alluvium

FINAL REPORT

Bellingen Shire Coastal Management Program – Stage 1 Scoping Study

May 2020

Bellingen Shire COUNCIL

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1 Introduction

1.1 Scoping study purpose

Bellingen Shire Council (BSC) is commencing the development of a Coastal Management Program (CMP) for the Shire's coastal areas, including the coastal catchments and estuaries of the Bellinger River and the Kalang River. The scoping study is the first stage in the development of a CMP. The scoping study assists council to (OEH 2018b):

- Identify the community and stakeholders and prepare an engagement strategy
- Determine the strategic context of coastal management
- Establish the purpose, vision and objectives
- Determine the key coastal management issues and the spatial extent of management areas
- Review current coastal management arrangements
- Establish roles, responsibilities and governance
- Determine where action is required through a first-pass risk assessment[1]
- Identify knowledge gaps and information needs
- Prepare a preliminary business case
- Determine whether a planning proposal will be prepared to amend coastal management area maps and the Local Environmental Plan
- Develop a forward program for subsequent stages of the coastal management program, including a fast-tracking pathway (where applicable)[2].

This document sets out the scoping study for the Bellingen Shire CMP. The scoping study establishes the program of work to be completed for the CMP and is completed in accordance with the requirements of the NSW Government Coastal Management Manual (OEH 2018a&c), and with regard to the Coastal Management Act 2016 and Coastal Management State Environmental Protection Policy (SEPP) 2016.

Bellinger River

[1] A risk assessment identifies the impact that various stressors (climate or otherwise) can have on the community values.
[2] Parts or all of Stages 2 and 3 are fast-tracked where the management approach is considered to be performing well or thresholds for drivers of change have not been exceeded.

1.2 CMP study area

The Bellingen Shire is located in the Coffs Harbour region of the north east coast of New South Wales (NSW). The Shire covers an area of 1605 km^2, with approximately 10 km of coastline including sandy beaches, rocky headlands, and the major estuary system and coastal floodplains of the Bellinger-Kalang River system. There are also several intermittently closed and open lake or lagoons (ICOLLs) in the study area, including ICOLLs at Dalhousie Creek and Oyster Creek.

The Bellinger River and Kalang River flow in a general easterly direction over 109 km and 77 km respectively, to their confluence at Urunga Island (Figure 1). The total catchment area is 1110 km^2 which is bordered to the east by the coastal dunes and headlands between Tuckers Rocks and North Valla Beach. The lower Bellinger-Kalang estuary zone covers approximately 160 km^2 and includes saltmarsh and saline wetlands.

The lower Bellinger-Kalang River Estuary covers an area of approximately 160 km^2.

Setting a forward program for integrated catchment management in the Bellinger-Kalang estuary is a current priority for the Bellingen Shire Council. The Shire has a history of management challenges related to streambank stability/erosion, catchment runoff/water quality, poor riparian condition, governance and community access to coastal areas. Therefore the Bellinger River and Kalang River catchment area is focus area for this CMP, along with the region's open coastline.

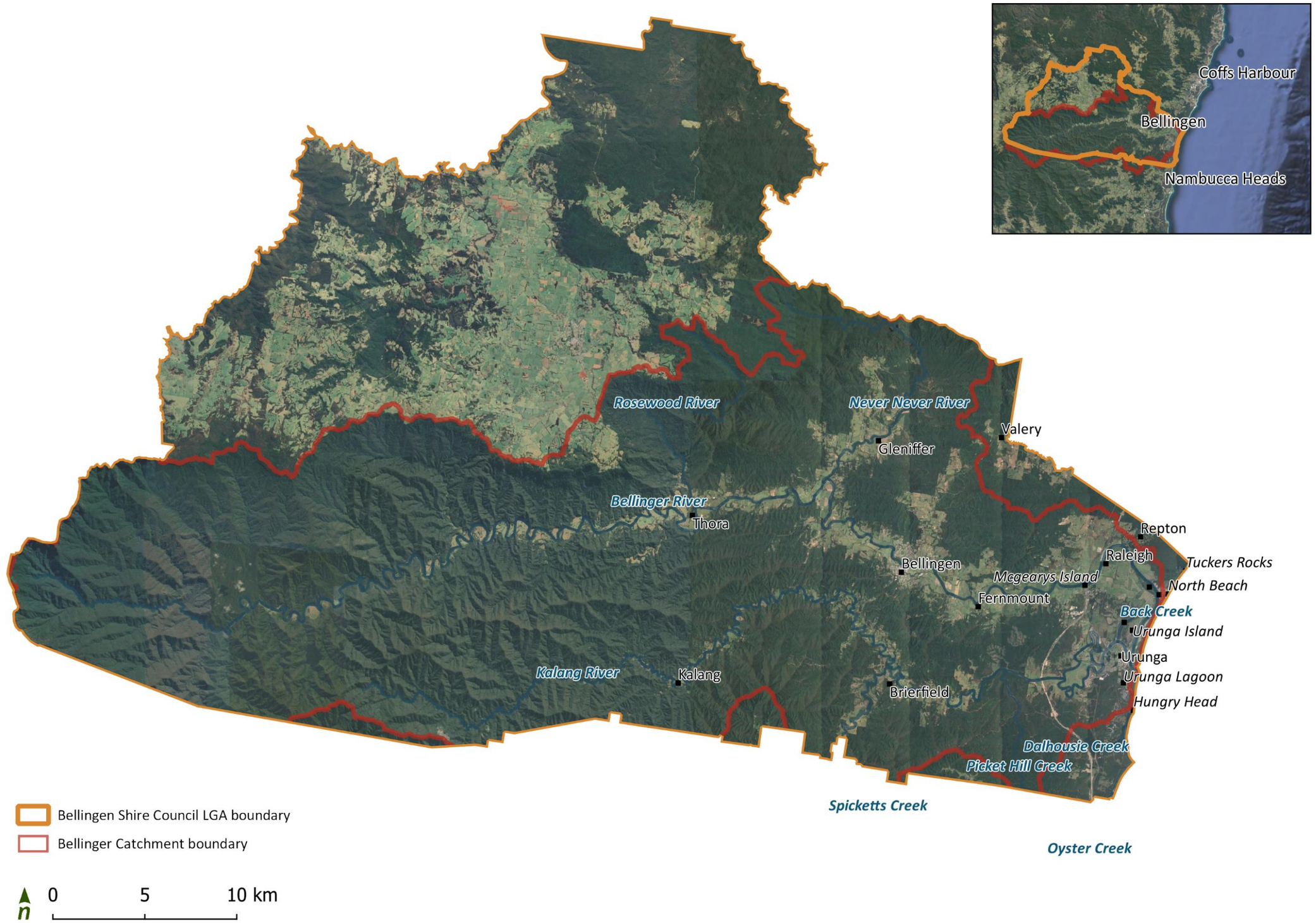


Figure 1. *Bellingen Shire Local Government Area and Bellinger River catchment boundaries.*

1.3 Report structure

The Bellingen CMP scoping study is structured as follows, reflecting the scope of the CMP as defined previously in Section 1.1.

