Local Adaptation Plan was prepared after the gazettal of the coastal Manual. It evaluated more than 160 management options, identified in a collaborative engagement process with the affected communities. The evaluation involved a detailed, weighted multi criteria assessment of feasibility, followed by a full complex CBA.

The LAP feasibility evaluation report is based on the three-step evaluation process in the Manual. It notes that the local community had previously conducted their own option evaluation with criteria, and builds on that work to prepare a formal MCA.

All the options for the LAP are broadly intended to address risks associated with tidal inundation and combined catchment and tidal inundation. Shoreline erosion associated with tidal currents and waves for the Pelican shoreline is addressed separately.

Different sections of the project area have different risk levels because of different hydrodynamic exposure and local terrain and development (including infrastructure and connectivity).

The project was supported by hydrodynamic modelling and damages calculations for different timeframes and different climate change scenarios.

The criteria for evaluating risk management options take into account community and statutory objectives (from the CM Act and SEPP). The community objectives include adapting in place.

Before evaluation proceeded, a review of all the options on the table was conducted to remove options that were part of the current 'base case'. The options evaluated in the assessment are only 'new' options, not options that are part of the current management, or options that are routine components of any adaptive management program. These were incorporated directly in the LAP.

Criteria: Six from the community

- Does the adaptation option agree with our objective?
- Will it work technically (does it manage the hazard in line with our objective?)
- How easy is it to adapt over time? How might it affect other options?
- Will it harm the environment and are impacts manageable?
- Will it maintain community well-being (health, safety, financial, business, leisure)

- Will costs outweigh benefits?

These were combined with criteria directed by the legislation and indicated by other adaptation assessments in complex contexts.

A summary of feasibility criteria is provided in **Table 3.3**.

Table 3.3 Feasibility criteria for LAP

Category of criteria	Criteria descriptions
Governance and statutory compliance	1. Option is consistent with the Objects of the CM Act 2. Option is consistent with relevant statutory and policy requirements and has a recognised approval pathway **3. Council and other government bodies have suitable capacity and capability to implement the option** 4. The option can be implemented without complex governance and partnership arrangements
Environment	**5. Consistent with the principles of ESD** 6. Would provide a natural buffer from natural hazards **7. Option does not transfer adverse environmental outcomes to other locations or parts of the local environment, specifically coastal wetlands, littoral rainforests or other sensitive areas** 8. Option does not create adverse environmental outcomes for lake Macquarie estuary and foreshores 9. Environmental impacts are acceptable to the (local) community
Social, cultural and community	10. Option maintains the presence and amenity of beaches and foreshores 11. Option is effective at protecting public health and safety from coastal hazards 12. Option maintains or improves physical connectivity and social cohesion within Swansea, Pelican and Blacksmiths 13. Option is acceptable to the people of Swansea, Blacksmiths and Pelican 14. Option is acceptable to the broader Lake Macquarie community 15. Option protects Aboriginal and historic heritage places and values
Technical practicality and certainty	**16. Option is feasible in engineering terms** **17. Option can address the identified issues and achieve the objectives now and in the long term** 18. Option is adaptive and can transition to alternative approaches 19. Option is part of a hierarchy or framework of related controls that should be implemented together
Economic/financial **Note- economic value was analysed in detail using CBA, for the short list of options developed from the MCA**	20. Indicative capital and maintenance costs are likely to be fundable within Council's budget 21. The cost to implement this option is acceptable to the people of Lake Macquarie

Note that criteria 9, 13, 14 and 21 are also about 'acceptability'.

Criteria were weighted using a process which asked participants to nominate criteria they considered to be of Very High Importance – to Low Importance. Results were organised by level of agreement.

The most important criteria, with high agreement (highlighted in **Table 3.3** above), were:

- This option is **feasible in engineering terms** (technical practicality/certainty)
- The option **can address the identified issues to achieve the objective**, now and over the long term (technical practicality/certainty)
- The option is **consistent with the principles of ESD** (Environment)
- The option **does not transfer adverse environmental outcomes to other locations or to sensitive environmental areas** (environment)
- **Council and other government bodies have suitable capacity and capability** to implement this option (governance)

The LAP also included a detailed CBA, conducted for 12 options against a detailed base case.

The 12 options were broadly:

- Wetland migration and offsetting (3 options)
- Raise and fill land and built assets (with different residential, commercial and infrastructure assets assessed separately) (7 options, for different assets and land uses)
- Channel and foreshore protection works (2 options)
- Relocate caravan parks (as a test for a retreat option)

A detailed report was prepared to document that CBA process, which included NPV of future net benefits, sensitivity analysis and a range of other factors which could not be quantified.

Wave Overtopping Study 2021

Salients (2021) provided a qualitative description of 'pros and cons' of management options for various overtopping locations from Blacksmiths to Redhead. There were generally three options for each locality – from 'do minimum', to managing/controlling/formalising access to nourishing and reshaping dunes with a high crest elevation.

A cost estimate was developed for each option.

A multicriteria evaluation process was conducted as a workshop. Six criteria were used, with weightings developed by collective views on the importance of the criterion.

The criteria are linked to the requirements of the Manual. All are described qualitatively and evaluated by a group to generate a shared position.

1. **Efficiency** (easy to implement with minimal disruption and in a timely manner)
2. **Fairness** (whether the option disproportionately disadvantages or provides benefits to a select group of people)

3. **Public Benefit** (whether the option is in the interest of the public and will help the community become more resilient)

4. **Effectiveness** (whether the option would provide a robust and effective solution)

5. **Social sustainability** (whether the option can be adapted over time, would create a legacy problem or a burden on future generations)

6. **Environmental sustainability** (whether the option would cause serious or irreversible environmental damage, threaten ecological integrity or biodiversity)

Each option was scored -5 (critically negative) to +5 (outstanding positive), with 0 used for negligible impact or not relevant

The process provided weighted MCA scores for nine options. These included options to manage impacts on Redhead Surf Club, from high waves and tides.

Surfing amenity assessment 2020

WRL provide background information about qualitative experience from other beaches where surfing conditions have been modified – by break walls, sand nourishment, dune management etc.

They provide data on beach usage from a beach monitoring camera, which shows the distribution of usage across a week and seasonally.

Management options are proposed for short, medium and long-term time frames. Only the actions proposed for the short term are proposed to be implemented within the 10 year time frame of this CMP.

- Short term – additional data collection and analysis to provide more certainty about processes affecting surf quality

- Medium term – feasibility and trials with careful monitoring – sand slug configuration placement associated with channel dredging works

- Long term – concept designs for sand transfer, planning processes for break wall upgrades.

These are fairly general management proposals and have not been evaluated. They do provide a staged, evidence-based set of responses, with opportunity for detailed feasibility and CBA assessment as options are refined.

Lake Activation Strategy 2021

During the development of the LAS, Council considered a detailed option evaluation process (which is available in Umwelt working documents), but the final published version uses a simple prioritisation process linked to IP&R planning and resourcing timeframes – with actions identified as high (within the first 4-year Delivery Program), medium (within second Delivery Program) or low (beyond 8 years – third Delivery Program) priority, or ongoing.

Priority is linked to urgency, with assets that are in poor condition, and which have a limited remaining estimated life having a higher priority. Assets that are in poor condition also may not be functional for their intended purpose and/or have safety issues.

The framework for classifying locations and aquatic infrastructure, gap analysis and process for identifying sites for investment incorporate similar evidence to an evaluation process, take into account data on demand, social issues, equity, and environmental context (environmental risks and constraints).

Each action is also linked to relevant Sustainable Development Goals (to which Council has committed), but not in an evaluation context.

In future revisions of the LAS, Council will consider whether a formally structured public facing option evaluation process is necessary. For instance, the LAS provides lists of criteria for making decisions about the right place/community for a new fully meshed swimming enclosure. In effect, these are an evaluation process to compare alternative sites (i.e., alternative options).

State of the Estuary Report 2020

The State of the Estuary Report reviews the current knowledge and science around multiple threats impacting on the health of Lake Macquarie. It provides a summary of the key drivers of the threats, where they are experienced, and how they interact.

For each of the major threats, the report provides recommendations for lake management (with the primary objective of protecting and restoring lake health), based on the best available science. The proposed responses are the outcomes of the science – there is no evaluation of these management responses in social and economic terms.

The recommended responses are often further studies or provide conceptual direction on what needs to be achieved – not necessarily how to achieve it e.g. reduce sediment loads in diffuse flows from large catchments, reduce DIN loads in urban runoff:

- Identify sediment and nutrient generation hotspots using spatially intensive, short term monitoring programs
- Identify prioritised strategies to minimise erosion losses from unconsolidated road verges, building sites and streetscapes etc.

There is a recognition that costs can be high and practical feasibility difficult for some actions – hence the responses focus on ‘prioritised strategies’.

The proposed priority actions for sea grass are more specific – such as mandating seagrass friendly moorings in seagrass beds, but also requiring further ongoing monitoring of seagrass extent and health.

Some recommended priority actions from the State of the Estuary report are already (wholly or partly) included in the previous CZMP or related reports.

Comparing feasibility evaluation processes for actions sourced from previous studies, plans and strategies

As explained in Section 2, options that have been considered for inclusion in the CMP are sourced from multiple previous studies and from consultation during the preparation of the CMP. Section 3.4 provides an outline of how previous studies have evaluated feasibility. This section compares the previous feasibility evaluation criteria and processes to the criteria and process proposed for the CMP, which are based on the requirements identified in the Manual and checklist. This comparison is used to determine the extent to which previous evaluation processes are consistent with current requirements, so that it is not necessary to re-evaluate feasibility.

Table 3.4 provides the comparison. In this table:

- Green shading indicates that the criteria used previously are compatible/consistent with the current requirements
- Peach colour indicates there is some overlap, but not as strong.
- No shading indicates that there is no evidence this criterion was formally considered when identifying or recommending actions.

Based on this review, the new feasibility and economic viability evaluation process should be applied to:

- All actions brought forward from the Surfing Amenity study
- All actions brought forward from the State of the Estuary report
- Actions from the CZMP (any area) which have had a substantial change to intent or spatial application

Table 3.4 also reviews the processes previously used to consider the economic viability of management responses, and the extent to which 'acceptability' has been incorporated in the evaluation process.

From this review, some aspects of economic viability – particularly around public and private benefit, should be reviewed for most actions brought forward from other plans, to provide a uniform approach.

State of the Estuary actions should be evaluated in relation to public acceptance/sustainability. Actions from other plans have been subject to some form of public consultation and/or are adopted by Council after an exhibition process. This is considered to be a reasonable indication of community acceptability.

All actions should be included in a process to determine priorities.

Table 3.4 Review of previous option evaluation processes

Current proposed feasibility criteria – based on Manual Stage 3	CZMP Part A	CZMP Part B	CZMP Part C	Swansea LAP	Swansea LAP Community	Wave overtopping study	Surfing amenity Study	Lake Activation Strategy	State of Estuary
Consistent with, promotes and gives effect to the objects of the CM Act and relevant coastal management areas	Actions can be implemented within existing statutory and policy frameworks including being consistent with the objects of the Coastal Protection Act (noting these were not the same as CM Act, but related)	Actions can be implemented within existing statutory and policy frameworks including being consistent with objects of the Coastal Protection Act (noting these were not the same as CM Act, but related)	Actions can be implemented within existing statutory and policy frameworks including being consistent with objects of the Coastal Protection Act (noting these were not the same as CM Act, but related)	Option is consistent with the Objects of the CM Act Would provide a natural buffer from natural hazards Option maintains the presence and amenity of beaches and foreshores Option is effective at protecting public health and safety from coastal hazards	CM act is not identified as a separate criterion	Objects of the Act are acknowledged as a key part of the management framework	No statutory criteria considered. This was a technical study with recommendations	Objects of the CM Act are noted as part of the Statutory framework in background documents and considered in scoping of management framework. Project based on 11 principles, some of which align with Objects of the CM act	Focus for developing responses is on protecting and restoring the health of coastal waterways and ecosystems; this is Object (a) of the CM Act: to protect and enhance natural processes and coastal environmental values including natural character, scenic value, biological diversity and ecosystem integrity and resilience
Other statutory or policy requirements can be managed (i.e. aligns with government priorities and **a**	Actions can be implemented within existing statutory and policy frameworks.	Action complies with existing legislation, policy and guidelines: Identifies complex interacting legislation and policy influencing	Legal or approval risk (is it consistent with legislation), and aligned with government priorities?	Option is consistent with relevant statutory and policy requirements and has a recognised approval pathway		Public Benefit (whether the option is in the interest of the public and will help the community	No Statutory criterion	Considers requirements of Local Government Act and various legislation and policy affecting lake health and	

Current proposed feasibility criteria – based on Manual Stage 3	CZMP Part A	CZMP Part B	CZMP Part C	Swansea LAP	Swansea LAP Community	Wave overtopping study	Surfing amenity Study	Lake Activation Strategy	State of Estuary
clear approval pathway)	Identifies complex interacting legislation and policy influencing lake, coastline and channel management	lake, coastline and channel management	Identifies complex interacting legislation and policy influencing channel management			become more resilient). public benefit is within NSW government policy		natural resources, EP&A Act.	
Effective and sustainable: Is known to be an effective response for the threat/risk involved, with no major unintended side effects (environment or social)	Effectiveness on its own not considered, but rationale for all actions included in implementation tables. Consider environmental effects: has minimal environmental impact or positive environmental benefit	Effective – is the action likely to meet the primary objective? Will it result in perverse outcomes in the long term? No or low regrets actions – is this what should be done anyway?	Consider environmental and social impact to identify where options may have trade offs on the surrounding environment, including beach amenity and access	Effectiveness over time – is the option a short term or longer-term solution (i.e. time frame over which it can be expected to be effective). Consistent with the principles of ESD Option does not transfer adverse environment outcomes to other locations or parts of the local environment, specifically coastal wetlands, littoral rainforests or other sensitive areas Option does not create adverse	Will it harm the environment and are impacts manageable? Will it maintain community well-being	Options are proposed as solutions that would be effective. Considers fairness (whether the option disproportionately disadvantages or provides benefits to a select group of people) Social sustainability (whether the option can be adapted over time, would create a legacy problem or a burden on future generations) Environmental sustainability	No effectiveness evaluation – actions are proposed as solutions that would be effective	Framework is based on analysis of physical environment constraints and opportunities, social need and economic potential, plus the condition and asset life of existing infrastructure. Underlying principles include using industry best practice (effective) protecting the health of the lake, opportunities for inclusiveness and accessibility	Recommended actions are based on expert scientific analysis and review, with the objective of refining the management of the lake to improve (reduce threats to) ecological health