- **Section 2 – Program context:** An overview of the strategic and legislative context to the NSW CMPs, and for the Bellingen Shire specifically.
- **Section 3 – Strategic context of coastal management:** A literature and data review on the relevant context and management challenges for the Bellingen Shire. Includes: environmental context, social and economic context, legal and planning context, review of Coastal Management Areas extents, current coastal management arrangements (existing plans), and potential barriers and enablers for effective management.
- **Section 4 – Purpose, vision and objectives:** Clarification of the purpose, and a preliminary vision and objectives of the Bellingen Shire CMP.
- **Section 5 – Scope of the CMP – key management issues and areas:** Outline of management issues and areas that will be the focus of the Bellingen Shire CMP, including a first pass risk assessment.
- **Section 6 – Preliminary business case and forward program:** A business case for the CMP, including activities across Stages 2 and 3, costs, roles and responsibilities – lead applicant and established partnerships, as well as timeframes and any requirements for an amended planning proposal.
- **Attachment A –** A Community and Stakeholder Engagement Plan (C&SEP) prepared as a document that is part of this scoping study and can also be a stand-alone document for ease of reference throughout the CMP process.
- **Attachment B –** Bellingen Shire CMP Survey Results
- **Attachment C –** First ARG Meeting Minutes
- **Attachment D –** Supporting economic information

Bellingen Shire coastline

2 Program context

2.1 NSW Coastal Management Framework

Overview

Recent coastal management reform led by the Department of Planning, Industry and Environment (DPIE) has involved the release of several key pieces of legislation, policies and guidance material over the last six years.

Figure 2 summarises the changes that have been developed under the supervision of the responsible ministers and the Coastal Expert Panel with the aim to manage the coastal environment in a manner consistent with the principles of Ecologically Sustainable Development (ESD), i.e. for the 'social, cultural and economic wellbeing of the people of the State'. Four key component documents/programs that provide direct influence/guidance for the Coastal Management Program are summarised further in Figure 3.

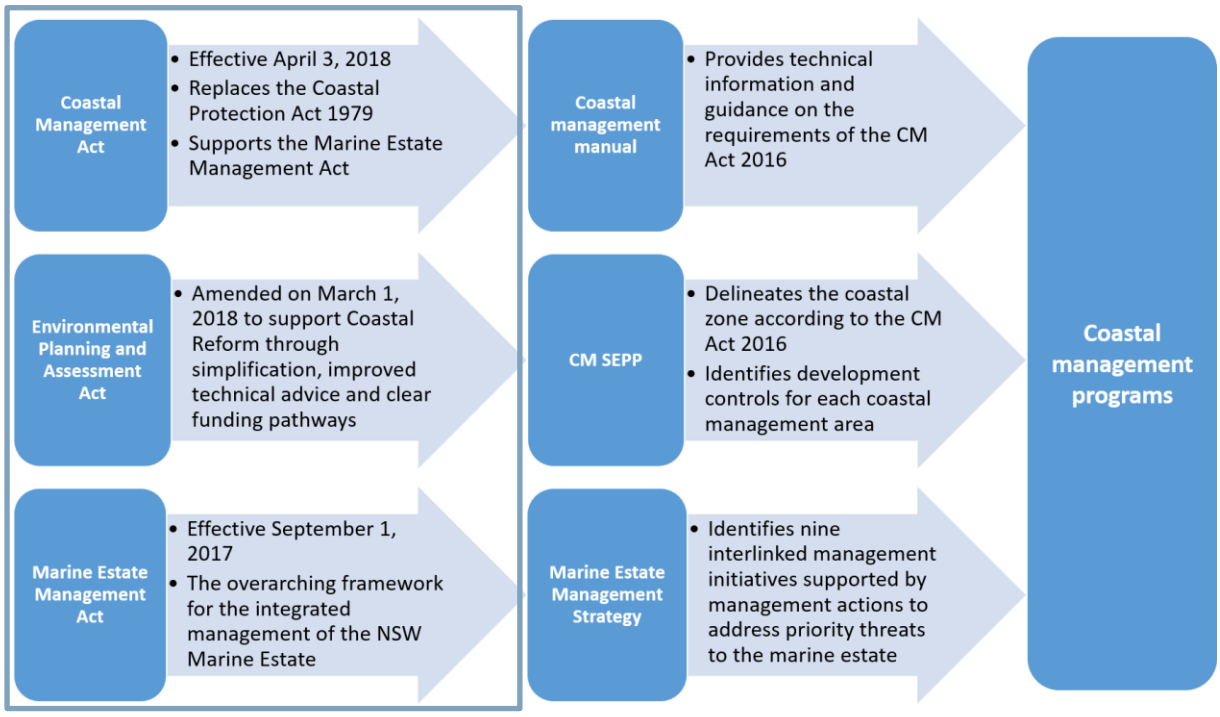


Figure 2. *An overview of the changes that have occurred to legislation, policies and guiding material involved in NSW coastal management reform.*

Coastal Management Act 2016	•This Act divides the coastal zone into four management areas which are to be used by local councils to achieve the objectives of the Act through the implementation of their respective Coastal Management Programs. The guidance for this process is provided for by the Coastal Management Manual (OEH 2018a) through a five-stage approach (see Table 1 below).
State Environmental Planning Policy (Coastal Management) 2018	•Updated in 2018, the Coastal Management State Environmental Planning Policy (Coastal Management) 2018 (CM SEPP) supports the Coastal Management (CM) Act 2016 through provision of the development controls specific to each of these coastal management areas. These controls are supported by the Environmental Planning and Assessment (EP&A) Act 1979.
Marine Estate Management Act 2014	•A key objective of the Marine Estate Management (MEM) Act 2014 is improved co-ordination by public authorities in relation to their responsibilities to the Marine Estate. This integration, critical to the delivery of outcomes for both the Marine Estate Management Strategy (MEMS) 2018 and the Coastal Management Program, is supported by the Coastal Management Act, which 'support(s) the objects of the MEM Act 2016'.
Coast and Estuary Grants Program	•Funding support for local councils has been made available by the State government for this reform process through the Coastal and Estuary Grants Program, which is part of a greater $83.6 million funding package for coastal management in NSW from 2016-to 2021. In developing the CMP, councils are required to clearly identify and balance competing interests and priorities within the coastal zone (OEH 2018).

Figure 3. *Summary of several key documents/programs influences the CMP process.*

2.2 Coastal Management Programs

The five recommended stages to preparing a CMP as set out in the Coastal Management Manual (OEH 2018a) are shown in Figure 4 and Table 1. When progressing through this approach, Councils are required to report on progress, outcomes and achievements in line with reporting requirements under the Integrated Planning and Reporting (IP&R) framework (OEH 2018a).

Completion of the Stage 1 scoping study involves a review of the existing understanding of the catchment, examining progress on the management of coastal issues, developing a shared understanding amongst stakeholders of the issues at hand, identifying the key knowledge gaps and risk, and developing recommendations for future studies/investigations and a forward program of work to complete the CMP.

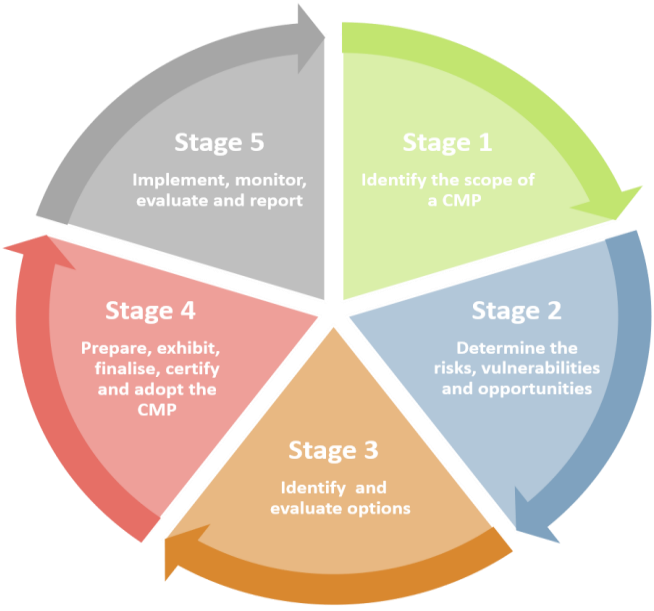


Figure 4. *Five stages to preparing a CMP (OEH 2018a).*

Table 1. An overview of the five-stage process of a Coastal Management Program (OEH 2018a)

CMP stage	Key steps	Key outputs
	– Identify key stakeholders and prepare an engagement strategy – Determine the strategic context of coastal and catchment management – Establish the purpose vision and objectives – Identify key coastal management issues and review coastal management arrangements – Determine where action is required through a first pass risk assessment	– Identification of the key knowledge gaps and how to bridge them – Established roles responsibilities and governance – Determination on whether a planning proposal will be prepared to amend coastal management areas and the Local Env Plan – Forward program for Stage 2 and Stage 3 of the coastal management program – A preliminary business case for recommended studies
	– Define the socioeconomic characteristics such as demographics, coast dependent economic activity, land use patterns and future development scenarios – Improve the understanding of the complexity of the issues and community perspectives – Ensure different perspectives are incorporated in the analysis of consequences and likelihood – Understand the range of potential future scenarios and the local community's attitude to risk	– Quantification of the nature and the extent of threats to public and private assets (both natural and built). – Context and data to support the identification and evaluation of management options in Stage 3. – Identification of opportunities to reduce risks and enhance the environmental, social and economic values. – The detailed information necessary for a planning proposal to amend the mapping of the coastal management areas
	– Confirm the strategic direction for the coastline and catchment – Identify potential options for integrated management of all coastal management areas. – Evaluate feasibility, viability and acceptability of management actions – Engage public authorities about implications for their assets and responsibilities – Evaluate mapped coastal areas and implications if a planning proposal is prepared	– Identify pathways and timing of actions – A business plan for implementation
	– Prepare a Coastal Management Program (CMP) – Submit the draft CMP to the Minister for certification – Review and adopt the draft CMP	– Exhibition of the draft CMP and any related planning proposal – Publishing of the certified CMP in the Gazette
	– Implement actions in the published CMP through the IP & R framework and land use planning system – Implement actions in partnership with adjoining councils and public authorities where relevant – Implement an effective monitoring, evaluation and reporting program – Monitor indicators, trigger points and thresholds	– Amendments, a review of and updates to the CMP – A report to stakeholders and the community on progress and outcomes through the IP&R framework

2.3 Towards the Bellingen Shire CMP

The final Bellingen Shire CMP will provide a framework for the future management of the catchment and coastal areas

Management challenges at a glance – the need for a CMP
Over time, the ability of the Bellinger River catchment to support a functioning ecosystem has been significantly compromised to the extent that several environmental, social, legal and planning issues now exist. Some of the key management challenges facing the catchment and broader coastal area relate to degraded waterway and estuary and coastline condition, increasing impacts of climate change, and barriers to implementing management actions.
The Bellingen Shire has experienced significant historical changes to land use as a result of European settlement. As pressure on the coastal areas increases and agricultural practices change, complex governance arrangements add to the complexity of managing legacy issues associated with riparian management and catchment runoff.

The low relief of the estuary exposes agricultural and urban areas (including Urunga, Mylestom and Bellingen) to the risk of tidal inundation due to sea level rise and increasing storm tides. There is some concern within the community as to how climate change and sea level rise will affect the beaches, estuary and existing infrastructure as they have already seen the impacts of storms in these areas. There is the ongoing need to quantify the threats and risks to the community.

With the new coastal management framework, the appropriate legislation is now in place to provide councils with the support to deal with complex issues associated with management of coastlines and coastal catchments. It is envisaged that the final Bellingen Shire CMP will provide a framework for the future management of the catchment and coastal areas. The framework will bridge key knowledge gaps on the social, environmental and economic impacts of erosion, poor water quality and tidal inundation in the catchment, which is key to the success of the CMP. Concurrent support for the adoption of the CMP from stakeholders and the community is essential.

Legislation and policy context for the NSW Mid-North Coast and statutory framework to the CMP
The statutory framework supporting the management of the Bellinger River catchment is complex. In addition to the regulatory and policy documents discussed as part of the coastal reform (Figure 3), several other key policy documents and pieces of legislation complete the regional statutory framework for the study area. This is illustrated and summarised in Figure 5.

Despite this complexity, progress has been made to simplify processes and aid the interaction between legislation for improved land use and environmental outcomes.

As part of the coastal reforms, the Marine Estate Management (MEM) Act 2014, includes an object: 'to promote the co-ordination of the exercise, by public authorities, of functions in relation to the Marine Estate'. Secondly, the Act's corresponding Marine Estate Management strategy identifies: 'inadequate, inefficient regulation or over regulation' as a priority threat to social, cultural and economic values derived from the Marine Estate. Finally, several actions in the MEM strategy (2.3 and 2.4) focus on reducing this threat in an evidence based, collaborative and strategic manner.

A range of management plans have previously been developed for the Bellinger-Kalang Estuary and Bellingen Shire coastline. Dalhousie Creek Entrance Management Strategy was drafted to formulate an approach for managing Dalhousie Creek entrance to maintain the safe access of Hungry Head Beach as well as the natural amenity (Hydrosphere, 2018). The Bellingen Coastal Zone Management Plan (CZMP) was developed under the superseded *Coastal Protection Act (1979)* which addressed the impacts of coastal hazards (BMT WBM 2017). The Bellingen Shire Council has also established a Healthy Rivers Program, which includes the Bellinger River Health Plan (2010) and Kalang River Health Plan (2010). The plans were developed under the NSW State

Government Estuary Management Program, which documents issues surrounding river health and water quality.

Further details of how objectives from local, regional and state policy and planning documents relate to the key management issues facing the Bellingen Shire are discussed in later sections of this document.