Current proposed feasibility criteria – based on Manual Stage 3	CZMP Part A	CZMP Part B	CZMP Part C	Swansea LAP	Swansea LAP Community	Wave overtopping study	Surfing amenity Study	Lake Activation Strategy	State of Estuary
				environmental outcomes for Lake Macquarie estuary and foreshores Option protects Aboriginal and historic heritage places and values		(whether the option would cause serious or irreversible environmental damage, threaten ecological integrity or biodiversity)			
Can be adapted, or is a component of an adaptive approach	Framework for adaptive management. Action has immediate benefits but also sets up future beneficial actions (delivering measurable outcomes that can be monitored and reported)	Flexible – can the option be adjusted (adapted)? Does it allow for incremental or staged implementation? Does it allow alternative options to be implemented in the future?	Effectiveness over time – is the option a long-term solution or a short-term solution requiring additional action or upgrades in the future (and is this the intent?)	Option can address the identified issues and achieve the objectives now and in the long term Option is adaptive and can transition to alternative approaches Option is part of a hierarchy or framework of related controls that should be implemented together	Is it easy to adapt over time; how might it affect other options?	Adaptation capacity not discussed, but purpose of actions is to make landforms and infrastructure more resilient, using responses tailored to risk (e.g. raise dune, relocate surf club)	Options not evaluated but proposed as a sequence of data collection, feasibility and trials, concept designs, planning approvals and implementation	Adaptability to cater for changes in lake use is one of 11 key principles. Adaptation to climate change a relatively low factor in setting investment priorities. Aquatic infrastructure asset life is relatively short, and designs can be readily adapted at replacement	Not a consideration for the recommended responses, although several could be considered to be related within an adaptive sequence
Is practical and can be implemented, including engineering	Few coastal protection works identified in the list of actions.	Coastal protection works not generally identified as actions – although scoping,	Technical viability or feasibility (can it be done, or other practical	Option is feasible in engineering terms	Will it work technically?	Effectiveness (whether the option would provide a robust	The suite of actions includes studies to develop and test concept	Current engineering capacity of structures	Engineering feasibility not an issue for these predominantly

Current proposed feasibility criteria – based on Manual Stage 3	CZMP Part A	CZMP Part B	CZMP Part C	Swansea LAP	Swansea LAP Community	Wave overtopping study	Surfing amenity Study	Lake Activation Strategy	State of Estuary
feasibility for structures	Engineering feasibility is not noted as a stand-alone consideration, only that Council has the skill and capacity to complete the action. practical constraints identified in an importance/ constraints matrix	design and evaluation of potential works are proposed (see LAP for Swansea)	constraints) – channel actions include coastal protection works	Council and other government bodies have suitable capacity and capability to implement the option The option can be implemented without complex governance and partnerships		and effective solution)	designs, so technical feasibility is built into subsequent phases.	identified as a reason to upgrade to meet future needs. Proposed actions included building ramps and jetties to meet technical specifications for high usage or larger vessels	scientific research projects.
Likely to contribute to new knowledge	The concept of research or pilot projects not used to distinguish projects and actions, but Part A does include a monitoring program and research actions which would contribute new knowledge	The concept of research or pilot projects not used to distinguish projects and actions, but Part B does include a monitoring program and research actions which would contribute new knowledge	Not identified as a criterion, but reducing long-term uncertainty is part of decision making	Not included in the MCA as a specific criterion. The MCA did not evaluate actions that would be considered to be part of a well-designed adaptive management approach, including monitoring and research – these went directly to the LAP	Community keen to adapt, and to gain new knowledge, but this was included as one of their key criteria	Some actions will provide new knowledge, but criteria did not rank options on the strength of knowledge gain	Includes actions that are intended to increase knowledge and understanding of coastal processes	Not used a criterion to determine feasibility, but there is a gap analysis and some actions are proposed specifically to fill knowledge gaps and improve evidence based decision making	No identified as a criterion for feasibility or priority, but several recommended actions are intended to strengthen knowledge for subsequent decision making

Current proposed feasibility criteria – based on Manual Stage 3	CZMP Part A	CZMP Part B	CZMP Part C	Swansea LAP	Swansea LAP Community	Wave overtopping study	Surfing amenity Study	Lake Activation Strategy	State of Estuary
Other criteria – may relate to economic viability and community acceptance									
Economic viability									
Compare indicative costs (capital and operational) and benefits of new actions to the base case (what is already being done to manage the risk or threat)	Benefits outweigh capital and maintenance costs	Proportional – are the costs of the action likely to be in proportion to the expected benefits (i.e. qualitatively, a net benefit) Positive benefit cost and affordable	Consider capital and recurrent cost. more detailed MCA and CBA analysis in a detailed evaluation of coastal protection works at Pelican and also previously considered for the navigation dredging strategy	**Feasibility MCA**: Indicative capital and maintenance costs are likely to be fundable Within Council's budget The cost to implement this option is acceptable to the people of Lake Macquarie Full CBA and distribution analysis prepared following the feasibility MCA	Will costs outweigh benefits?	Cost benefit not discussed in the MCA criteria, but can be inferred from a combination of criteria such as efficiency, public benefit and effectiveness	Not part of the scope of this project	Council provided only indicative costs for actions that range from policy and planning initiatives to infrastructure upgrades and changes to on water services. Cost benefit not developed at this stage, but will be part of future more detailed planning.	Based on the assumption that a healthy lake underpins all other benefits
Do the benefits accrue to a **Council or State government strategic priority**? On balance, will the new actions increase the value proposition?	Not directly addressed, but benefits and constraints of actions are described qualitatively in the action implementation plans	Not directly addressed, but benefits and constraints of actions are described qualitatively in the action implementation plans	Mentioned in Part C, but considered in a subsequent MCA and CBA for coastal protection works at Pelican and previously considered in the Navigation	Business case prepared as part of the LAS, following full CBA and distribution analysis	Not addressed	Not addressed	Not addressed	The concept and premise of the Lake Activation Strategy was to leverage social and economic benefits from the natural character of Lake Macquarie which is central to	The health of coastal waterways is a government strategic priority (see MEMS)

Current proposed feasibility criteria – based on Manual Stage 3	CZMP Part A	CZMP Part B	CZMP Part C	Swansea LAP	Swansea LAP Community	Wave overtopping study	Surfing amenity Study	Lake Activation Strategy	State of Estuary
			Dredging Strategy (2011)					the city. This is a fundamental LMCC strategic priority. Also relevant to objects (b) and (d) of the CM Act	
Do the benefits accrue primarily to the public? How are costs and benefits distributed to public and private stakeholders?	Not directly addressed	Not directly addressed	Not addressed in Part C, but subsequently included in MCA and CBA for coastal protection works at Pelican. Previously considered in Navigation Dredging strategy	Full, complex CBA and distribution analysis prepared, against a base case	Not addressed	Public benefit – whether the option is in the interest of the public and will help the community become more resilient	Not addressed	Not specifically addressed, but a key principle was maintaining public access and amenity and not privatising public waterfront land.	Not specifically addressed, although the actions are to improve the health of a public waterway
Are there funding partners available? i.e. does the cost not fall entirely to Council? If public costs, which organisation is responsible for costs? **Has that public authority committed to meeting the costs** to deliver the	Consider whether Council has funds available within its current budget cycle or has applied for and obtained grant funds; or action focuses on sourcing grants funds from multiple sources	Identifies potential funding programs and partners but does not address authority commitments	Option evaluation did not include commitment of funding partners, although this was refined in a subsequent CBA for coastal protection works at Pelican	Addressed in the final LAP documents, business plan	Not one of the community criteria. Assumed resolving funding arrangements would be a Council responsibility.	Refers to CMP as a funding process – Council or Coast and Estuary Grants.	Not a consideration in this study, but there is an assumption that funding will be resolved in the CMP	Equitable distribution of council resources is a project principle. Council will fund works, in conjunction with the TfNSW boating programs. Council has been successful in these programs in the past, and has	Proposes some projects funded by various state agencies (e.g. through MEMS projects) and through the CMP. This assumes that commitment from funding partners will be forthcoming.

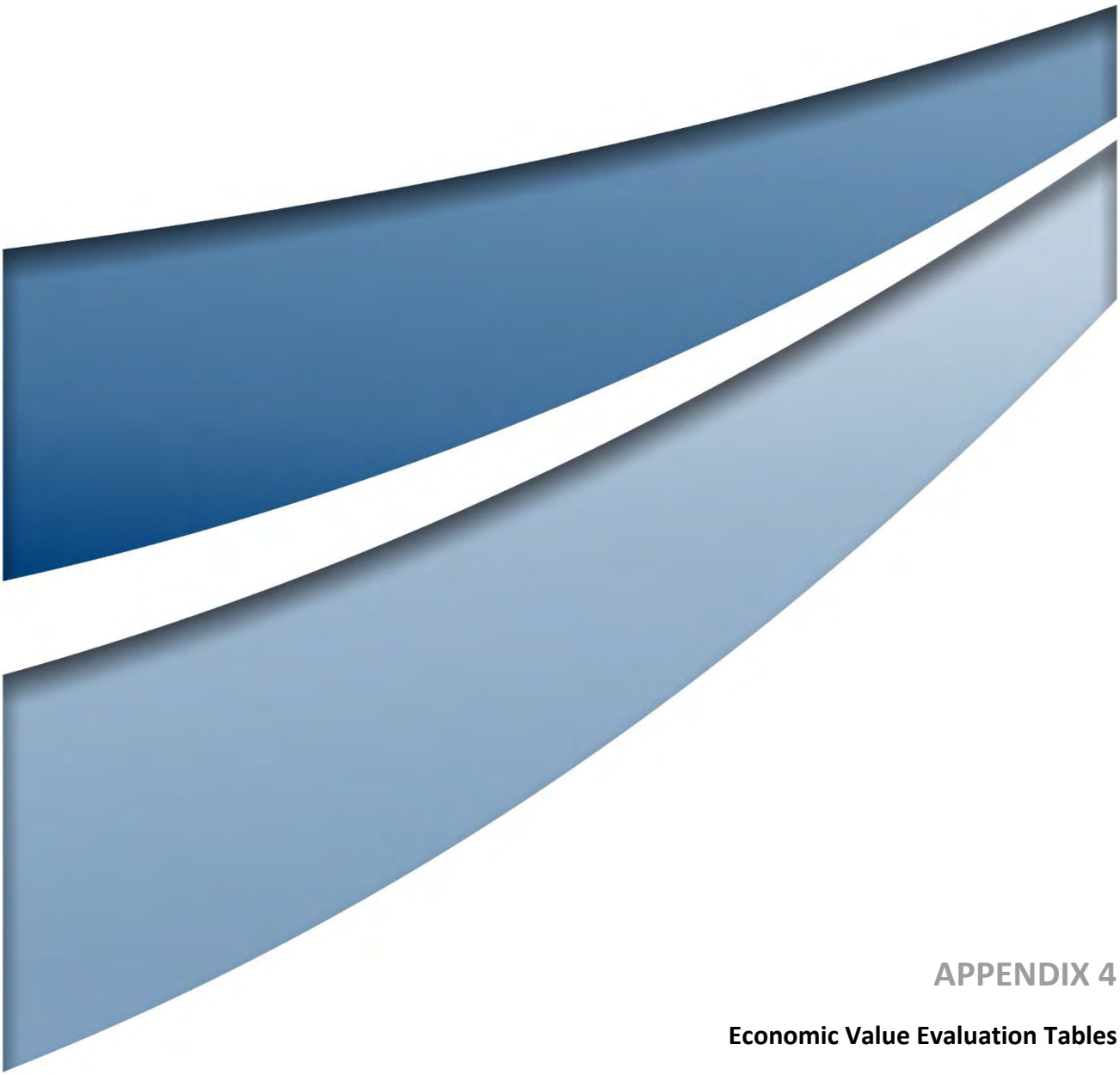
Current proposed feasibility criteria – based on Manual Stage 3	CZMP Part A	CZMP Part B	CZMP Part C	Swansea LAP	Swansea LAP Community	Wave overtopping study	Surfing amenity Study	Lake Activation Strategy	State of Estuary
proposed benefits?								strong continuing expectations.	
Community acceptance									
Refer to Council's Sustainability Policy and ESSAP, and its 'Pillars of Sustainability'. In addition to environmental sustainability and contributing to financial prosperity, the action supports social equity, quality of life, a resilient community, fairness and accountability	Is supported by the local community, or builds community awareness, knowledge and resilience so that local communities are better able to manage coastal hazards (and threats?) affecting their properties and community assets	Is the option culturally, socially, environmentally and politically acceptable? Will there be a major backlash?	Considers environmental and social impact and potential trade-offs.	Option maintains or improves physical connectivity and social cohesion within Swansea, Pelican and Blacksmiths Consistent with local objective (to adapt in place) Environmental impacts are acceptable to the (local) community Option is acceptable to the people of Swansea, Blacksmiths and Pelican Option is acceptable to the broader Lake Macquarie community	One of community objectives was fairness, + transparency and involvement in decision making	Social sustainability (see above) and fairness are both criteria, as is environmental sustainability	Not a consideration for this study, but will be for future stages, when more detailed proposals are available.	Used directly in developing the framework for the LAS	Directly informed by objects of CM Act and MEM Act, which are about sustainable management of the NSW coastal zone and marine estate.
Feedback received in consultation processes about	Feedback received in consultation processes about	Feedback received in consultation processes about acceptability of actions	Community acceptability, informed by	Involved community working groups, community	See LAP process	Community involved in review of actions and report is available	Not a consideration in making recommendations,	Feedback received in consultation processes about	Not a consideration in making recommendations

Current proposed feasibility criteria – based on Manual Stage 3	CZMP Part A	CZMP Part B	CZMP Part C	Swansea LAP	Swansea LAP Community	Wave overtopping study	Surfing amenity Study	Lake Activation Strategy	State of Estuary
acceptability of actions	acceptability of actions		feedback during exhibition	membership of Project Steering Committee, public workshops, community surveys and exhibition. In combination, these provided strong data about acceptability		on Council website for further public feedback	noting that the project was triggered by community concerns about loss of surfing amenity and actions are intended to restore valued surf breaks	acceptability of actions LAS adopted by full Council	
Identify priorities – program of actions									
Higher priority given to actions which have strong positive scores for feasibility, economic viability and acceptability	Part A used MCA process to identify higher scoring options, noting that MCA criteria included qualitative costs and benefits, but there was no formal CBA	Part B used MCA process to identify higher scoring options, noting that MCA criteria included qualitative costs and benefits, but there was no formal CBA. Swansea LAP provides this information for high inundation risks across the low lying east Lake Macquarie urban areas	Part C used MCA process to identify higher scoring options, noting that MCA criteria included qualitative costs and benefits, but there was no formal CBA. Pelican CBA provides this information for the high risk, high capital cost response	MCA uses a weighted scoring system to identify a short lit of priority actions for detailed CBA and to incorporate in the LAP	Community based MCA to identify options which had more positive scores	Weighted MCA used to identify priority responses for key sites.	Not part of this project	Council has a detailed multi criteria prioritisation scheme sitting behind the LAS, which will help refine business plan and budget development.	Not part of this process

Other criteria suggested for identifying potential programs of actions include:

Key factors for Higher priority:

- Risk focus - reduces emerging, high and extreme and unacceptable risk.
- Aligns with one or more of six key local and state strategic priorities (6 key themes: Aboriginal involvement and cultural value, water quality and litter; climate change risks and resilience; coastal community well-being (recreation access); collaborative governance and partnerships; opens access to funding partnerships).
- Improves management – provides better evidence, research or innovation.
- Are ready to go – approvals are done or are easy; funding is available.
- Are on public land or protect public assets (public good).