Uranga boardwalk

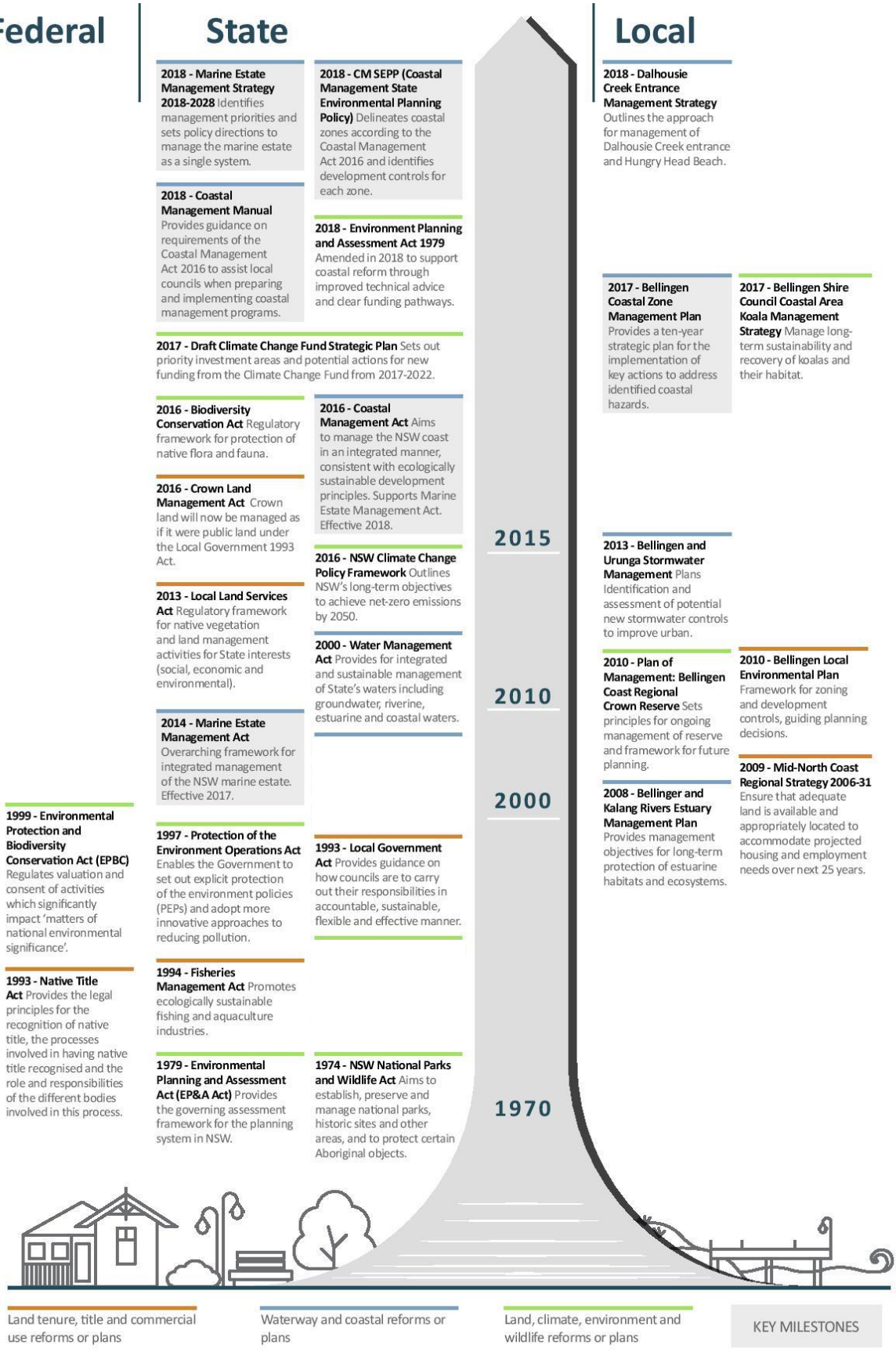


Figure 5. *Relevant federal, state and local legislation, policies and management plans and guidance material which comprise the statutory landscape for the Bellingen Shire CMP*

3 Strategic context of coastal management

The following section provides a review of the background information relating to the existing management practices and studies that have been conducted in the Bellingen Shire. This includes a literature review and summary narratives that incorporate the following elements:

Landscape context and physical processes shaping the landcape

Climate

Values and threats (environmental, social, economic).

3.1 Geology and soils

Key points

- The geology and soils in the catchment have been mapped using information from Geoscience Australia and the Australian Soils Classification system
- Soils within the lower catchment and estuary are highly erodible
- There is a high probability of ASS occurring along the length of the Bellinger River and Kalang River close to the upper tidal limits.

Geological setting

The Bellingen Shire lies within the New England Fold Belt. The landscape setting is one in which the coastal fringe meets the Carboniferous to Permian aged metamorphic slates of the Nambucca Beds group with minor igneous deposits (BMT WBM 2012). There are three broad topographical areas: the seaboard (Mylestom, Repton and Urunga), valleys and plateau (Dorrigo) (NSW Water Solutions 2012b). Much of the study area is at very low elevation within the seaboard and valley settings.

The Nambucca Beds are comprised of slate, phyllite, schist, lithofeldspathic sandstone and minor conglomerates, and is the dominant geology in the region. The remaining geology is largely a reflection of climate and sea level variations that have occurred over time. The channels in the catchment flow over Quaternary alluvium and a small area of the coastal zone south of Hungry Head is overlain by Quaternary dunes. Sea level high stands in the Pleistocene and Holocene have contributed to the formation of coastal barriers. The Holocene high stand is likely to have formed the present coastal dune system (BMT WBM 2012).

The underlying geology of the Bellingen Shire local government area (LGA) is shown in Figure 6.