APPENDIX 4

Economic Value Evaluation Tables

Appendix 4: Economic evaluation of channel actions

Table 1.2 Economic evaluation of channel actions

Priority issues from Stage 1	Responses to this issue Feasible (green shading)?	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency add the section of council here	Base case	Type of Action (One-off or ongoing)	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funding available?
The collaborative framework for management across multiple agencies needs to be clearer and stronger	**C1 Maintain the entrance breakwaters** in accordance with asset management framework; considering sea level rise and climate change	Existing (CZMP) with minor wording change	The entrance breakwaters keep the entrance to Lake Macquarie permanently open to the sea. This is essential for safe navigation into Lake Macquarie by recreational vessels. Lake Macquarie is an important recreational waterway. The breakwaters have had negative impacts on the stability of the entrance channel, driving bed and bank erosion in response to higher tidal velocities. Climate change and sea level rise will put pressure on the structural integrity of the breakwaters, on boating safety in the entrance area and on the safety of people walking along or fishing from the structures. Future management of the entrance breakwaters will respond to these risks. Due to the importance of maintaining these structures, a short timeframe until commencement is appropriate.	1	TfNSW	Y	Operations – planning and maintenance (Ongoing)	L	$0	To come from TfNSW. Indicatively $0.5million/year	$0	No, direct agency funding
	C2 Conduct further investigations of sites or structures in the channel, assessed as high risk, and clarify responsibilities of agencies.	New – adapted from the CZMP, but with a different intent	This action focuses on foreshores, training walls and structures such as wharves and boat ramps within the channel. These assets all contribute to the high recreational amenity of the channel, by providing safe recreational access. Risks include high current velocities, bed and bank scour/undercutting. the investigations will clarify hazards and risks associated with foreshore infrastructure along the channel, and resolve management responsibilities so integrated climate adaptation for recreational assets can be delivered. Due to the importance of these structures, a short timeframe until commencement is appropriate	1	Council, DPE, LLS, MIDO, RMS	N	**Planning** Staff time for management (One-off)	M	$0	$0 (maintenance addressed in C1)	Costs of site investigation will vary considerably depending on the nature of the site.	No

Priority issues from Stage 1	Responses to this issue Feasible (green shading)?	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency add the section of council here	Base case	Type of Action (One-off or ongoing)	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funding available?
	C3 Develop interagency infrastructure design criteria for current and future coastal hazards	New – from the CZMP, not commenced with minor change to wording and intent	As above, this action will support integrated and consistent management of recreational assets in Swansea Channel, including structural requirements and designs for training walls, foreshore promenades, ramps and jetties. A medium timeframe until commencement is appropriate as this action due to a medium level of risk.	2-5	Council, DPE, Crown Lands, MIDO, RMS, and other agencies	N	**Planning** Staff time for management (One-off)	M	$0	$0	Staff time only	No
	C4 Consider coastal hazards and risks in Asset Category Plans and when planning major public infrastructure	New – brought forward from the CZMP, but with changed wording and updated intent	Council has identified Swansea Channel as a focal area for future recreation and tourism, building on the current high popularity of the sandy bed, clear waters and easy access to the sea. All public infrastructure along the channel is affected by coastal hazards which will increase risks as sea level rises and climate change affects the hydrodynamics of the lake. Work has commenced on this item hence a short timeframe until commencement is appropriate.	1	Council, Hunter Water, Telstra, Ausgrid, NBN Co, Jemena, RMS	N	**Planning** Staff time for management (Ongoing)	M	$0	$0	Staff time only	No
	C5 Construct or retrofit coastal protection works by **public land holders**, in accordance with the CM SEPP; incorporate environmentally friendly designs for all seawalls or revetments	New	Much of Swansea Channel already has foreshore protection works, built at various times and with a range of construction standards. This action foreshadows maintenance and reconstruction of publicly owned coastal protection works along the channel, to reduce coastal hazard risks, but also to enhance the habitat value of protection works. Several sections of revetments in the channel are already in design hence short timeframe until commencement is appropriate.	1	Council, LLS, MIDO, NSW Fisheries	N	**Operations** (maintenance) Planning for approvals Staff time for management (Ongoing)	M	Will vary depending on site.	Maintenance Indicatively, allow $100,000/year (by public authorities)	Staff time only	Potentially, if there are works for Council. Other works directly funded by public authorities

Priority issues from Stage 1	Responses to this issue Feasible (green shading)?	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency add the section of council here	Base case	Type of Action (One-off or ongoing)	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funding available?
	C6 Investigate expanding the pilot tidal gates project to other sites (Swansea urban areas, Black Neds Bay, Blacksmiths behind northern revetment)	New (LAP)	Council has conducted a successful pilot study of tidal gates to reduce the impacts of tidal inundation in low lying parts of Swansea, including the Pacific Highways and parts of the business centre. The tide gates provide an initial protection system against elevated water levels. This action would extend the tidal gate installation. Work has commenced on this item hence a short timeframe until commencement is appropriate.	1	**Council**	N	**Planning** Staff time for management (Ongoing)	M	Capital $80,000 cost of current pilot	$10,000/yr	Staff time only	Yes
	C7 Support LAP actions implementation relating to future inundation and/or pilots on public land	New (LAP)	The LAP was adopted by Council in early 2022. This action enables Council to integrate implementation of LAP actions with the CMP. Work has commenced on this item hence a short timeframe until commencement is appropriate.	1	**Council, TfNSW, Crown Lands**	N	**Research** Planning Operations (Ongoing)	L	Integrate into future drainage upgrade projects. Costs will vary depending on project scope.	Unknown – dependant on site and design	Design costs dependant on site conditions and scope	Some projects will be eligible for grants
Erosion along the Pelican foreshore threatens public recreation space and safety	**F1** Secure funds to and implement recommendations of the Pelican foreshore design report Stabilise Pelican foreshore – Precinct A (using scheme B approach identified in the Pelican Foreshore Design Project); Incorporate environmentally friendly design principles.	New, from Pelican foreshore CBA and MCA	A feasibility assessment and cost benefit assessment have been prepared for the proposed works on the Pelican foreshore, which is a popular recreation area for swimming and boating and is a key part of the recreation and tourism value of the Channel. The CBA supported the construction of protection works (see also Actions F2 and F3). Implementation of necessary coastal protection works will require external funding. Work to secure funding is a priority, hence a short timeframe until commencement is appropriate. Given the likely timeframes involved in securing funding, timing for implementation is medium term.	1 for securing funding 2-5 for implementation	Council, Crown Lands, Lake Macquarie Airport	N	Planning for Capital works (One-off)	H	Detailed assessment completed including Probabilistic Hazard Assessment, Cost Benefit Analysis, and designs. Capital costs estimated as $4,670,000.	See F6	Approval costs included in capital cost.	Yes for implementation. Coast and Estuary Grants plus other potential grant programs. No for the application and negotiation process

Priority issues from Stage 1	Responses to this issue Feasible (green shading)?	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency add the section of council here	Base case	Type of Action (One-off or ongoing)	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funding available?
	F2 Stabilise Pelican foreshore – Precinct B (using Scheme B approach identified in Pelican Foreshore Design Project); incorporate environmentally friendly design principles	New (Pelican foreshore CBA and MCA)	The CBA for the Pelican foreshore recommended construction of Scheme B for Precinct B as an effective way to stabilise the bank and maintain recreational and tourism values, for this high-profile section of Swansea Channel. Work to secure funding is a priority, hence a short timeframe until commencement is appropriate. Given the likely timeframes involved in securing funding, timing for implementation is medium term	1 for securing funding 2-5 for implementation	Council, Crown Lands, Bahtabah Aboriginal land council TfNSW RMS Marine Rescue	N	Planning Staff Time Capital (One-off)	H	Detailed assessment completed including Probabilistic Hazard Assessment, Cost Benefit Analysis, and designs. Capital costs estimated as $2,100,000.	See F6	Approval costs included in capital cost.	Yes for implementation. Coast and Estuary Grants plus other potential grant programs. No for the application and negotiation process
	F3 Stabilise Pelican Foreshore Precinct C (using Scheme B approach identified in Pelican Foreshore Design Project); incorporate environmentally friendly principles	New (Pelican foreshore CBA and MCA)	The CBA for the Pelican foreshore recommended construction of Scheme B for Precinct C as an effective way to stabilise the bank and maintain recreational and tourism values, for this high-profile section of Swansea Channel. Work to secure funding is a priority, hence a short timeframe until commencement is appropriate. Given the likely timeframes involved in securing funding, timing for implementation is medium term.	1 for securing funding 2-5 for implementation	Council, Crown Lands,	N	Planning Staff Time Capital (One-off)	H	Detailed assessment completed including Probabilistic Hazard Assessment, Cost Benefit Analysis, and designs. Capital costs estimated as $3,750,000.	See F6	Approval costs included in capital cost.	Yes for implementation. Coast and Estuary Grants plus other potential grant programs. No for the application and negotiation process
	F4 Stabilise Pelican Foreshore Precinct D (using Scheme B approach identified in Pelican Foreshore Design Project); incorporate environmentally friendly principles	New (Pelican foreshore CBA and MCA)	The CBA for the Pelican foreshore recommended construction of Scheme B for Precinct D as an effective way to stabilise the bank and maintain recreational and tourism values, for this high-profile section of Swansea Channel. Work to secure funding is a priority, hence a short timeframe until commencement is appropriate. Given the likely timeframes involved in securing funding, timing for implementation is medium term	1 for securing funding 2-5 for implementation	Council, Crown Lands,	N	Planning Staff Time Capital (One-off)	H	Detailed assessment completed including Probabilistic Hazard Assessment, Cost Benefit Analysis, and designs. Capital costs estimated as $950,000.	See F6	Approval costs included in capital cost.	Yes for implementation. Coast and Estuary Grants plus other potential grant programs. No for the application and negotiation process
	F5 Monitor the Pelican foreshore – foreshore position, bathymetry and stability, and report publicly	New (Pelican foreshore CBA and MCA)	Monitoring of the performance of management actions is a key part of the CMP and will also highlight where channel changes are likely to impact on the stability of foreshore protection works. A short timeframe till commencement is appropriate.	1	Crown Lands, TfNSW Council	N	Monitoring (Ongoing)	M	$0	$0	Include in routine TfNSW channel bathymetry monitoring and supplement with DPE surveys for non-navigable areas.	No

Priority issues from Stage 1	Responses to this issue Feasible (green shading)?	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency add the section of council here	Base case	Type of Action (One-off or ongoing)	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funding available?
	F6 Maintain the Pelican Foreshore stabilisation works	New	This is the final step of management for the Pelican foreshore, to provide for enduring stable protection. the proposed works are designed to be resilient to climate change ad sea level rise in the mid-term, but there are several uncertainties that will likely require future adaptation of the design and maintenance regime for the protection works. Given the likely timeframes involved in securing funding for works, timing for implementation is medium term	2-5	Council, Crown Lands, Bahtabah Aboriginal land council TfNSW RMS Marine Rescue, Lake Macquarie Airport	N	Maintenance (Ongoing)	M	$0	Assume $50,000	Staff time only	No Likely to be directly funded by responsible agencies
Private property and public assets and infrastructure are threatened by tidal inundation	**P2** Implement priority actions of the Eastlakes LAPs; explore resilience planning	New (from LAPs)	The Marks Point and Swansea, Blacksmiths and Pelican Local Adaptation Plans have all been adopted by Council. They were developed collaboratively by council and the relevant communities. While several of the agreed actions do not need to happen yet, there are short term priorities which will provide more information, or help prepare for future actions. These are the focus of this CMP action. A short timeframe till commencement is appropriate.	1	Council, Hunter Water, TfNSW	N	Planning Operations (Ongoing)	M	Costs vary dependant on actions – refer to LAP and associated CBA	Costs vary dependant on actions – refer to LAP and associated CBA	Costs vary dependant on actions – refer to LAP and associated CBA	Yes, for some actions

Priority issues from Stage 1	Responses to this issue Feasible (green shading)?	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency add the section of council here	Base case	Type of Action (One-off or ongoing)	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funding available?
Navigability of Swansea channel needs to be balanced with environmental and resilience impacts	**N1** Implement dredging and sand placement in accordance with the Sustainable Framework for Navigation in Swansea Channel (SFNSC). Small episodes of navigation dredging may be required at other locations such as the entrances to Swan Bay/Village Bay and Black Neds Bay and sand may be used to provide build dune resilience. See also N4	Existing (CZMP and Sustainable Framework for Navigation)	The SFNSC proposes beneficial reuse of sand dredged to improve safe navigation, with most of the sand to be used to help raise the height and volume of low dune crests at Blacksmiths. Cost effective beneficial reuse is supported by short transport distances and the SFNSC considered a pipeline from the channel to Blacksmiths. The dredging strategy (completed in 2011) included cost benefit analysis which did not provide unequivocal support for dredging the channel to make permanent access for deep keeled yachts. The patterns of boating and size if vessels using Lake Macquarie have changed over the last decade, but the CBA has not yet been updated. Work has commenced on this item hence a short timeframe till commencement is appropriate	1	Crown Lands, TfNSW (Ongoing)	Y	Operations (Ongoing)	M	$0	Maintenance Indicatively $500,000 per year	Staff time	Direct funding from TfNSW as per NSW Coastal Dredging Strategy
	N2 Conduct regular hydrosurvey of Swansea Channel in accordance with SFNSC (relationship to F5)	Existing (CZMP and SFNSC)	Regular hydrosurvey to monitor the movement of sand shoals and impacts on navigability is a key component of the SFNSC and is linked to triggers for commencing new dredging campaigns. It also helps boat owners to understand the risks of navigation in Swansea Channel. Work has ongoing on this item hence a short timeframe till commencement is appropriate	1	Crown lands, MIDO (TfNSW)	Y	Monitoring (Ongoing)	L	$0	$0	Maintenance Indicatively, allow $50,000 per year (quarterly hydrosurveys)	Direct funding from TfNSW

Priority issues from Stage 1	Responses to this issue Feasible (green shading)?	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency add the section of council here	Base case	Type of Action (One-off or ongoing)	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funding available?
	N3 Update the SFNSC to include channel evolution and impact of dredging on the natural environment. This may influence the appropriate frequency of dredging, improved monitoring, including tidal processes and impacts on the lake.	New	As noted above, the SFNSC was completed a decade ago, using data that are now up to 15 years old. Boating usage on Lake Macquarie is changing; the impact of climate change and sea level rise on the channel and lake shorelines is becoming more apparent, as is the impact of a deep dredged channel on water levels and tide range. The data inputs need to be updated and the strategy reviewed. Given the likely timeframes involved in securing necessary agreements and funding, timing for implementation is medium term	2-5	TfNSW	N	Planning TfNSW staff time, plus costs for specialist consultant (One-off)	M	$0	$0	Assume $100,000 to review and update the SFNSC	Direct funding from TfNSW
	N4 Utilise dredged sand for nourishment at priority locations and in accordance with dune management plans and foreshore areas along the channel. Consider transport costs (including at planning stage).	New – based on CZMP with change of intent	The SFNSC proposed that sand dredged from Swansea Channel would be used to increase the height and erosion buffer capacity of coastal dunes. Sand placement would be in accordance with dune management plans. Stable dunes have biodiversity value and protect land behind them from short term coastal erosion events. Work has ongoing on this item hence a short timeframe till commencement is appropriate	1	Crown Lands, MIDO/TfNSW	N	Planning Operations Staff time for alignment of dune management plans and dredged sand emplacement (Ongoing)	M	$0	$0	Links with N1 for dredging and transport costs. Assume $50,000 per episode for sand shaping.	Direct funding from TfNSW
	N5 Investigate the feasibility of a west channel diversion to reconfigure and train the navigation channel via the Airforce Channel, to address scour, navigation and maintenance issues	New	The SFNSC considered but did not recommend realigning the channel into the Airforce Channel. Shoaling of navigable channels in Swansea Channel is highly dynamic. The Airforce channel alignment would create a primary channel which turns west into Lake Macquarie, rather than north past the entrance to Swan Bay. Both routes are within the tidal delta. High cost of infrastructure to train channel (and potential estuary process, inundation and ecological issues) makes 'training' unlikely to proceed, hence a long timeframe for commencement is appropriate. (note: 'non-training' option may be more viable).	5-10	Council, Crown Lands, NSW Fisheries, MIDO/TfNSW	N	Planning Operations Staff time for project management. This will feed into the review of the SFNSC (One-off)	H	$0 for investigation	$0	Capital works to realign the channel into the Airforce Channel will require major coastal engineering studies and modelling Assume $250,000 over this four-year period	No

Priority issues from Stage 1	Responses to this issue Feasible (green shading)?	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency add the section of council here	Base case	Type of Action (One-off or ongoing)	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funding available?
Swansea channel is a major recreation and tourism asset for Lake Macquarie; some assets are not aligned with the potential	**LA1** Support actions to enhance recreation activation along Swansea Channel, as identified in the Lake Activation Strategy	New (from Lake Activation Strategy) This links the LAS to the CMP	Council adopted the Lake Activation Strategy in September 2021. It identifies Swansea Channel and surrounds as a high value activation precinct, which already attracts large numbers of locals and visitors and has potential to grow its 'adventure tourism' credentials. Work has commenced on parts of this item hence a short timeframe till commencement is appropriate	1	Council	N	Planning (Ongoing)	M	Dependant on project. Eg., Swansea western foreshore boardwalk, car park, wayfinding and landscaping project cost is $1.89 million.	Dependant on project	See LAS proposed indicative budgets	Yes. Various programs such as Public Spaces legacy program
Estuary wetlands are vulnerable to sea level rise and climate change	**W1** Research best practice approach for enabling landward movement of saltmarsh in the estuary	New (un-commenced and brought forward from CZMP and LAP)	The supporting documents for the CZMP and LAP identified the need to better understand the options for saltmarsh adaptation, in the context of a tidal lagoon such as Lake Macquarie. W1 and W2 are partner actions, one looking at how best to enable landward/upward migration of intertidal saltmarsh communities and the other looking at establishing saltmarsh in areas that become intertidal as sea level starts to rise. Given the likely timeframes involved in securing funding for research, timing for implementation is medium term.	2-5	Council, with NSW Fisheries, Universities	N	Research (One-off)	L	$0	$0	Check LAP	Possible MEMS project. Env Trust Research Program. LM Enviro Research Grants could assist for smaller research projects.
	W2 Undertake pilot projects for re-establishing estuarine wetland communities such as saltmarsh and seagrass, which will be affected by higher lake levels	New (LAP)	As above. both of these actions focus on the intertidal wetlands along the channel. similar actions are needed for intertidal wetlands elsewhere around Lake Macquarie, where the tidal range is lower. Given the likely timeframes involved in securing funding, timing for implementation is medium term.	2-5	Council	N	Research/Pilot Council staff time for project management (One-off)	M	$0	$0	$30,000 per project	Yes Coast and Estuary Grants. Possible MEMS project.
	W3 Monitor wetlands to evaluate the performance of protection activities and/or pilot projects for re-establishing estuarine wetland communities	New (LAP)	This action follows on from W1 and W2. It will provide monitoring data to evaluate the performance of saltmarsh adaptation strategies.	2-5	Council	N	Research/ monitoring Council staff time for project management (One-off)	L	$0	$Check LAP	$10,000 per monitoring project	Yes Coast and Estuary Grants. Possible MEMS project.

Priority issues from Stage 1	Responses to this issue Feasible (green shading)?	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency add the section of council here	Base case	Type of Action (One-off or ongoing)	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funding available?
	W4 Conduct wetland rehabilitation works	Existing (brought forward from the CZMP), some projects previously implemented	This is a general wetland management action, which includes both intertidal wetlands and freshwater wetlands. It includes wetland rehabilitation for sites that receive high nutrient loads or other contamination, or are severely impacted by invasive plant or animal species. Wetlands generally provide important ecosystem services such as buffering foreshore erosion processes, enhancing habitat diversity and biodiversity, treating urban stormwater and broader catchment runoff (e.g. floodplain wetlands) and providing recreational and visual amenity for urban residents. Work has commenced on parts of this item hence a short timeframe till commencement is appropriate	1	Council, Landcare Bahtabah LALC, Biraban LALC	Y	Operational (Ongoing)	M	$0	$0	$30,000/yr wetland rehab program (noting that this is citywide not specific to the channel)	Yes
	W5 Work with existing or establish a formal Landcare program to undertake rehabilitation in priority locations around the channel	Existing (CZMP) referring to Salts Bay. Note the CZMP actions were referring to dune management, not wetlands See also EK2 below	Landcare is one of council's most important environmental management assets. It provides effort from large numbers of committed volunteers, working on targeted sites across coastal dunes and wetlands, the lake foreshore, tributary creeks and catchment. Work has commenced on parts of this item hence a short timeframe till commencement is appropriate	1	Council, Landcare	Y	Operational (Ongoing)	M	$0	$0	Included in $1,300,000 annual Landcare allocation for the whole of LMCC	Yes
	W6 Protect roosting, feeding and nesting habitat for migratory shorebirds. Strategies include sand placement and fencing	Existing (CZMP), but with changed approach and locations.	The sand islands in Swansea Channel are habitat for several migratory shorebird species. This action provides controls on recreational access to minimise disturbance of shorebird nesting and roosting sites at critical times of the year. Work has commenced on parts of this item hence a short timeframe till commencement is appropriate	1	Council, Crown Lands, MIDO, NPWS	Y	Operational (Ongoing)	L	$0	$0	$10,000/yr	Yes

Priority issues from Stage 1	Responses to this issue Feasible (green shading)?	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency add the section of council here	Base case	Type of Action (One-off or ongoing)	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funding available?
Strengthen evidence of tidal inundation patterns and levels	**T1** Monitor frequency, depth and spatial extent of storm inundation, tidal inundation and lake flooding events. Monitor and analyse data from tidal gauges to assess local trends in sea and lake levels.	New (from LAP)	This action was included in the LAP to enhance data on trends in tidal inundation. Existing (CZMP and LAP) noted the evidence of tidal anomalies and community concern that tidal variations were increasing above the longer-term record. This action will provide new analysis of tide data and its impacts in vulnerable areas. This is key input to understand when tidal inundation thresholds are being approached. Work has commenced on parts of this item hence a short timeframe till commencement is appropriate	1	Council, DPE	N	Research/ monitoring (Ongoing)	L	$0	Operation and maintenance of tidal gauges funded by DPE	Operation and maintenance of tidal gauges funded by DPE	N
Clarity about land tenure is needed to enable management	**L2** Formalise ownership arrangements and responsibilities for public assets in Swansea Channel.	Existing (CZMP) with wording change	Assets and infrastructure along Swansea Channel have been constructed over many decades. It is not clear which public authorities are responsible for key pieces of infrastructure, which constrains maintenance. Clear and formal ownership arrangements are needed so that responsibilities and costs can be allocated appropriately Work has commenced on parts of this item hence a short timeframe till commencement is appropriate	1	Council, Crown Lands, TfNSW	N	Planning (One-off)	M	$0	$0	Staff time	N
Engage community stakeholders	**EK1** Consult with Awabakal Traditional Owners and relevant Local Aboriginal Land Council when undertaking works or engagement activities	Existing (CZMP)	This is part of the process of involving Aboriginal community in the management of the coast. It applies to statutory requirements for engagement about works that could disturb objects and asking Aboriginal people about their perspectives on proposed policies or programs. It is a necessary part of reconciliation. Work has commenced on parts of this item hence a short timeframe till commencement is appropriate	1	Council	Y	Staff time (Ongoing)	L	$0 - included as part of project consultation	$0	$0 - included as part of engagement activity planning	N

Priority issues from Stage 1	Responses to this issue Feasible (green shading)?	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency add the section of council here	Base case	Type of Action (One-off or ongoing)	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funding available?
	EK2 Support community stewardship of natural areas through ongoing support for Landcare	Existing (CZMP), but with changed wording and updated intent.	This is a general action to provide resources for Landcare. Landcare volunteers are a significant environmental management asset for Council. A qualitative review of the value of Landcare (Henry, Koech ad Prior 2016) highlighted multiple benefits of Landcare for the environment and natural systems, for local communities, for intergenerational learning about the environment, for engaging Aboriginal people, building capacity, addressing climate change and encouraging leadership. https://landcarensw.org.au/wp-content/uploads/2019/06/161216-The-Value-of-Landcare.pdf Work has commenced on parts of this item hence a short timeframe till commencement is appropriate	1	Council	Y	Capital, Operations, Staff time (Ongoing)	H	$0	$0	$1,300,000 (annual Landcare citywide allocation)	Y

Appendix 4: Economic evaluation of coastline management options

Table 1.1 Key issue structure

Priority issues from Stage 1	Responses to this issue Feasible (green shading)	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency	Base case	Type of action (One-off or ongoing)	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funds available
Increase understanding of coastal risks	**C1** Conduct further analysis of the interactions of lake sourced inundation, coastal recession and marine inundation from overtopping, to clarify likely constraints to land use and potential for retreat.	New (included in CZMP, and not commenced, revised here)	This action is particularly relevant to Blacksmiths and Swansea, where tidal inundation from Lake Macquarie may interact with coastal inundation (wave overtopping) in severe weather events/coastal storms, which may also cause storm bite erosion or long-term recession in the frontal dune system. This action will provide analysis of the interactions of different coastal hazards at Blacksmiths, so that risk and vulnerability are better understood. Extensive analysis already undertaken as part of Swansea Surrounds LAP, hence a longer timeframe till commencement appropriate.	5-10	Council, DPE	N	Planning/investigations Staff time, likely with specialist consultants (One-off)	L	$0	$0	$10,000	Coast and Estuary Program for consultants to conduct specialists studies
	C2 Encourage further research on the behaviour of dunes in pocket and long barrier coastal sediment compartments, as climate changes and sea level rises.	New (revised from CZMP)	Lake Macquarie has both long barrier beaches and small pocket beaches, each with distinctive sediment budgets – so different vulnerability to sea level rise and storm waves/water levels. This action would help to define when coastal hazards are likely to threaten assets in different beach contexts. Relatively little residential development is currently within the area affected by open coast hazards. Extensive analysis already undertaken as part of coastal process assessment in CZMP, hence a longer timeframe till commencement appropriate	5-10	Research institutions, DPE	N	Staff time Council's research grants (Ongoing)	L	$0	$0	$10,000 Potentially funded through Environmental Research Grants Program	Council research grants University funding?

Priority issues from Stage 1	Responses to this issue Feasible (green shading)	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency	Base case	Type of action (One-off or ongoing)	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funds available
	C3 Expand beach camera network and connect with the need to monitor coastal change (revetments, erosion, trigger points) (Redhead, Blacksmiths, Caves, Catherine Hill Bay beaches)	Continuing/ New (from CZMP)	A beach camera network has functioned for some time. Its effectiveness is well established, and the technology is readily adaptable to multiple purposes, including monitoring dune erosion and coastal change. The action contributes to new knowledge and builds on current understanding. Good network of cameras already in-place, which presents opportunities to expand the functionality in monitoring coastal landform change. A medium timeframe till commencement is appropriate.	2-5	Council	Y	Operations Staff time (One-off)	L	$10,000	$1,000/yr	$0	Coast and Estuary Program
	C4 Continue to adopt use of technology to support management of the coastline	Continuing (from CZMP)	Council knows that the tools available to monitor coastal environments and modify coastal hazards are continually evolving. This action reminds managers to continue to look for new ways of gathering data, to better inform coastal management. It is an ongoing action of testing and review. A medium timeframe till commencement is appropriate.	2-5	Council	Y	Operations Staff time (Ongoing)	L	$10,000	unknown	$0	Maybe
Adaptive approach to managing coastal hazards needs to be strengthened	**A1** Consider coastal hazards in future asset planning and determine trigger points for commencing detailed planning for protecting or relocating surf clubs	Existing (CZMP)	This action focuses on public assets on the coastline – primarily surf clubs and associated infrastructure. Redhead surf club is in the immediate coastal hazard zone and is affected by wave overtopping during storms. Other surf clubs (Catherine Hill Bay, Caves Beach and Blacksmiths) and associated car parks and hard stand/walking path areas, will be impacted by coastal hazards in the longer term. This action is preparation for choices between significant coastal protection works or relocating assets. It involves community discussion of risk tolerance, how the frontal dune is managed, and how safe beach access, use and amenity will be maintained. See Wave overtopping Study (Salients 2020) A medium timeframe till commencement is appropriate.	2-5	Council	Y	Planning Staff time (One-off)	M	$0	$0	$0	No

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	A4 Implement a resilience planning approach to managing coastal risk, aligned with the NSW government approach	New (from council response April 2022)	The Coastal Manual encourages local councils to manage their coastal landscape to maintain or enhance the resilience of the coastal environment, communities, assets and infrastructure, to coastal hazards and the changes coming with climate change. Resilient communities have the structures and communication to prepare for, respond to and recover from impacts from coastal hazards, minimising the likelihood of disasters. Resilient communities have access to good information and they have strong networking, partnership and collaboration skills. They understand the value of healthy natural systems contribute to reduced coastal risks. This action will build understanding of what makes Lake Macquarie communities resilient to coastal hazards and also what are the weaknesses in resilience. A short timeframe until commencement is appropriate.	1	Council	N	Planning Staff time (Ongoing)	H	$0	$0	$60,000/yr	Yes
	A5 Hunter Water Corporation to consult with LMCC and DPIE through detailed design, planning and assessment of the desalination plant proposed for Nine Mile Beach - Ensure that long term coastal hazards (erosion and wave overtopping) are addressed	New	The proposed (and approved) desalination plant to be located at Belmont on Blacksmiths Beach when necessary and detailed design is underway for this facility. The Desalination plant is in the coastal hazard zone to minimise pumping distances for seawater inputs. Understanding of coastal processes and hazards continues to evolve. This action will lead to review and update of proposed management around the desalination plant to minimise coastal risks. It will also strengthen the partnership between council and Hunter Water Corporation. A short timeframe till commencement is appropriate.	1	Hunter Water Council	N	Planning Staff time (One-off)	H	$0	$0	$20,000	No

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Coastal dune stability is threatened by coastal erosion, disturbance, and unplanned access	**D1** Encourage community stewardship of natural areas through ongoing support of Landcare and increased awareness raising activities (Mini-videos. Use local surfers, sports people. Put on Instagram, Facebook. Use drone shots. QR codes on posters)	Existing (CZMP)	Support for Landcare is included in several other actions. This action also addresses community interest in environmental projects, which may not be accompanied by knowledge of values, or of processes and hazards. The action will contribute to awareness raising by making coastal information available in easily accessible and understandable information about natural areas. A medium timeframe until commencement is appropriate.	2-5	Council, Landcare, Land Councils	Y	Planning Operations Staff time (Ongoing)	M	$0	$0	Indicatively $1.3 million/year	Commonwealth funding for National Landcare?
	D2 Continue with community activity programs focusing on coastline protection and key environmental issues e.g., summer activities.	Existing and continuing	This action is a subset of action D1, specifying community activity programs on the open coastline, during summer. Coastal dunes are an important natural buffer for the coast. Community activity programs enable agency staff to talk to asset owners and share information This program is already underway hence a short timeframe until commencement is appropriate.	1	Council	Y	Planning/Comms Staff time (Ongoing)	M	$0	$0	$10,000/yr	No
	D3(A) Maintain priority access to beaches, install fencing and matting on beach access ways to protect dune vegetation and habitats. Include signage and other education material regarding domestic animals / 4WD access	Existing (CZMP) and new (signage)	As noted above, dunes are an important part of the beach system, providing habitat and a natural buffer against coastal erosion and wave overtopping. They are also the primary pathway onto the beach for recreational users. This action includes a range of measures to protect the natural values of dunes while enabling safe and inclusive public access to the beach. A short timeframe until commencement is appropriate.	1	Council	N	Operations Staff time (outdoor staff) (Ongoing)	H	S3, which includes a total of $100,000 for new viewing platform and accessible pathways at Blacksmiths Beach board and Chain accessway $50,000 $300,000 at Blacksmiths over four years	Assume $50,000/yr	$0	Yes