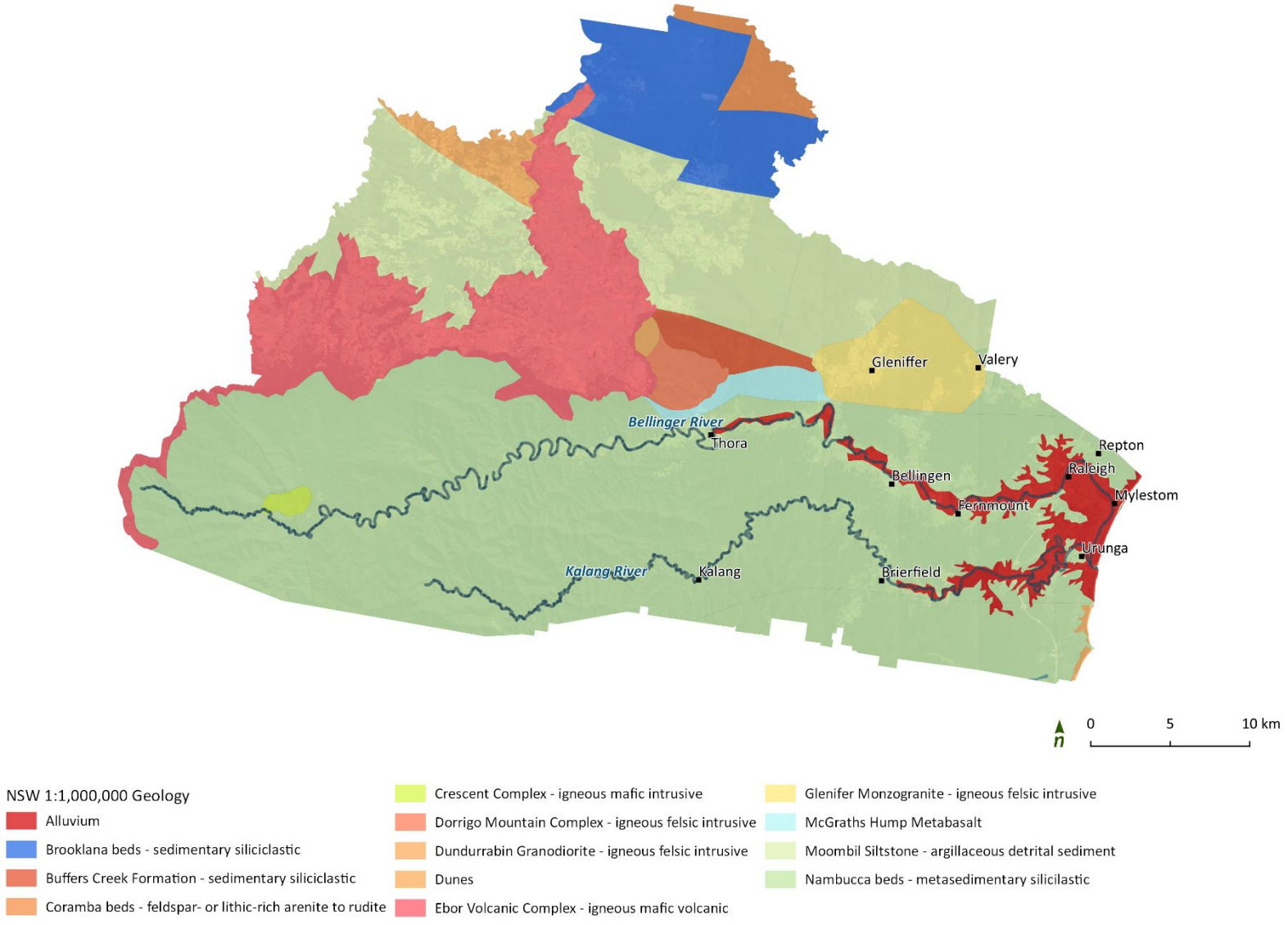


Figure 6. *Surface geology of the Bellingen Shire LGA (Geoscience Australia 2012).*

Soil classification
The soils of the Bellingen Shire within the coastal zone are shown in Figure 7. They have been classified according to the Australian Soils Classification scheme (CSIRO) which classifies the soils as they occur *in situ*, relating them back to the parent material and the geomorphic processes acting upon them.

Coastal areas: The soils along the Bellingen coastline are dominated by Rudosols, which are siliceous sands. These soils are composed of Holocene quartz beach sands that have been formed through aeolian processes and are therefore highly prone to erosion by wind, tidal dynamics and wave action. They are young in age as a result of sea level incursion occurring during the Holocene high stand. A number of dune areas along the Bellingen coastline have been disturbed by sandmining in the past, encouraging the infestation of weed cover, including bitou bush and lantana.

Lower catchment areas: Within the lower catchment area of the marine-tide delta and along the channels, the main soil types are podosols, hydrosols and tenosols (alluvial). The podosols are primarily organic-rich sands forming flat to gently undulating sandplains. They are strongly acidic soils that are highly susceptible to erosion by aeolian processes. Hydrosols are present up to the tidal limit along the Bellinger River and Kalang River. They have a predominantly clay texture, forming Holocene peats and muds that overly Holocene and Pleistocene clays which have acid sulfate potential (See Figure 7).

Floodplains: The alluvial tenosols form loamy to clayey soils on the floodplains, likely as a result of inundation during the Holocene high stand. They signify the transition to fluvially-dominated reaches of the catchment and demonstrate a change in the catchment slope. They have a high water-erosion hazard and generally have acid sulfate potential.

Hills: The overall dominant soil type in the Bellinger River catchment is kurosols, forming extensive areas of moderately inclined hills. These soils are predominantly clayey textured and have been derived from weathering of the Bellingen Slate. These soils are widespread throughout the forestry, grazing and horticultural areas of the catchment. They have a high erosion potential, particularly sheet and rill erosion in cropping areas.

Soils along the Bellingen Shire coastline are predominantly beach sands that are prone to erosion by wind, wave action and tidal processes.

Acid sulfate soils: Acid sulfate soils (ASS) pose a risk to estuarine water quality and can contribute to the degradation of lowland environments (Naylor et al. 1998). The disturbance of such soils leads to the oxidation of pyrite to sulfuric acid and the acid production can exceed the buffering capacity of the soil, generally causing the pH to fall below 4. Figure 7 highlights the probability of ASS in the Bellingen Shire within the area of interest. It is believed that ASS are widespread on the Bellinger and Kalang Rivers floodplain (BSC 2010a). The network of drains on the floodplain may cause the soils to become oxidised resulting in acid transport during subsequent rainfall events (BSC 2010a). However, there is currently inadequate water quality monitoring to determine the effects of ASS on the water quality in the Bellinger River and Kalang River estuaries. Only a small extent of the total catchment area has been mapped to determine the ASS risk.

The soils along the Bellingen coastline, Urunga Lagoon and Yellow Rock Island pose the lowest risk of producing ASS (See Figure 7). This is likely due to the sandy texture of the soils along the coastline. The greatest probability of ASS along the channels upstream of the Bellinger River mouth. There is a high probability of ASS occurring along the length of the Bellinger River and Kalang River close to the upper tidal limits. This higher risk is likely due to the clay soils that dominate the floodplain landscapes.