Priority issues from Stage 1	Responses to this issue Feasible (green shading)	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency	Base case	Type of action (One-off or ongoing)	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funds available
	D4 Fence and formalise access to the beach at Belmont WWTW and Pony Club	New	This is a specific site where access management is needed to protect the natural values of the dune system (noting the low dune crest height at this site). A medium timeframe until commencement is appropriate.	2-5	Council	N	Operations Outdoor staff (One-off)	M	$250,000	Assume $1,000/yr	$0	Yes
	D5 Develop and implement dune management plans for priority areas (Blacksmiths, Redhead, Nine Mile, Caves Beach and Catherine Hill Bay) – Link to action D11	New (included in the CZMP, but not commenced)	Dune management plans set out the values and objectives of dune management for each beach or section of coast. They will set out where actions are needed to restore vegetation, protect specific habitat (such as migratory waders or dune wetlands), where access ways should be located and how access will be managed. The plans will provide a consistent framework for all coastal dunes in the city. A short timeframe until commencement is appropriate.	1	Council	N	Planning Staff time (One-off)	H	$50,000/yr for implementation	$0 see D3 for maintenance	$20,000 per plan for development.	Yes
	D6 BWSP – review and improve permit issuing practices to manage numbers during peak periods and regulate waste dumping	Existing (CZMP)	Four-wheel drive vehicles are permitted in Belmont Wetlands State Park and it is extremely popular. High numbers of vehicles impact on safe access and on waste management on the beach. There is an expectation that people will take all waste with them, but this is not always adhered to. This action will help to protect the values of BWSP, prevent littering and reduce unnecessary tasks for rangers in the park. A short timeframe until commencement is appropriate.	1	Council, BWSP, DPE, Crown Lands	Y	Operations Compliance Staff time (One-off)	M	$0	$0	Staff time only	Yes

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	D7 Assess vehicle use of other areas of Nine Mile Beach and which organisations have regulatory responsibilities	Existing (CZMP) with changed intent	Vehicles access Nine-mile Beach at Awabakal Avenue, Docker Street, Ocean Park Road and on the State Park access track (Kalaroo Rd). Crown lands and management of BWSP have been working to fence the incipient foredune and frontal dune systems to reduce the impact of vehicles on dune vegetation and to try to stabilise mobile dunes. Responsibilities outside the State Park are less clear. This action is initially directed at clarifying the organisations that need to partners to manage the dune system in an integrated way. A medium timeframe until commencement is appropriate.	2-5	BWSP, Council, DPE, Crown Lands	Y	Planning Staff time (One-off)	M	$0	$0	Staff time only	No
	D8 Conduct beach management works to revegetate, reshape and increase dune volume /recovery after storms, and to control weeds Raise and reinforce low points in the dunes (using on-site sand, or sand sources from dredging works)	Existing and ongoing (from the CZMP), (but with further investment from the Wave Overtopping Assessment)	This action incorporates the on-ground works that would be implemented in accordance with dune management plans. Benefits of these actions include protection of the sand volume of dunes and their erosion buffering function, safe beach access and protection of habitat such as for migratory shorebirds and other threatened species. This is a simple solution requiring a relatively small amount of sand and can be localised where needed. It is flexible and adaptable over time and several innovative products are already available on the market. A short timeframe until commencement is appropriate, depending on availability of dredge sand.	1	Council, BWSP, Crown Lands, NPWS, Belmont Golf Course	Y	Maintenance and ongoing operations (Ongoing)	M	Assume $50,000 per project (which will occur when sand is available) links to action D45 and dredging action in Channel.	$0	$0	Yes

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	D9 Investigate the feasibility of a sand slug configuration placement for future dredging campaigns. If feasible, undertake monitored trial(s) of configuration placement of sand slugs as sand becomes available, including: Bathymetric surveys, smart cameras, trial of drone based bathymetric monitoring, interviews with stakeholders; ongoing analysis of beach change. Should also include community awareness program on the terminology and what would actually happen	New (from Surfing amenity Assessment)	This action is an option from the surfing amenity assessment at Blacksmiths Beach. Sand dredged from Swansea Channel may already be transported to Blacksmiths Beach to augment dune crest heights and dune volume. This action presents an alternative, which involves placing the sand in the surf zone. This will rebuild offshore bars, rather than dunes in the first instance, but sand is likely to eventually move onto the frontal dune system. If the action is implemented, it will be accompanied by a range of monitoring activities to understand how the sand placement affects the beach profile and also whether it achieves the improved surfing conditions. This action is the first step, to investigate whether this type of sand placement is feasible as part of the sand management strategy for sand dredged from Swansea Channel. A medium timeframe till commencement is appropriate.	2-5	Council, DPE	N	Planning Staff time (likely with consultants) (One-off)	L	$0	$0	$50,000 for investigation	Yes
	D10 Consider the development of a concept design and detailed design for a sand transfer scheme and consider surfing amenity in any breakwater alterations at Blacksmiths or Swansea Heads. (Note that partial or complete removal of the breakwater would not be acceptable to the broader community) (follows from D9)	New (proposed in the Surfing Amenity Assessment)	This action refers to sand transfer from the southern side of the breakwalls at the lake entrance, to the Blacksmiths side. It is an alternative to placing sand dredged in the channel onto Blacksmiths Beach. The aim is to restore sand to the beach sediment budget at Blacksmiths by reducing the volume that accumulates on the Swansea Heads side. The action does not involve construction of a sand transfer scheme at this stage – only the investigation of potential designs to suit the entrance of Lake Macquarie. A longer timeframe till commencement is appropriate given the complexity of this issues, constrained resources and current ability to place sand in this location using alternate means (temporary pipeline or trucking).	5-10	Council, DPE	N	Planning Staff time (One-off)	L	$0	$0	$150,000 for assessment if detailed design is included	Yes

Priority issues from Stage 1	Responses to this issue Feasible (green shading)	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency	Base case	Type of action (One-off or ongoing)	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funds available
	D12 Investigate transfer of private land along the coast from MHW in the immediate coastal hazard zone to public tenure.	New (brought forward from CZMP)	For Lake Macquarie, this only relates to two locations – Belmont Golf Course parcels of land at Catherine Hill Bay. The aim is to have all land in the immediate coastal hazard zone in public tenure, reducing risks and any potential conflicts about land use. A medium timeframe till commencement is appropriate.	2-5	Council, DPE	N	Planning Staff time (One-off)	L	$0	$0	Staff time only	No
	D13 Prepare creek management and water quality improvement plans for small coastal creeks and lagoons, used for recreational swimming/splashing. Initiate recreational water quality monitoring. - Provide community information about poor water quality E.g. algae in First and Second Creek – receives stormwater and potentially septic tank effluent?	New	As noted above, the beach within BWSP is extremely popular for four-wheel drive vehicles and for beach camping. People paddle in the entrance to the small creeks that ross the beach. These creeks receive urban stormwater and water quality may not be suitable for primary contact recreation. This action will firstly investigate the issue and then develop responses to reduce risks for recreational users. Improved confidence in the safety of swimming/paddling areas will add value to recreation and tourism at BWSP (also an issue at Redhead and Catherine Hill Bay). A medium timeframe till commencement is appropriate as this action follows on from D14.	2-5	Council BWSP EPA (Beach Watch)	N	Planning Operations Staff time May be supported by specialist consultants (One-off)	M	$0	$0	$20,000 per plan	Yes

Priority issues from Stage 1	Responses to this issue Feasible (green shading)	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency	Base case	Type of action (One-off or ongoing)	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funds available
	D14 Coordinate and implement monitoring and management efforts relating to water quality monitoring and improvements at beaches and waterways and link with state programs. This includes recreational and ecological water quality	New	Swimming and paddling are widespread uses of Lake Macquarie, large tributaries of the lake and small creeks that discharge across beaches. All Lake Macquarie waterways are potentially impacted by stormwater and sewer pump station overflows during wet weather. A coordinated program, connected to state-wide programs such as Beachwatch and DPE environmental water quality monitoring (such as Estuary Health report cards) will provide a cost-effective approach to keeping the community informed about health risks from swimming in urban waterways and evaluating the success of management actions to reduce risks. A short timeframe until commencement is appropriate.	1	Council, Hunter Water, NPWS, Crown Lands	N	Planning Operations Staff time (Ongoing)	M	$0	$0	$30,000/yr analysis costs	Yes
Habitat for migratory shorebirds is threatened by coastal processes and recreational use	**M1** Research the impacts of sea level rise on migratory shorebirds	New	Several species of migratory shorebirds visit Lake Macquarie, using beaches, sand islands and rock platforms for feeding, nesting or roosting. All of these habitats are vulnerable to sea level rise, being either submerged by persistent higher water levels, or undergoing landward migration. Landward migration may be limited by other land uses, landforms and structures. This project would investigate the extent of vulnerability of migratory shorebird habitat in Lake Macquarie – and would be part of a larger assessment of the vulnerability of shorebird habitat in NSW. It would inform development of habitat replacement or restoration initiatives. A medium timeframe till commencement is appropriate.	2-5	DPE, NPWS Universities	N	Staff time (project management) (One-off)	L	$0	$0	$5-10,000 Potentially funded through Environmental Research Grants Program	Maybe

Priority issues from Stage 1	Responses to this issue Feasible (green shading)	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency	Base case	Type of action (One-off or ongoing)	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funds available
	M2 Raise awareness of the importance of migratory shorebirds. Signage (about species and impacts of recreation) in key locations; identify other awareness raising option	New	Although Lake Macquarie is visited by multiple species of migratory shorebirds, protected under international conservation agreements such as JAMBA, ROKAMBA and CAMBA, many residents of Lake Macquarie are not aware of the significance of birds on their shorelines, or that their local area is part of the international network of habitats for migratory species. Disturbance of habitat can be avoided if residents are aware of the significance of the species, and of simple things they can do to protect them A medium timeframe until commencement is appropriate.	2-5	Council	N	Operations Staff time (Ongoing)	L	$5,000	$0	$5,000 for design etc	May be funded via NPWS?
	M3(A) Protect little tern and pied oystercatcher nesting and feeding areas on beaches (Nine Mile Beach) and dunes, using fencing and vehicle access controls	Existing (CZMP) and continuing	This action focuses on threats to the coastline habitats for two distinctive species of migratory shorebird – little tern and pied oystercatcher. It focuses on access controls for pedestrians and vehicles during the summer breeding season. Protecting these species contributes to local biodiversity, but also national and international biodiversity. A short timeframe till commencement is appropriate.	1	Council, with DPE, HBOC	Y	Operations Staff time (Ongoing)	M	$0	$5,000/yr	$0	LLS, potential partnerships with NPWS. Save our Species.
	M3(B) Control domestic animal access to sensitive areas. Domestic dogs are the highest priority	Existing and continuing (CZMP)	This action focuses on the threat to migratory shorebirds from domestic animals (principally dogs), uncontrolled on beaches. The benefit is more successful breeding of threatened species, so populations are maintained. A medium timeframe until commencement is appropriate.	1	Council, with NPWS, LLS, Crown Lands	Y	Operations Staff time (Ongoing)	M	$0	$0	Staff time only (Rangers)	Direct funds also from NPWS and Crown Lands (BWSP)

Priority issues from Stage 1	Responses to this issue Feasible (green shading)	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency	Base case	Type of action (One-off or ongoing)	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funds available
Recreational and conservation values of headlands and rock platforms need to be managed	**H1** Headland management: review PoMs considering opportunities for improved management (vegetation, cultural, tourism) at Swansea Heads and other prominent headlands	New	Coastal headlands in the Lake Macquarie LGA are visually prominent, culturally significant and have important ecological values including areas of littoral rainforest and endangered ecological communities/species. They are threatened by ongoing development and uncontrolled recreational access and use. This action will review current management programs and controls and identify new opportunities to strengthen protection for natural and cultural values while maintaining safe public access. See also actions for coastal walking tracks. A medium timeframe till commencement is appropriate.	2-5	Council with Crown Lands, NPWS Involve Bahtabah LALC	N	Planning Management Staff time (One-off)	M	$0	$0	$50,000 per POM.	Maybe
	H2 Identify and promote conservation status (Marine Protected area) for an intertidal area (Swansea Heads rock platform)	New	The Swansea Heads rock platform is a NSW geo-heritage site and also has important cultural heritage values. The intertidal ae supports diverse marine species. This action will investigate the most effective conservation tool to protect the rock platform from excessive harvesting of shellfish and damage to geo-heritage features. Consider also including the headland and rock platform in the Lake Macquarie State Conservation Area, or reviewing Crown reserve status to better protect conservation values. A medium timeframe till commencement is appropriate.	2-5	Council, with DPI Fisheries (if protected under the FM Act)	N	Planning management, staff time (One-off)	M	$0	$0	Staff time only	Yes
	H3 Review and implement awareness raising and enforcement activities for protecting rock platform biodiversity (e.g. hotline, signs, fishing shop information material)	Existing (CZMP)	This action is a partner for H1 and H2, and focuses on the community awareness aspect of protecting rock platform biodiversity. These are all easy to deliver actions. A medium timeframe till commencement is appropriate.	2-5	Council, with NPWS	Y	Planning/ compliance Staff time (Ongoing)	L	$0	$0	$5,000 for resource development	Maybe

Priority issues from Stage 1	Responses to this issue Feasible (green shading)	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commenc ement)	Council or agency	Base case	Type of action (One-off or ongoing)	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funds available
	H4 Continue with community activity programs focusing on coastline protection and key environmental issues e.g.: summer activities (note this applies more broadly to the whole of the coastal environment). Include swimming safety as well as environmental issues	Existing (CZMP), ongoing, changed intent	Council has conducted summer programs of community activities on the coast for several years. These raise awareness of processes and values of the coastline that may not be commonly known or understood, and show people how their behaviour affects these values. Lake Macquarie has several patrolled beaches but also several accessible unpatrolled beaches, with dangerous rips and waves. It includes rock platforms with a long history of people being washed off – risks to life. Community programs will address both ecological and safety aspects of coastal use. This program is already in-place hence a short timeframe until commencement is appropriate.	1	Council, with NPWS	Y	Planning/Comms Staff time (Ongoing)	M	$0	$0	$10,000/yr	No
	H5 Assess hazards and risks and conduct a community awareness program about rock platform safety	New	As above, the Lake Macquarie coast includes rock platforms, cliffs and caves used for walking, fishing and swimming (intertidal pools in the shore platform), where multiple people have been washed into the sea by high waves. Risk to life events occur every year. This action will provide more detailed information about how and where these risks arise and will support more effective community information about an unacceptable risk. A medium timeframe until commencement is appropriate.	2-5	Council, with NPWS DPE	N	Planning and Comms Staff time (One-off)	L	$0	$0	Staff time only	Coast and Estuary Program

Priority issues from Stage 1	Responses to this issue Feasible (green shading)	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency	Base case	Type of action (One-off or ongoing)	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funds available
	H6 Review and upgrade the coastal walking path from Caves Beach to Catherine Hill Bay and further south to Munmorah SCA.	New	The coastal walk from Caves Beach south through Pinny Beach, Catherine Hill Bay, Moonee Beach, Fraser Park and Birdie Beach in Central Coast Council offers spectacular views and a high diversity of coastal features, including cliffs, rock platforms, remote beaches and multiple slots and sea caves. Parts of the walk are popular with local people, but it is not widely known. The northern section was constructed as part of the residential development around Caves Beach and is currently in poor condition. Tracks in national park lands are also badly eroded, and continue to be accessed by off road vehicles. There are no safety controls on high cliffs. This route has the potential to be a high profile coastal walk, attracting visitors from all over Australia. This action includes a review of track alignment and condition, safety issues, tenure, cost sharing and other issues that are necessary to develop a plan for a safe and functional coastal walking track. A medium timeframe until commencement is appropriate.	2-5	Council, NPWS Council is responsible for the northern section and NPWS for the southern section	N	Planning (including staff time for project management) Capital Operations (One-off)	M	Not costed, but assume more than $2 million for track upgrades, fencing, carparking	$0 Assume Council has not spent money on the Caves to Pinny Beach section. Check with NPWS re maintenance costs for their section.	$Allow $500,000 over 4 years for studies and design. Could be done in segments, but an overall plan is needed	Needs grant funding for planning and implementation Regional Development programs
	H7 Investigate stormwater impacts on headlands and rock platforms (i.e. erosion issues, water quality and litter)	New	This action is linked to investigations of stormwater impacts on small coastal creeks. In this case, stormwater flows that discharge over cliffs have the potential to destabilise steep slopes and to impact on water quality at the landward side of shore platforms. Stormwater also carries litter from suburban streets. This action is a first step to managing the issue, by reviewing where stormwater impacts occur and the extent of risks, so that management responses can be properly targeted. A medium timeframe until commencement is appropriate.	2-5	Council with University	N	Investigations Staff time, may need monitoring budget (One-off)	M	$0	$0	Assume $10,000 for monitoring over 4 years	Coast and Estuary Grants

Priority issues from Stage 1	Responses to this issue Feasible (green shading)	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency	Base case	Type of action (One-off or ongoing)	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funds available
Manage (mitigate) risks to beach access and safety infrastructure	**S1** Refurbish revetment and add wave return wall at Redhead surf club	New (from Wave Overtopping Assessment)	Redhead surfclub is impacted by wave overtopping and coastal inundation in storm conditions. A rock wall currently provides some protection from erosion, but not from wave overtopping. This action proposes to modify the design of the coastal protection structure to mitigate wave overtopping. A short timeframe until commencement is appropriate.	2-5	Council	N	Capital (One-off)	M	$850,000 capital cost (not annual) (from Wave Overtopping Assessment Report)	$1000/yr	$20,000 for design	Yes – Coast and Estuary grants
	S2 Investigate options to reduce coastal hazards to Redhead Surf Club and associated facilities or Relocate surf club facility to a location outside the immediate costal hazard zone	New (from Wave Overtopping Assessment)	As above. As sea level rises, the rock protection in front of the surf club will not provide adequate protection for the structure or safety for people visiting the beach. This is a longer-term action to maintain surf club services at Redhead and avoid costs of regular repairs to the building. Relocating the surf club requires earlier planning actions such as identifying the site and ensuring it is not compromised by other development. Community and stakeholder engagement will be essential. A medium timeframe until commencement is appropriate.	2-5	Council	N	Capital Planning Staff time (One-off)	M	Note: estimated $5,800,000 capital cost for surf club relocation is required. (from Wave Overtopping Assessment Report)	$0	$30,000 (initial studies)	Yes
	S3 Maintain surf club facilities such as boat sheds and signage	Ongoing From Community buildings program and Beach and Aquatic facilities program	Current program includes: Replacement of boat sheds at Redhead and Blacksmiths Signage upgrades at Blacksmiths, Catherine Hill Bay. Redhead and Caves Beach Upgrades of beach access ways, pathways and/or viewing platforms at Blacksmiths. A short timeframe until commencement is appropriate.	1	Council	Y	Operations, some capital cost for replacement assets (Ongoing)	M	Proposed budget for 2022/23 $150,000 (Blacksmiths) $39,350 for signage upgrades 25/26 budget: $100,000 boat sheds $300,000 Blacksmiths paths and platform $39,350 for signage	Not quantified	Not quantified	For viewing platform and accessible pathways at Blacksmiths

Priority issues from Stage 1	Responses to this issue Feasible (green shading)	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commenc ement)	Council or agency	Base case	Type of action (One-off or ongoing)	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funds available
Cultural management actions	**L1** Translate educational material (about coastal processes and hazards, habitats and protected species) into languages that reflect visitor profiles (add QR code to materials). May need to focus or target materials for specific and high priority needs and/or locations e.g. re safety and fishing.	New	This action acknowledges that many visitors to the Lake Macquarie coast come from multicultural backgrounds and speak languages other than English as their first language. This action will provide inclusive access to information about the coastal environment and coastal safety. A longer timeframe until commencement is appropriate.	5-10	Council	N	Operations - Comms Staff time (One-off)	L	$0	$0	$5,000	No Community development
	L2 Consult with Aboriginal groups and land councils when planning works in, or developing plans for, the coastal zone	Existing and ongoing	This is a statutory requirement for development that will impact on Aboriginal objects protected under the NPW Act. Council's aim here is to extend consultation to opportunities to take a Country-led approach to coastal planning. A short timeframe until commencement is appropriate.	1	Council, with NPWS, Crown Lands NSW GA	Y	Planning Staff time (Ongoing)	M	$0	$0	Staff time only	No
	L3 Investigate pathways and feasibility for achieving co-management of coastal Country in LMCC.	New	Co management of public land has not been implemented in Lake Macquarie. This action is a first step to creating opportunities for co management of coastal land (including lake foreshore lands and the open coastline). The action will identify potential models for co management that could be implemented in this area, and identify practical steps that can be taken. A longer timeframe until commencement is appropriate.	5-10	Council, with Crown Lands NPWS Awabakal, Bahtabah and Biraban LALCs	N	Planning Staff time (Ongoing)	M	$0	$0	$20,000 for assessing pathways	No
	L4 Build awareness of cultural values and sensitivity for council construction staff (inductions for outdoor staff and site workers)	Existing and ongoing	This action was identified in Council's Aboriginal heritage strategy a decade ago, along with cultural heritage awareness training for Landcare volunteers. Building awareness across all Council staff is a key building block in reconciliation. A short timeframe until commencement is appropriate.	1	Council with Awabakal, Bahtabah and Biraban LALCs	Y	Operations, HR Staff (Ongoing)	M	$0	$0	$10,000/yr for staff training	Maybe

Priority issues from Stage 1	Responses to this issue Feasible (green shading)	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commenc ement)	Council or agency	Base case	Type of action (One-off or ongoing)	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funds available
	L5 Include cultural awareness programs, developed with the Aboriginal community, in community activities in the coastal zone	New	This is a subset of H4 and other community awareness/education activities for the coastline and the estuary. It is also a component of reconciliation and creates opportunities for the broader community of the city to learn more about Awabakal country. A short timeframe until commencement is appropriate.	1	Council, with Awabakal, Bahtabah and Biraban LALCs	N	Planning Staff time (Ongoing)	L	$0	$0	$5,000/yr	No

Appendix 4: Economic evaluation of estuary management options

Table 1.3 Economic evaluation of proposed estuary management actions

Priority issues from Stage 1	Responses to this issue Feasible (green shading)?	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency	Base case	Type of action	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funding available?	Extends beyond coastal zone
Hazard assessment and management need to be updated with new information to provide the best direction on management processes and priorities	**E1** Identify actively eroding creek bank sites on public land	Existing (CZMP), not commenced	Creek bank erosion results from high flow impacts on erodible alluvial or colluvial materials. Creek bed and bank erosion contributes to loss of riparian habitat and sediment from creek bed and bank erosion contributes to the deposition of coarse sediment deltas in the lake and smothering of seagrass by finer sediment. Excess sediment also impacts on lake amenity. This project will identify the most important creek erosion sites, taking the risk factors into account. It informs investment choices for remediation works. Work has commenced on this item hence a short timeframe until commencement is appropriate.	1	Council, LLS	No	**Investigation - Management** Staff time Consultant fees (Ongoing)	M	$0	$0	Staff time only	No	Yes
	E2 (S1) Review existing flood studies and floodplain risk management studies and plans	Existing (CZMP), not commenced	Updates previous information on inundation risk for floodplain and lake shore areas, with the best available inputs on sea level rise, rainfall intensity and storm recurrence intervals, and exposed development. Work has ongoing on this item hence a short timeframe until commencement is appropriate	1	Council	No	**Planning - Management** Staff time Consultant fees (Ongoing)	M	$0	$0	Council currently spends $30,000 per year (plus 2 for 1 funding through flood program) on flood studies	Yes (from Flood program)	Yes
	E3 Conduct condition assessment of lake foreshore erosion treatment sites on public land	Existing (CZMP), not commenced	Council has previously invested in innovative natural foreshore treatments at some locations and traditional rock or concrete wall protection at other sites. To understand the long-term effectiveness (including maintenance costs, habitat and amenity), Council needs to assess the condition of different treatment sites with different hazard exposures and uses. This action will inform future investment decisions for foreshore treatments. See **Action S3** Work ongoing on this item hence a short timeframe till commencement is appropriate	1	Council	No	**Investigation - Management** Staff time (Ongoing)	M	$0	$0	Staff time only	Yes (coast and Estuary Grants possible)	No

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Ongoing Community engagement is needed to support a resilient community with an adaptive balance between planning to avoid risk, coastal protection actions and other actions													
	S3 Continue foreshore stabilisation program	Existing (CZMP) and continuing	This action will follow the condition assessment (E3). The foreshore stabilisation program will continue to focus on natural defences approaches to foreshore management where the evidence indicates this is robust and meets community and lake health objectives. Soft engineering techniques not only protect foreshores, but also act to improve water quality by reducing nutrient enrichment of the near-shore zone and providing intertidal habitat. More engineered foreshore treatments will be used where a formal 'edge' is required in high usage foreshores or where the erosion and inundation processes affecting the foreshore cannot reduce the risk to an acceptable level. Work has commenced on this item hence a short timeframe till commencement is appropriate	1	Council	Yes	**On ground works** Planning/ Management staff time Operations – potentially contractors (Ongoing)	M	Current: Foreshore stabilisation asset replacement $140,000 See also review of performance of natural defences, to understand how much the continuing program will cost – which sites and what potential designs?	$100,000/tr		Yes – Coast and Estuary Grants	No

Priority issues from Stage 1	Responses to this issue Feasible (green shading)?	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency	Base case	Type of action	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funding available?	Extends beyond coastal zone
	S5 Continue adaptation conversations and planning with affected communities. Consider a resilience planning approach for future plans	Existing (CZMP) and continuing (new locations)	Council has made a strong commitment to working with communities around the lake that are affected by coastal processes and climate change, and has conducted collaborative adaptation processes in eastern Lake Macquarie where communities are vulnerable to tidal inundation combined with catchment flooding. Adaptation planning has commenced in western Lake Macquarie in the 5 Bays area, and will have a broader 'climate resilience' focus rather than focussing solely on inundation risks. The high level of community engagement and collaborative decision making is a key contribution to resilience. Work has commenced on this item hence a short timeframe till commencement is appropriate	1	Council	Yes	**Planning - Management** Planning and management staff time Consultant fees (for new adaptation plan support) (Ongoing)	H	$0	$0	Assume $40,000 plus staff time	Yes	Yes
Targeted studies and controls needed to fill management gaps	**W2** Review council's water cycle development controls for all new development	Existing (CZMP), but not commenced, not currently funded	Urban stormwater is a key threat to estuary health for systems with urbanised catchments. Clear development controls that deliver WSUD will protect lake water quality from stormwater impacts and also maintain water in the landscape to support riparian vegetation and urban forest. These in turn support urban amenity and resilience to climate change heat impacts. Work has commenced on this item hence a short timeframe till commencement is appropriate	1	Council, Central Coast Council, DPE	No	**Planning** Planning/management staff time (One-off)	M	$0	$0	Staff time only	No	Yes

Priority issues from Stage 1	Responses to this issue Feasible (green shading)?	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency	Base case	Type of action	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funding available?	Extends beyond coastal zone
	W3 Investigate hydrological characteristics and water quality of Muddy Lake and develop a suitable management approach	New	Muddy lake is a modified wetland area associated with the delta of Dora Creek and affected by the Eraring canal and main road runoff, as well as flows from local rural properties. An infestation of Salvinia is impacting significantly on the health of the area. Council has not previously looked closely at the health of this wetland lagoon, which provides habitat for water birds, including Green and Golden Bell Frogs. Given the likely timeframes involved in securing funding and agreements, timing for implementation is medium term	2-5	Crown Lands, Council, DPE Science, Origin Energy, Universities	No	**Investigations** Planning/ management staff time (One-off)	M Also DPE staff time and likely DPI Fisheries	$0	$0	Allow $100,000 Indicative for other research/studies. Resources in this timeframes will be to implement the management recommendations - $ depends on the results of studies in year 1-4 .	Yes	No
	W4 Seek funding to implement the LT Creek Dredging Plan to address historic sediment deposits in the upper tidal reaches and improve aquatic ecosystem health	Existing but modified. Not currently funded	Council has been working with residents along LT Creek for many years, to improve the health of the estuarine creek system. The creek receives runoff from a heavily disturbed catchment and has accumulated coarse sediment in the bed which impedes navigation. There have been discussion about dredging to remove excess sediment for 15 years and some navigational dredging has previously been undertaken in the downstream section, but works are required in the upper section for environmental purposes. Work to secure funding is a community priority, hence a short timeframe till commencement is appropriate. Given the likely timeframes involved in securing funding, timing for implementation is medium term	1 for securing funding 2-5 for implementation	Council	No	**Program administration** Planning/management staff time (One-off)	M	$0 for seeking funding $1.63 million for implementation.	$0	Included in capital costs	Funding may come from boating/dredging programs?	No

Priority issues from Stage 1	Responses to this issue Feasible (green shading)?	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency	Base case	Type of action	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funding available?	Extends beyond coastal zone
Urban stormwater continues to impact on lake water quality and estuary health	**U1A** Monitor performance of GPT type SQIDs and review to inform the maintenance schedule, considering available sensors and other technology and modelling	Existing (CZMP) but not commenced Council monitors how much material they remove from SQIDS	Council invested in multiple GPT style SQIDs during the implementation of the Premiers Taskforce Plan for the estuary, approximately 20 years ago. The SQIDs are intended to reduce the impacts of urban stormwater on lake water quality and estuary health, particularly in embayments with poor tidal circulation and high urban runoff contribution to catchment inputs. It is critical to understand how GPT style SQIDs perform relative to wetland style SQIDs. Council spends over $1.6 million p/a in maintaining SQIDs and monitoring is important to ensuring that this maintenance is optimised in terms of effectiveness, efficiency and water quality performance. Work has commenced on this item hence a short timeframe till commencement is appropriate	1	Council	Yes	**Monitoring** Planning/management staff time Operations (Ongoing)	L	Sensors and technology current is $10,000) Remote sensing $10,000 (more for beach) These will cover data collection for a variety of monitoring projects across the coastal zone Continue to share technology costs for remote sensing of performance, $10,000/year	$0	Staff time	Yes	Yes
	U1B Prepare a list of SQIDs in the city, identifying their roles – water quality or flood mitigation	New	This action will improve council's record keeping and enable better analysis of performance and improved ability to tailor maintenance to the purpose of the device. Work has commenced on this item hence a short timeframe till commencement is appropriate	1	Council	No	**Planning** Planning/management staff time (One-off)	L	$0	$0	Staff time	No	Yes
	U2 Minimise the use of machinery by adopting a bush regeneration approach to maintenance of vegetated SQIDs	Existing (in CZMP) but not commenced Not currently funded for this specific aspect	The effective functioning of vegetated SQIDs requires of the presence of healthy aquatic vegetation and removal of built up sediment and nutrient. The optimise the performance of these devices, particularly for nutrient removal, maintenance needs to focus on ensuring that the aquatic vegetation is healthy by utilising bush regeneration techniques. Work has commenced on this item hence a short timeframe till commencement is appropriate	1	Council	No	**Planning** Planning/management staff time (Ongoing)	H	$0	Council currently spends $1.6/yr on SQID maintenance and part of this funding would fund this changed approach	Staff time	No	Yes