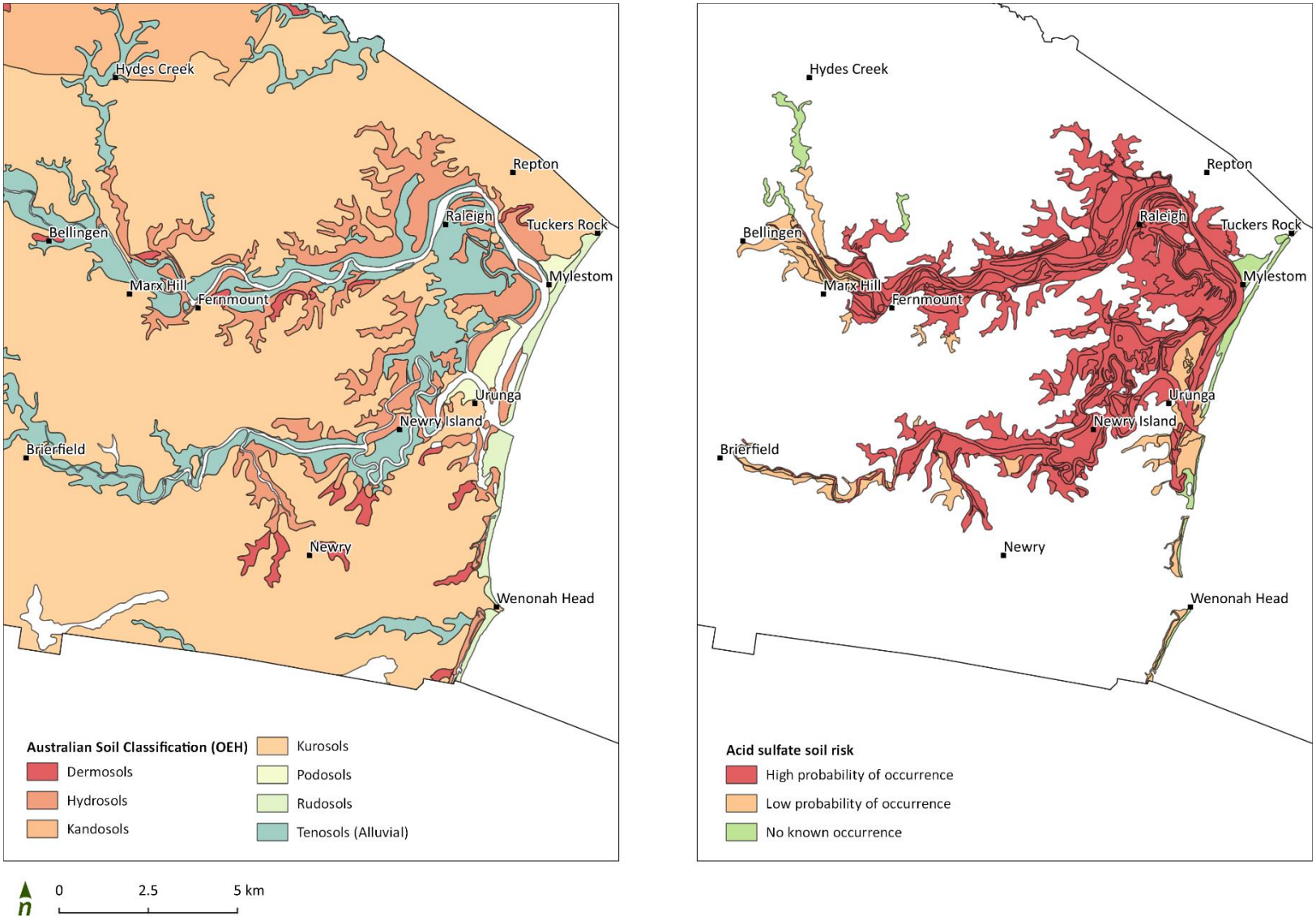


Figure 7. *Soils within Coastal Environment Area (as defined by SEPP) of the Bellingen Shire according to the Australian Soil Classification, and acid sulfate soil risk (OEH 2017).*

3.2 **Climate**

Key points

- A relatively short record of temperature and rainfall is available for the Bellingen Shire. Information has also been taken from a recording station located inland of the coast or outside of the Shire.
- The climate is sub-tropical, with most of the rainfall occurring from January to June.
- Climate change will have a range of implications for the Shire, including increased temperatures and extreme events (flooding, bushfire, erosion).

The climate within the Bellingen Shire is classified as sub-tropical. The region experiences warm, wet summers and mild, dry winters (DWE 2008). It is believed that the dominant climate influence will vary between seasons and years for the mid-north coast of NSW. At present it is understood that blocking high pressure systems influence synoptic-scale weather (Climate Risk 2010). Blocking highs are strong high pressure systems that can remain stationary for extended periods and have variable weather effects depending on their location (BoM 2008).

Temperature and rainfall

Data availability is limited within the Bellingen Shire. Figure 8 shows the mean minimum and maximum monthly temperatures for Dorrigo (light and dark green) within the Bellingen Shire. However, given the distance of Dorrigo from the coast (See Figure 1), the minimum and maximum temperature ranges at Coffs Harbour Airport (light and dark blue) have also been graphed to develop a better understanding of the climate within the coastal area. Mean summer high temperatures are between 3 and 5°C higher along the coast at Coffs Harbour compared to Dorrigo. The average winter lows were also higher at Coffs Harbour. There is an average annual rainfall of 2,170 mm, with majority occurring from January to June (BoM 2019b) (Figure 9).

Significant flood and storm events

The Bellingen Shire has been subject to significant flooding in the past. Major floods have occurred in 1946, 1950, 1954, 1974 and 2001 (Lawson & Treloar 2003). More recently, significant floods have also occurred in 2004, 2006, 2009 and 2013 (Figure 10). Lawson & Treloar (2003) have identified these flood events as the main cause of erosional channel change in the alluvial reaches.

A series of significant storm-tide events have also been experienced in recent times. During 2009, damaging storm tides occurred in February, March, May and November (BMT WBM 2012). It was observed that there was significant coastal erosion along the Shire's shoreline. It was remarked that the erosion caused by the 2009 storm tides was similar to the extent caused by storms during 1974 (BMT WBM 2012). According to BoM (2019d), there were also a number of storm events in November and December 2013, and in November 2015. However, reporting of these storms gave no indication of coastal erosion or flooding, only hail damage.

A changing climate and implications for the Bellingen Shire

Climate Risk Pty Ltd (2010) conducted a risk assessment of climate change for the Bellingen Shire. The following section is based on the findings in their report. Climate projections for the Bellingen Shire depict a warming of 0.9°C by 2030, 1.8°C by 2050 and 2.9°C by 2070. Temperature increases have been coupled with a decrease in the return period of heatwaves. Overall, the future total annual rainfall is not expected to vary much. However, projections indicate variation by month and season, with increases from November to May.

The CoastAdapt support tool, which employs eight climate models to predict temperature and rainfall extremes at a Local Government Area level, similarly showed projected changes in temperature extremes for the Bellingen Shire (Figure 11). Increases in hot days, warm nights and heatwaves have the potential to impact the liveability and productivity of the catchment. These increases could test the climate for which facilities, such as retirement homes, have been designed. Primary production may also be at risk, particularly those industries sensitive to climatic change. These industries may include intensive horticulture and oyster culture.

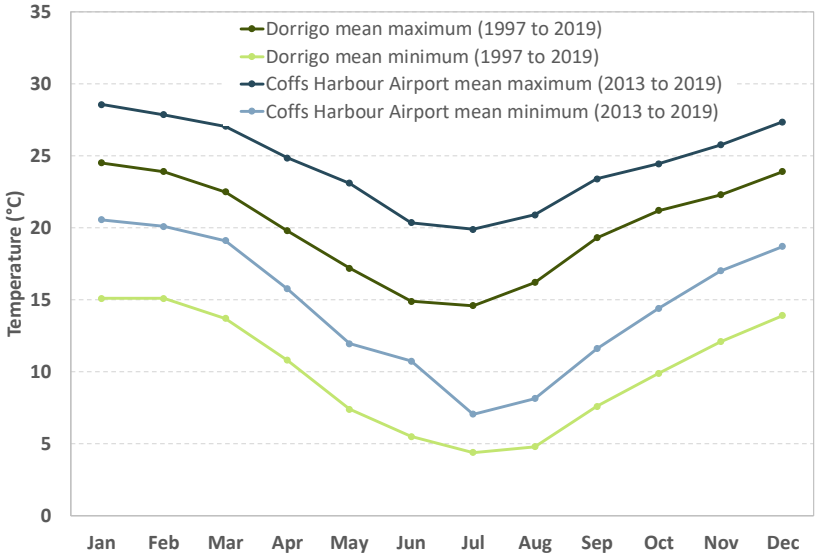


Figure 8. *Mean maximum and minimum temperature for Dorrigo from 1997 to 2019 and Coffs Harbour Airport from 2013 to 2019 (BoM 2019a)*

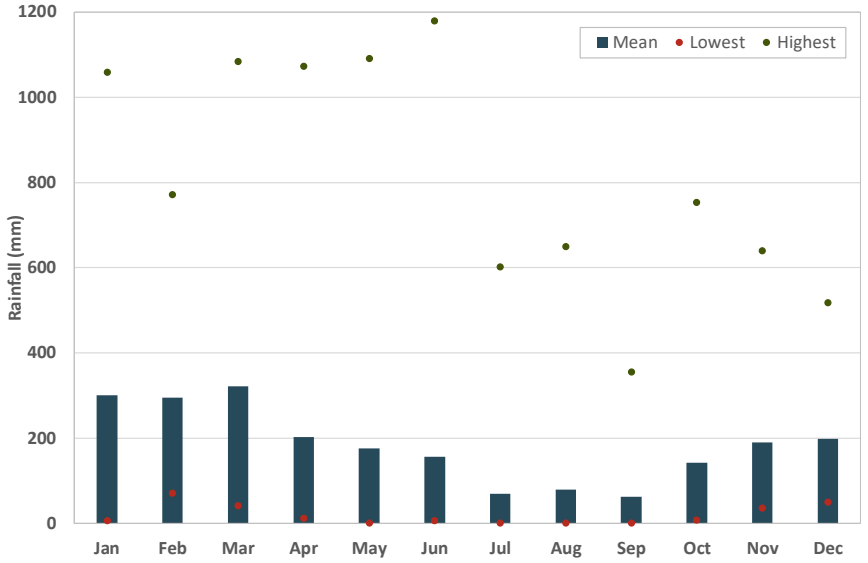


Figure 9. *Highest, lowest and mean monthly rainfall from 1966 to 2019 at Promised Land (Bellingen Shire) (BoM 2019b)*

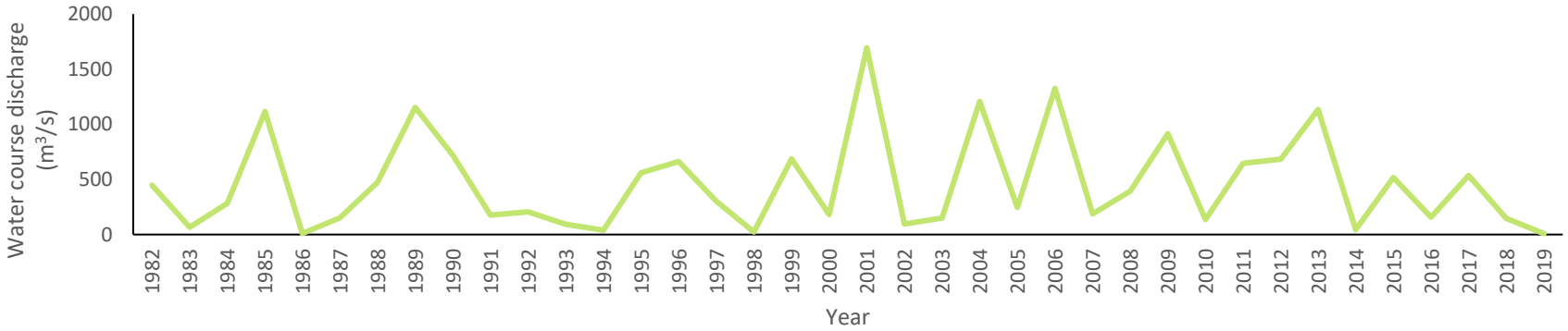


Figure 10. *Total annual rate of discharge volume from the Bellinger River at Thora – station number 205002 from 1982 to present (BoM 2019c).*

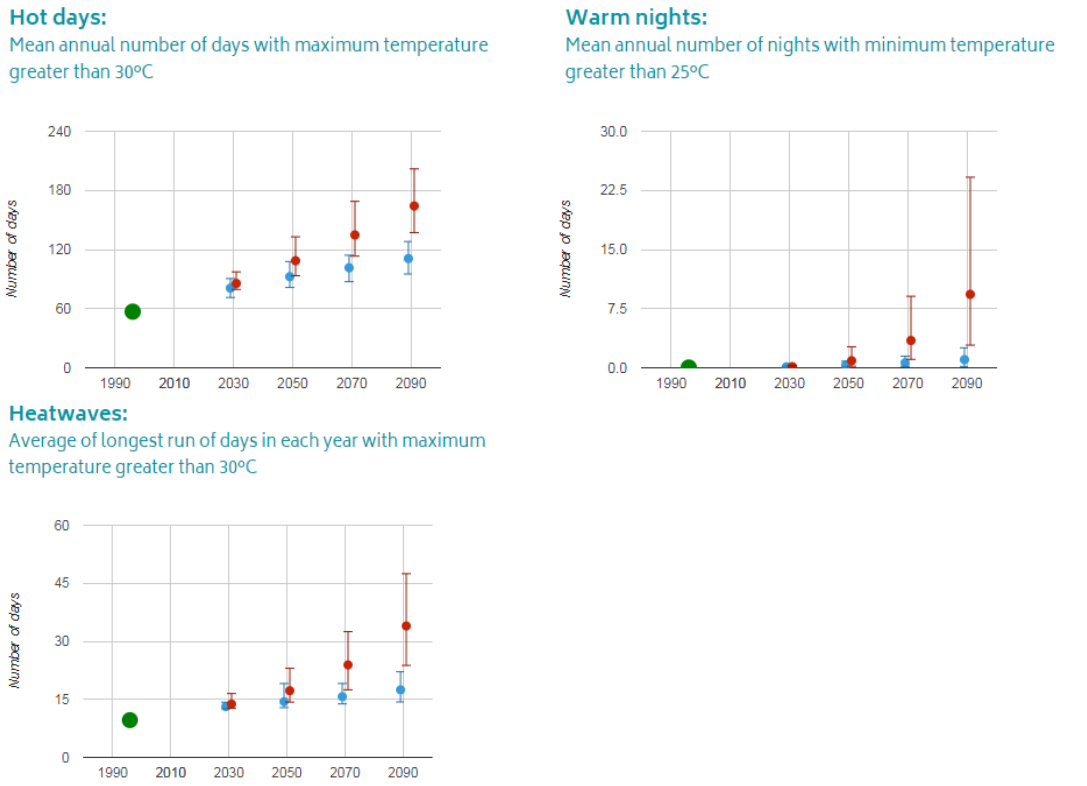


Figure 11. *Temperature extremes plot for the Bellingen Shire. The green dot represents observed conditions based on 1981-2010 data and the bars indicate future (modelled conditions for four time slices up to 2090. The red dots delineate the highest greenhouse gas scenario (RCP8.5) and blue represent the low (RCP4.5) scenario. The dot is the mean across the eight climate models, the upper end of the bar is the maximum value from the eight models and the lower end of the bar the minimum (NCCARF 2018).*

The potential changes in rainfall that could occur as a result of climatic change are presented in Figure 12. These changes indicate a mild reduction of rainfall in the near (2030), mid (2050) and long term (2090). Such changes may impact the viability of marginal primary production, aquifer recharge rates and the resilience of marginal ecosystems within the catchment/region.