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	U3 Retrofit upgrades to existing SQIDs to improve asset performance, targeting catchments contributing high concentrations of nutrients and/or high sediment loads to sensitive parts of the lake	In CZMP and SoE but not commenced, not currently funded	This action is the adaptive response to the performance review of SQIDS including GPT style devices. Priority will be given to subcatchments which have high sediment and nutrient yields and where the SQID is not designed in the best way to control the transfer of these loads into the lake. Work is ongoing on this item hence a short timeframe till commencement is appropriate	1	Council	No	**On ground works** Planning/management staff time Operations Capital works (Ongoing)	H	SQID Asset Replacement $125,000 New SQID (and retrofits) generally $450,000/yr	Continue current resourcing commitments	Design and approval included in capital budget	No	Yes
	U4 Install and maintain WSUD devices to reduce sediment and nutrient load, maximising pollutant removal efficiencies and prioritising catchments contributing high concentrations of nutrients and/or high sediment loads to sensitive parts of the lake	In CZMP and SoE but not commenced, not currently funded	As above, but for new devices	1	Council	No	**On ground works** Planning/management staff time Operations Capital works (Ongoing)	H	SQID Asset Replacement $125,000 New SQID (and retrofits) generally $450,000/yr	Continue current resourcing commitments	Design and approval included in capital budget	No	Yes
	U5 Continue compliance and education programs for the construction industry and residential property owners to promote best practice stormwater management	In CZMP, continuing	Residential and commercial land development is a high-risk time for sediment load and other contaminants. This action continues Council's work with builders and property developers, and purchasers of homes in new estates, to minimise sediment and nutrient yield from these sites, with easy to implement actions. Work is ongoing on this item hence a short timeframe till commencement is appropriate	1	Council	Yes	**Comms** Planning/management staff time (Ongoing)	H	$0	$0	Predominantly staff time. Allow $5,000/yr for development of educational resources	No	Yes

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	U6 Identify sediment and nutrient generation hotspots using spatially intensive, short term monitoring programs undertaken during a major rainfall event	New, from SoE	Previous research projects have highlighted some sub catchments that are erodible or are potential sources of elevated nutrient load. This actions provides data to ground truth modelled risks. It will also provide information about the types of events that are the greatest risk in terms of sediment and nutrient load. Given the likely timeframes involved in securing funding research proposals, timing for implementation is medium term. Reasonable information is already available have it presents a lower level of risk.	2-5	Council DPE University support (modelling and monitoring)?	No	**Investigations / monitoring** Planning/management staff time Operations (One-off)	L	$0	$0	Allow $50,000 (one off) indicative for data collection	Yes – Coast and Estuary Grants	Yes
	U7 Identify **prioritised strategies** to minimise erosion losses from unconsolidated road verges, building sites and other streetscape generation hotspots	New, from SoE	This actions goes with U5 (education programs for builders and homeowners). It provides a spatial focus for the delivery of controls (on public land by Council, Crown Lands) and on private land by industry and land holders, and education activities. Given the likely timeframes involved in securing funding research proposals, timing for implementation is medium term. Reasonable information is already available have it presents a lower level of risk.	2-5	Council	No	**On ground works** Planning/management staff time Operations (One-off)	M	No current allocation. Council has previously had road verge stabilisation programs	$0	Cost depends on number of sites. Allow indicatively 10 sites at $75,000 each over the life of the CMP	Yes – Coast and Estuary Grants	Yes

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Ongoing monitoring is necessary to track changes in seagrass response to estuary processes, water quality and lake use	**H1** Continue seagrass mapping and health monitoring, and investigate partnership opportunities with other organisations required to monitor seagrass. This will include sea grass monitoring near boat ramps and jetties, as proposed in the LAS	Existing from CZMP, with minor modifications	Sea grass condition and extent are key indicators of estuary health. LMCC and local industry have monitored seagrass in some parts of the lake for at least 20 years. Some participants are likely to have less involvement in the future (e.g. as power generation moves out of the LGA) and there are also new or growing impacts to consider (e.g. changes to recreational boating intensity). This action will continue seagrass monitoring, but is also to review who should be involved, which sites are important, and to establish a clear method to be used by all organisations that are involved. Work has commenced on this item hence a short timeframe till commencement is appropriate	1	DPI Fisheries, Council	Yes	**Investigations and Monitoring** Planning/management staff time (One-off, but repeat every 5yrs)	H	$0		DPI whole of lake mapping indicatively $250,000 (currently funded by MEMS). Targeted monitoring near boat ramps. Allow summer and winter at 20 sites, $10,000 per site Indicatively $100,000)	Costs to be shared with industry partners and DPE Currently funded via MEMS	No
	H2 Continue to monitor lake health, identifying areas for partnering with industry	Existing from CZMP, ongoing	This action includes the implementation of any changes arising from H1. Council is committed to continue to monitor condition and other indicators of estuary health. Other indicators are identified in DPE estuary health report cards (water clarity and Chlorophyll-a) as well as indicators of mangrove health and distribution, wetland condition, fishery habitat and shoreline processes. Work is ongoing on this item hence a short timeframe till commencement is appropriate	1	Council DPE Origin Energy Others?	Yes	**Monitoring** Planning/management staff time Operations (Ongoing)	L	$0	$0	$65,000 Maintain this allowance for monitoring across multiple sites, plus investigate industry contributions	Yes – Coast and Estuary Grants	No
	H3 Continue wetland/saltmarsh rehabilitation program. Including removing potential barriers posed by natural and constructed features around wetland margins to facilitate migration of saltmarsh and other wetland species	Existing from CZMP and Swansea LAP, but not commenced and not previously funded	The LAP identifies wetland adaptation to sea level rise as a topic which requires more local research so that tailored best practice management can be developed for different wetland types and contexts around the lake. This action focuses on physical barriers to migration, but in some cases adaptation may require the capacity to maintain ground levels that match sea level. Work is ongoing on this item hence a short timeframe till commencement is appropriate	1	Council DPI Fisheries DPE Science, Landcare	No	**Planning and on ground works** Planning/management staff time Operations/Assets (Ongoing)	M	Currently $30,000/yr (with matching grant funds). Also volunteer works by Landcare	Volunteer works by Landcare	Staff time	Yes - Coast and Estuary grant or LLS projects, may be also a MEMS project	No

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Coal fired power stations continue to operate in the immediate lake catchment and discharge pollutants (including metals and thermal pollution) to the waterway. **A review of environmental risk is needed**	**P1** Conduct and publish a study of surface water and ground water around Lake Macquarie's coal fired power stations and associated coal ash dams, and their potential impacts on the surrounding environment	New (from Parliamentary Inquiry)	See the report of the Parliamentary Inquiry	2-5	EPA	No	**Investigation and Planning** Minor Planning/management staff time		No current budget commitment	To be confirmed by EPA	To be confirmed by EPA	No	Yes
	P2 Establish air and groundwater monitoring sites surrounding all power station and coal ash dams. publish current, real time and historical data from these and other existing monitoring sites online	New (from Parliamentary Inquiry)	See the report of the Parliamentary Inquiry	2-5	EPA	No	**Monitoring** Minor Planning/management staff time		No current budget commitment	To be confirmed by EPA	to be confirmed by EPA, note Eraring Power Station to close in 2025	No	Yes
	P3 Review surface water, groundwater, water temperature, air quality and other relevant monitoring data and use this information to inform ongoing reviews of EPA licence conditions for power stations	Existing and ongoing action by EPA	Review of licence conditions based on analysis of performance is a routine responsibility of the EPA. Pollution Reduction Programs attached to industry licences (coal mining and processing, power generation) have been used to drive improved controls and reduce pressure on lake ecosystems from warming, contaminants, changes to flow patterns and other factors.	2-5	EPA	Yes	**Review and analysis** – planning for regulatory purposes		To be confirmed by EPA	To be confirmed by EPA	to be confirmed by EPA, note Eraring Power Station to close in 2025	No	Yes
	P4 Improve the usability of EPA licence monitoring data by making it available in spreadsheet format for use by researchers, other agencies and the community	New (from Parliamentary Inquiry), although EPA does already make some data available	See the report of the Parliamentary Inquiry	2-5	EPA	No	Planning and analysis		To be confirmed by EPA	To be confirmed by EPA		No	Yes

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	R1 Conduct monitoring of recreational swimming areas – monitoring bacterial counts to improve management of sewage and stormwater systems	New, from LAS	This action is about the suitability of different sites around Lake Macquarie for primary contact recreation, which depends on a combination of water clarity and pathogens. Swimming areas that are adjacent to town centres may be impacted by local stormwater runoff in wet weather. The results of this monitoring will help council and community select appropriate sites for any new swimming enclosures, but also target areas where there may be sewer leaks or overflows contributing to intermittent poor water quality events close to town centres. Work is ongoing on this item (currently 13 sites monitored weekly in swimming season) hence a short timeframe till commencement is appropriate	1	Council	Yes	**Monitoring** Operations (Ongoing)	M	$0	$0	Sampling undertaken by Council staff (13 sites sampled weekly during swimming season). Cost of analysis is $15,000/yr	No	No
Impact of stormwater and wastewater overflows on recreational water quality is not clear in the context of increasing demand for primary contact recreation **Catchment and foreshore vegetation modification –**	**R2** Implement recommendations from '*Effects based assessment of wastewater overflows in Lake Macquarie catchment*'	New	This is a broader action to improving the understanding of sources of diffuse source pathogens in Lake Macquarie and its tributary catchments. The effects-based study identifies potential sources of pathogens in the Cockle Creek catchment. The sewage transport system runs along tributary creeks and on the lake shore in several areas, including pump stations on the lake shore. As a current monitoring program is continuing for swimming sites, a medium timeframe is appropriate for this action which will improve understanding into the future.	2-5	HWC	No (but is a commitment in LAS)	**Monitoring** Operations (One-off)	M	$0	$0	Allow $100,00 for studies No current budget allocation. Needs advice from Hunter Water Corporation	No	No

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riparian vegetation around Lake Macquarie is extensively modified or removed, affecting nutrient loads, foreshore stability and habitat	**V1** Continue streambank, riparian corridor rehabilitation program	Existing (from CZMP and SoE) and ongoing	Parts of the catchment and tributary floodplains of Lake Macquarie are erodible and susceptible to channel scour during high rainfall events. Creeks in the long developed sub-catchments of the lake (residential, mining, power transmission and industry) may be deeply incised and/or experiencing widening. In the tidal reaches, bed and bank erosion impacts of protected riparian and wetland communities such as Swap Oak forest, mangrove and saltmarsh. Restoration works benefit ecological connectivity and reduce sediment and nutrient loads. Work is ongoing on this item hence a short timeframe till commencement is appropriate	1	Council Crown Lands NSW Forests(?) Transport for NSW	Yes	**Planning and implementation** Planning/management staff time (Ongoing)	M	$200,000/yr	$20,000/yr	Staff time	Yes Coast and estuary program. May be funded through LLS grants	Yes
Catchment and foreshore vegetation modification – riparian vegetation around Lake Macquarie is extensively modified or removed, affecting nutrient loads, foreshore stability and habitat **Vigilance is necessary to protect Lake Macquarie**	**V2** Support community stewardship of natural areas through ongoing support of Landcare	Existing from CZMP and SoE	Lake Macquarie has an outstanding record of Landcare projects, with more than 200 Landcare groups. Council recognises that rehabilitation projects require volunteer resources as well as council staff, particularly to support weeding, growing of new locally native tube stock and replanting. This action will also support Landcare with training, WHS equipment and equipment. The value to Council is in terms of on ground results, community awareness of environmental issues, and council reputation. Work is ongoing on this item hence a short timeframe till commencement is appropriate	1	Council Central Coast Council LLS Landcare (note Landcare also has Corporate sponsors and receives Commonwealth and State government funds)	Yes	**On ground works** Planning/ management staff time (Ongoing)	H	$0	$0	$1,300,000 per year, note this is for the whole local council area, not just in the coastal zone or estuary context	Yes	Yes

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from invasive aquatic species	**AV1** Manage new outbreaks of aquatic weeds and pests.	Existing and continuing	Marine weeds and pests can have a destructive impact on the ecology of estuaries. There are ongoing programs for several marine pests and requirements for vigilance and managing any new invasive species. Also note pest plant species in freshwater wetlands on the floodplains of major creek systems.	2-5	Council Crown Lands, DPI, Fisheries LLS	Yes	**On ground works** Planning/management staff time Operations (Ongoing)	L (Ongoing)	Dependant on nature of new outbreak.	Dependant on nature of new outbreak.	Dependant on nature of new outbreak.	Yes	No
Vigilance is necessary to protect Lake Macquarie from invasive aquatic species **Residents need best practice on ground examples of managing modified shorelines**	**AV2** Explore opportunities to establish (and implement if feasible) an aquatic weed and pests surveillance program	New (but an additional part of above)	This is a specific part of the strategic approach to aquatic pest plants and animals. It focuses on how data will be collected on the location and scale of invasive species impacts. Without this information, Council cannot realistically assess the risks. Given the likely timeframes involved in securing funding and agreements, timing for implementation is medium term	2-5	Council DPI Fisheries LLS Crown Lands, Universities	Yes	**Planning and implementation** (Ongoing)	M	Potentially capital items required for surveillance (vessel, UAV etc.)	$0	Staff time from relevant agencies Not currently funded	Yes	No
	AV3 Continue to evaluate opportunities local use of approved biocontrol applications for managing aquatic weeds and pests	New	This is a continuation of the above, with a particular focus on Salvinia in Muddy Lake. Work is ongoing on this item hence a short timeframe till commencement is appropriate	1	Council DPI Fisheries LLS Crown Lands Universities	No	**Planning** Staff time (and agency time) (Ongoing)	L	$0	$0	Staff time only	Yes	No

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	AV4 Develop an awareness raising, education and safety risk management program for razor clams, noting changes to the dispersal of the species around the lake and the risk to community safety	New (as in not a current project), not currently funded	Razor clams are a native bivalve species that is widespread in shallow seagrass beds around Lake Macquarie, but their numbers are very variable both spatially and year on year. Their upright habit and sharp shell edge mean they are a safety risk for people swimming or wading near the shore. Management of razor clams in formal swimming areas is a significant annual cost for council. Council has previously provided information to the community about the distribution of razor clams and how to reduce risks, based on advice from researchers. This action updates previous advice and brings it forward for attention. Given the likely timeframes involved in securing resources, timing for implementation is medium term	2-5	Council DPI Fisheries	No	**Planning** Staff time and advice from DPI Fisheries (On-off)	L	$0	$0	Assume $5,000 for development of resources. Not a currently funded project, although Council has previously provided some information to the community about razor clams	Yes	No
	SW1 Pilot an environmentally friendly seawall (retrofitted to an existing seawall structure)	New	Although Council has implemented extensive natural defences protection around the shoreline of the lake, it knows that some sites, in medium to long term, will require more intensive management of shoreline erosion and inundation hazards. This project tests the performance of seawall designs – for protection of assets, but also to minimise disruption to habitat values. For eroding banks along tributary creeks, bank protection works may add to habitat. Given the likely timeframes involved in securing resources, timing for implementation is medium term	2-5	Council DPE	No	**On ground works** Planning/management staff time Operations (One-off)	M	Allow $20,000 - 50,000 for design, construction and monitoring Not currently funded but potential to fund via foreshore stabilisation or streambank stabilisation budgets.	$0	Staff time	Yes – Coast and Estuary Grants and others	No

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Environmental issues associated with access to marine estate – Recreational boating in Lake Macquarie damages seagrass	**RB1** Raise awareness of the impacts of boating on seagrass (focus on Posidonia) Note slow recovery of Posidonia	Existing in CZMP and SoE, noted in LAS	Noted in the LAS as part of the response to balance protection of important ecological values of Lake Macquarie with community interest in a lifestyle built around lake-based recreation (boating). The impact of boat moorings on Posidonia in eastern Lake Macquarie has been reported for many years. This action focuses on moorings and navigation over Posidonia beds, but also references damage to other seagrass around moorings, boat ramps, adjacent to shallow jetties (prop scour) and where people run vessels up onto the shoreline. Although running a vessel onto the shoreline in sand is unlikely to have a significant habitat impact, the same behaviours on shallow seagrass shorelines can be quite destructive. Given the likely timeframes involved in securing resources, timing for implementation is medium term	2-5	Council DPI Fisheries TfNSW	Yes	**Comms** (Ongoing)	L	$0	$0	Assume $5,000 for development of resources. + Staff time (Continue to fund Council contribution) TfNSW contribution through update of Mooring management Plan and Boating Management Plan. See also update of Mooring Management Plan RB3		No
Environmental issues associated with access to marine estate – Recreational boating in Lake Macquarie damages seagrass **Migratory shorebird and marine species habitat around**	**RB2** Generally raise awareness of the processes, functions and value of all seagrass communities and threats to seagrass health, vulnerability and other impacts e.g. runoff, nutrients, boating infrastructure construction, moorings	New	This task has been within the role of DPI Fisheries. There are opportunities to raise awareness of the value of seagrass in regulatory/approval contexts such as for moorings and ramp and jetty construction. Impacts are more widespread than these physical works and include links to catchment development and the impact of stormwater on the health of lake ecological communities. Given the likely timeframes involved in securing resources, timing for implementation is medium term	2-5	DPI Fisheries TfNSW LMCC	No	**Comms** (Ongoing)	L	$0	$0	As per above	Yes	No

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Lake Macquarie is impacted by recreational activities	**RB3** Review the Lake Macquarie Mooring Management Plan, to require seagrass safe moorings in sea grass beds	New (but updates an existing strategy)	The Mooring Management Plan for Lake Macquarie is approximately a decade old. The LAS notes work by council, TfNSW and others on changing boating preferences in terms of the size and power of vessels. Mooring space in Lake Macquarie is limited by shoreline exposure to strong winds and wave chop, and by the presence of protected sea grass communities. The updated Mooring Management Plan will take a broader perspective and consider boat storage options beyond on water moorings. Moorings in seagrass will be required to be designed to minimise impacts, with specific designs required. Given the likely timeframes involved in securing resources and agreements, timing for implementation is medium term	2-5	TfNSW DPI Fisheries	No	**Comms** (One-off)	M	$0	$0	Assume $50,000. Review will be carried out by TfNSW. Budget to be confirmed by them.	No	No
	RB4 Use the Jetty Impact Assessment Tool when assessing new applications for jetty construction and in the redesign of existing public jetties to minimise impacts on adjacent seagrass beds.	New	The design of jetties should balance the impacts of both shading, and vessel scour. The Jetty Impacts Assessment Tool was developed to assist assessing agencies in quantifying these impacts and an increased use of this tools can assist in minimise impacts of jetties. Work is ongoing on this item hence a short timeframe till commencement is appropriate	1	Council	No	**Planning** – staff time for contributing to the review Council role will come from recreation and economic development planning as well as environmental team (Ongoing)	L	$0	$0	Staff time only	No	No

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	RB5 Establish marked approach corridors to high use jetties and educate the boating community about avoiding propeller and anchor damage in seagrass beds.	New (from SoE and noted in LAS)	Several popular jetties used for recreational boating are located over or in proximity to seagrass beds. Some are also near to shallow shoals that may impact on navigability. This action is to contain boating traffic away from sensitive seagrass beds as much as possible, by marking appropriate routes for approaching a jetty. In shallow water, propellors and anchors can scour seagrass and the lake bed, as well as damaging the vessel. Given the likely timeframes involved in securing resources, timing for implementation is medium term	2-5	TfNSW	No	**Planning** Staff time	L	Assume $20,000 Not currently funded or resourced Cost to be confirmed by TfNSW	Ongoing maintenance cost for TfNSW	Staff time	No	No
	MB1 Review factors influencing the population and breeding success of migratory shore bird species	Existing in CZMP, but broader scope	Multiple species of migratory shorebirds, protected under NSW or Commonwealth legislation (and international agreements) are known to nest, roost or feed around Lake Macquarie – on sand, rock, muddy substrates, and fresh water and estuarine wetlands. Examples include Australian Painted Snipe, Bar-tailed Godwit, Latham's Snipe, Sharp tailed sandpiper, Lewins Rail, Black bittern, Double banded plover, Red capped plover, Sooty and Pied oystercatcher, Little tern. The breeding success of some species is declining. This project is to improve understanding of local factors contributing to the success of these species. It will benefit local managers, but also contribute to wider scientific information about trends in migratory bird populations and options to stabilise numbers. Given the likely timeframes involved in securing resources, timing for implementation is medium term	2-5	DPE Council will contribute local knowledge and monitoring data	No	**Comms** Staff time (One-off)	L	$0	$0	Not currently funded for Lake Macquarie. There are existing state and Commonwealth programs that assess key threats to these species. Cost of local threat assessment to be confirmed by DPE.	Yes	No

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Migratory shorebird and marine species habitat around Lake Macquarie is impacted by recreational activities **Access to the marine estate, social issues. Key aspects of boating management need to be updated as recreational boating demand increases**	**MB2** Raise awareness of bird species especially migratory birds and their vulnerability to disturbance. (Sooty and Pied Oyster Catchers, and other species) **Note: also applies to open coastline (see coastline action M2)**	New	Information from other areas and anecdotal information from Lake Macquarie indicate that disturbance by people (recreation – walking or driving) and by domestic pets detracts from the well-being of migratory shorebirds (e.g. oyster catchers). This action translates science into actions that people can take to recognise and protect these species. Given the likely timeframes involved in securing resources, timing for implementation is medium term.	2-5	Council DPE	No	**Planning** Staff time	L	$0	$0	Not currently funded as a specific project for Lake Macquarie. Guidance likely to come from DPE	Yes	No
	MB3 Raise awareness of marine mammals and other protected species within the lake, such as seals, turtles, dolphins. Include advice on natural behaviours and appropriate interactions with people	New	Seals, turtles, dolphins are all present in the lake, but seals and turtles are close the edge of their range. They are a novelty in Lake Macquarie. This action provides people with advice on how to act to protect vulnerable species. Given the likely timeframes involved in securing resources, timing for implementation is medium term	2-5	NPWS Council DPE	No	**Comms**	L	$0	$0	Not currently funded as a specific project for Lake Macquarie. Guidance likely to come from DPE	Yes	No

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	BM4 Provide public boating access infrastructure (including improved access for persons with a disability). Work to provide equitable provision of boating facilities around the Lake (ie: concentration in north compared to the southern shores)	New, adopted in LAS	Equitable distribution of boating facilities to meet the needs of growing urban areas within the lake social catchment is an underlying principle of the Lake Activation Strategy and has informed Council's strategy and priorities for providing/upgrading boating access infrastructure such as launching ramps and jetties. While facilities in the north are essential to provide for the north west growth corridor and for connectivity to recreational users from Newcastle, some upgraded facilities are also proposed for the south west to meet growing demand from the Morisset area and from the Central Coast and Sydney. Work has commenced on this item hence a short timeframe till commencement is appropriate	1	Council TfNSW	No	**Planning and capital works** (Ongoing)	M	Dependant on facility. Current project include: - Bolton Pt Boat ramp replacement ($400,000) - Bolton Pt fishing platform ($100,000) - Toronto Lions Pk – pontoon jetty ($270,000) - Belmont Wharf ($1,000,000) - Blacksmiths fish cleaning table ($20,000)	Dependant on facility and provision included in maintenance programs	Staff time	Yes, State boating programs	No

Priority issues from Stage 1	Responses to this issue Feasible (green shading)?	Existing, continuing or new?	Benefit, prioritisation and timing rationale	Timing (years till commencement)	Council or agency	Base case	Type of action	Staff Resources Required Low 1d/m Med 1d/w High 5d/w	Indicative Capital Cost	Indicative Maintenance Cost	Indicative Operational Costs (excluding staff time)	Grant funding available?	Extends beyond coastal zone
	BM3 Monitor community use of the lake and foreshores to provide up to date information on recreational use, demand and patterns – consider technology applications such as QR codes and vehicle registration monitoring.	New, adopted in LAS	The context review for the Lake Activation Strategy demonstrated that there are limited reliable data on recreational use of Lake Macquarie and its foreshores. This is critical information for making decisions about the provision of new infrastructure for water and foreshore recreation and tourism. This action will create several new data streams to better monitor and report on the use of different parts of the lake and its foreshore, different boating facilities and swimming locations. Given the likely timeframes involved in securing resources, timing for implementation is medium term	2-5	Council	No (in LAS Implementation budget – but is it in the forward budget for the next Delivery Strategy	**Monitoring, Planning and On ground works** (Ongoing)	L	Low for monitoring (possibly new equipment)	Low	Low	Yes	No
Foreshores and wetlands of Lake Macquarie are a passive recreation asset and will help meet public open space and natural area management objectives **Governance arrangements for coordinated management need to be strengthened**	**FW2** Investigate enhancement of passive recreation access to wetlands and foreshores in other public land – link to future Tracks and Trails Strategy.	New	There are several wetlands that adjoin residential areas of Lake Macquarie. Each affords an opportunity for a local scale walking track, bird viewing platforms or hides, and environmental awareness/education activities. examples include Belmont Lagoon, Galgabba Track at Swansea and the Greenway, Toronto wetland and Fennell Bay wetlands at Toronto. There are opportunities to upgrade these paths, create new routes and better integrate them into council's broader Tracks and Trails Strategy. Given the likely timeframes involved in securing resources, timing for implementation is medium term	2-5	Council NPWS Crown Lands	No	**Planning** (One-off)	M	$0 action for investigation only	$0 action for investigation only	Staff time plus integration with Tracks and Trails strategy	Yes	No

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	G1 Establish and implement an interdepartmental coastal management working group to support CMP implementation	Existing in CZMP, but updated and clarified	Coordination of actions by local councils and public authorities is a key challenge for coastal management, especially in estuaries where there are multiple organisations with interlinking responsibilities. LMCC has a strong historical record of successful coordination of program delivery through the Premiers Task Force and Office of Lake Macquarie. This interdepartmental working group will not be a statutory organisation but will foster sharing of information about lake management actions, their scheduling and resourcing, streamlined approvals and reporting of outcomes. Work has commenced on this item hence a short timeframe till commencement is appropriate	1	Council Multiple public authorities	No	**Planning and Management** (Ongoing)	L	$0	$0	Staff time	No	n/a
Governance arrangements for coordinated management need to be strengthened **Council and community need ongoing feedback on performance and outcomes of lake management and share knowledge**	**G2** Maintain close liaison with State and Commonwealth agencies about Lake Macquarie issues and initiatives, to lay groundwork for innovative management, planning, monitoring and reporting processes	New	Although operational management of the coastal zone is delegated to local councils in NSW, all three levels of government have interests in a healthy, well managed coastal zone, and in quality information about trends in its condition. LMCC has a demonstrated track record in innovation to enhance coastal management. This action maintains partnerships between council and researchers at state and commonwealth level to ensure council has access to up to date science and monitoring techniques, as well as management processes for complex and contentious coastal issues. Work has commenced on this item hence a short timeframe till commencement is appropriate	1	Council Multiple public authorities	No	**Planning and management** Council planning/ management staff time (Ongoing)	L	$0	$0	Staff time	No	n/a

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	A1 Conduct an annual review of CMP action status	Existing and ongoing	The CM Act establishes a framework that expects councils and public authorities to be accountable for commitments made in the CMP. It gives the coastal Council a role in auditing the performance of councils in delivering their CMP, if requested by the minister to do so. This actions reflects council's commitment to transparency in its management processes but will also help it prepare for a future audit of implementation. Costs are in staff time to establish necessary action monitoring and reporting systems, consistent with best practice advice. Work has commenced on this item hence a short timeframe till commencement is appropriate	1	Council (see guidance on audit procedures and what needs to be monitored and recorded)	Yes	**Planning** (Ongoing)	L	$0	$0	Staff time	No	No
Council and community need ongoing feedback on performance and outcomes of lake management and share knowledge	**A2** Continue the Lake Macquarie environmental attitudes survey (every 4 years)	Existing and ongoing	The environmental attitudes survey and council's community satisfaction survey are both valuable tools to understand what is important to the local community and whether they perceive that council is managing important natural and social assets effectively. It is a key part of monitoring how attitudes change over time, and considering the implications for management priorities. This survey was last conducted in 2020, hence a medium timeframe is appropriate.	2-5	Council	Yes	**Monitoring** (One-off projects undertaken every 4 yrs)	M	$0	$0	$20,000 + staff time	No	n/a

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	F1 Share the findings of research grant funded projects more widely with the community	Existing and ongoing	Council has funded research projects on issues associated with the local environment, the lake and creeks for more than 30 years. The program often supports post graduate students provides value for money monitoring, studies and analysis about natural processes, coastal zone health amongst other topics. This action reinforces the value of these research projects and the need to share the results obtained. This will provide new information about their local area to the community, as well as supporting improved management of the lake, its tributary creeks and floodplains. Work is ongoing on this item hence a short timeframe till commencement is appropriate	1	Council	Yes	**Monitoring** (Ongoing)	L	$0	$0	Staff time	No	n/a
	F2 Collaborate with University of Newcastle and other research institutions to bring research results into the community	Existing and ongoing	As above, Council has a well-established partnership with academic staff and students at Newcastle University. Projects conducted by students provide local based data to test broader regional hypotheses about coastal processes. By ensuring that the results of the university projects are widely available, council continues the valuable collaboration, but is also able to inform residents about new locally focused research information, wat a low cost. Work is ongoing on this item hence a short timeframe till commencement is appropriate	1	Council University of Newcastle	Yes	**Comms**	L	$0	$0	Environmental Research grants Program has annual allocation of $20,000 (plus sponsorship).	N	n/a

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