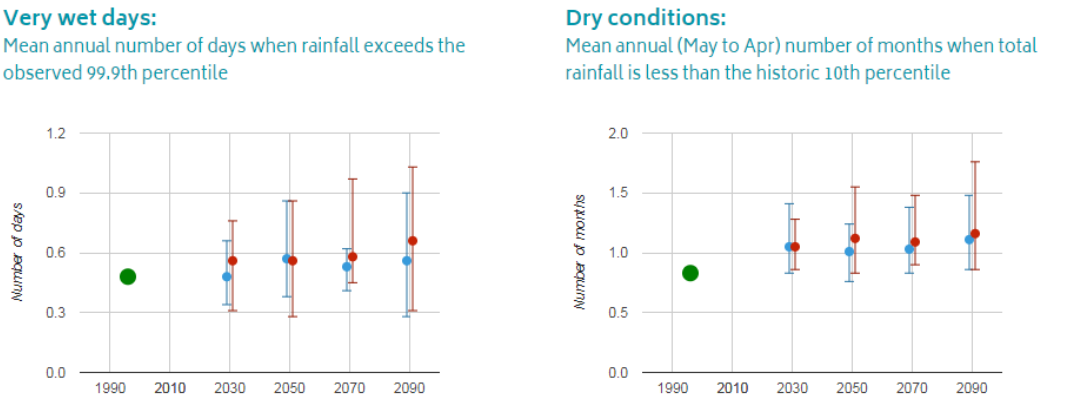


Figure 12. *Extreme rainfall plots for the Bellingen Shire. Very wet days which are the mean annual number of days when rainfall exceeds the historic 99.9th percentile, and Dry conditions which are the mean annual (May to April) number of months when total rainfall is less than the historic 10th percentile. The green dot represents observed conditions based on 1981-2010 data and the bars indicate future (modelled) conditions for four time slices up to 2090. The red dots delineate the highest greenhouse gas scenario (RCP8.5) and blue represent the low (RCP4.5) scenario. The dot is the mean across the eight climate models, the upper end of the bar is the maximum value from the eight models and the lower end of the bar the minimum (NCCARF 2018).*

The CoastAdapt risk assessment tool provides for the initial screening of climate change hazards and implications. This tool has been applied to the Bellingen Shire and considers the climate hazards relevant to the Bellingen Shire under a 2100 planning horizon assuming a RCP 8.5 scenario. A summary of the potential climate hazards and implications identified within the catchment are provided in Table 2.

Table 2. Summary table of potential climate hazards within the Bellingen Shire within the 2100 timeframe

Potential hazard	Have these occurred in the past?	Likely future direction of the hazard?	Which geographic area/sector/assets/ecosystems can be impacted?
Storm surge inundation	Yes	Increase	All low-lying areas within and adjacent to the tidal 2100 extent of Bellingen coastline as depicted in Figure 35.
Entrance instability	Yes	Increase	Any training walls and entrance management (including dredging) which did not take 2100 projected sea level rise (and associated sediment transport impacts) into consideration during construction.
Tidal inundation of estuary and surrounding area	Yes	Increase	All low-lying areas within the catchment which intercept the projected tidal inundation levels for years 2050 and 2100 at RCP 8.5. Refer to Figure 35.
Open coast erosion	Yes	Increase	Coastal areas including beaches, foreshores and estuaries may be exposed to increased storm frequency and intensity as a result of East Coast lows, variable swell direction and sea level rise.
Erosion within estuary	Yes	Increase	All exposed or poorly vegetated banks along Bellinger River and Kalang River and the estuary as outlined in low lying areas within the catchment at risk of inundation are also at risk of increased erosion.
Saline intrusion in estuary	Yes	Increase	Estuarine macrophytes, especially those at the upper end of the tidal extent, groundwater dependent ecosystems, groundwater dependent industry/agriculture. Low lying green spaces and recreation spaces. Primary industry through groundwater intrusion.
Prolonged summer heatwave	Yes	Increase	Entire catchment, especially townships (urban heat island effect), young and elderly, Primary industry
Increased number of hot days and nights	Yes	Increase	Entire catchment, especially townships (urban heat island effect), young and elderly, Primary industry
Surface water flooding	Yes	Increase	All low-lying areas within the catchment and proximal low-lying developed areas, particularly Urunga.
Erosion induced by excessive rainfall	Yes	Increase	All areas within the catchment with exposed soil.
Bushfire	Yes	Increase	Well vegetated areas and/or grasslands which are prone to drying out due to seasonality or drought. Downstream receiving waters including the estuary will be impacted by post-fire runoff.

The Bellingen Shire community have recognised the threat that climate change poses to their natural assets and values. On March 27th 2019, the Bellingen Shire Council voted to declare a climate emergency (Carey 2019). This leads the way for developing a strategic plan, works program and planning documents to address the climate emergency.

3.3 Historical changes to the catchment

Key points

- The Gumbaynggirr people are the traditional owners of the land.
- Extensive land clearing since European settlement has led to a loss of riparian vegetation, contributing to bank erosion and sedimentation.

The Gumbaynggirr people have occupied the Coffs Harbour region for thousands of years and were one of the largest coastal Aboriginal nations in NSW (Thomas 2013). Prior to European settlement, the land was viewed as rich, and the traditional owners often shared resources with surrounding Aboriginal nations. It is understood that the Gumbaynggirr people migrated seasonally to take advantage of available resources. They relied heavily on marine life for food, incorporating fish, oysters and pipis into their diet (NPWS 2010). The Gumbaynggirr people also relied on terrestrial food sources, including kangaroo, pigeon and possum, as well as fruiting trees.

Bongil Bongil is described by the Gumbaynggirr people as 'a place to stay a long time' due to the abundance of food

The Bellinger Valley was settled by Europeans in the 1840s, establishing the primary industry of cedar getting, with the initial settlement between Raleigh and the coast. The vegetative cover on the coastal floodplains was described by early settlers as "dense brush" and the alluvial plains were covered with broad-bladed grass, as well as cedar, rosewood, fig trees, nettle trees and plum wood (Telfer & Cohen 2010). Vegetation in the non-tidally influenced sections of the catchment was sparser than on the coastal plain.

Following European settlement of the Bellinger Valley, extensive areas of land were logged for cedar, then other rainforest species once those supplies had been exhausted. The Crown Lands Act in 1861 then saw further vegetation clearing by landowners. By the late 1890s, further lands had been cleared on the alluvial flats of the estuary for maize cultivation, seeing a shift from sub-tropical rainforests to bare floodplains by the beginning of the 20th Century. A period of drought conditions in the valley during the early 20th Century saw a shift away from maize cropping to dairy and beef cattle production.

Land clearing has led to a loss of riparian vegetation which is likely to have contributed to channel erosion and sedimentation in the lower reaches. Accounts suggest that during the first 50 to 60 years of settlement there was a change in the volume of sediment supply in the Bellinger River with the downstream aggradation of sediments (Telfer & Cohen 2010). However, this is a purely anecdotal observation and studies have yet to be conducted to understand the historical sediment supply in the catchment. In the early 1900s, a partially trained entrance and half-tide training walls were emplaced, primarily to improve navigability but they also control the hydrodynamics of the system (Lawson & Treloar 2003).

Over time, there has been a decrease in dairy production, however beef cattle remain widespread in the catchment. This transition was brought about by a number of factors, including de-regulation of the dairy industry, an increase in rainfall and the declaration of National Parks within the LGA. Current land use includes logging, agriculture, hobby farming, agroforestry, shared rural residential blocks, and a shift away from commercial shipping to recreational boating. Dredging of the lower estuary began in the early 20th Century to aid commercial shipping navigation for logging. It continues into the present day within the Raleigh Shoal for the purpose of providing construction materials to the Coffs Harbour region.

Figure 13, Figure 14 and Figure 15 highlight some of the major changes to the Bellingen River catchment since 1943 (including an unspecified year but assumed to be 1943).

Figure 13. *Historical imagery comparison of the Bellinger River catchment near Urunga between 1943 and 2019.*

Figure 14. *Historical imagery comparison of the Bellinger River catchment near Mylestom between an unspecified year (assumed to be 1943) and 2019.*

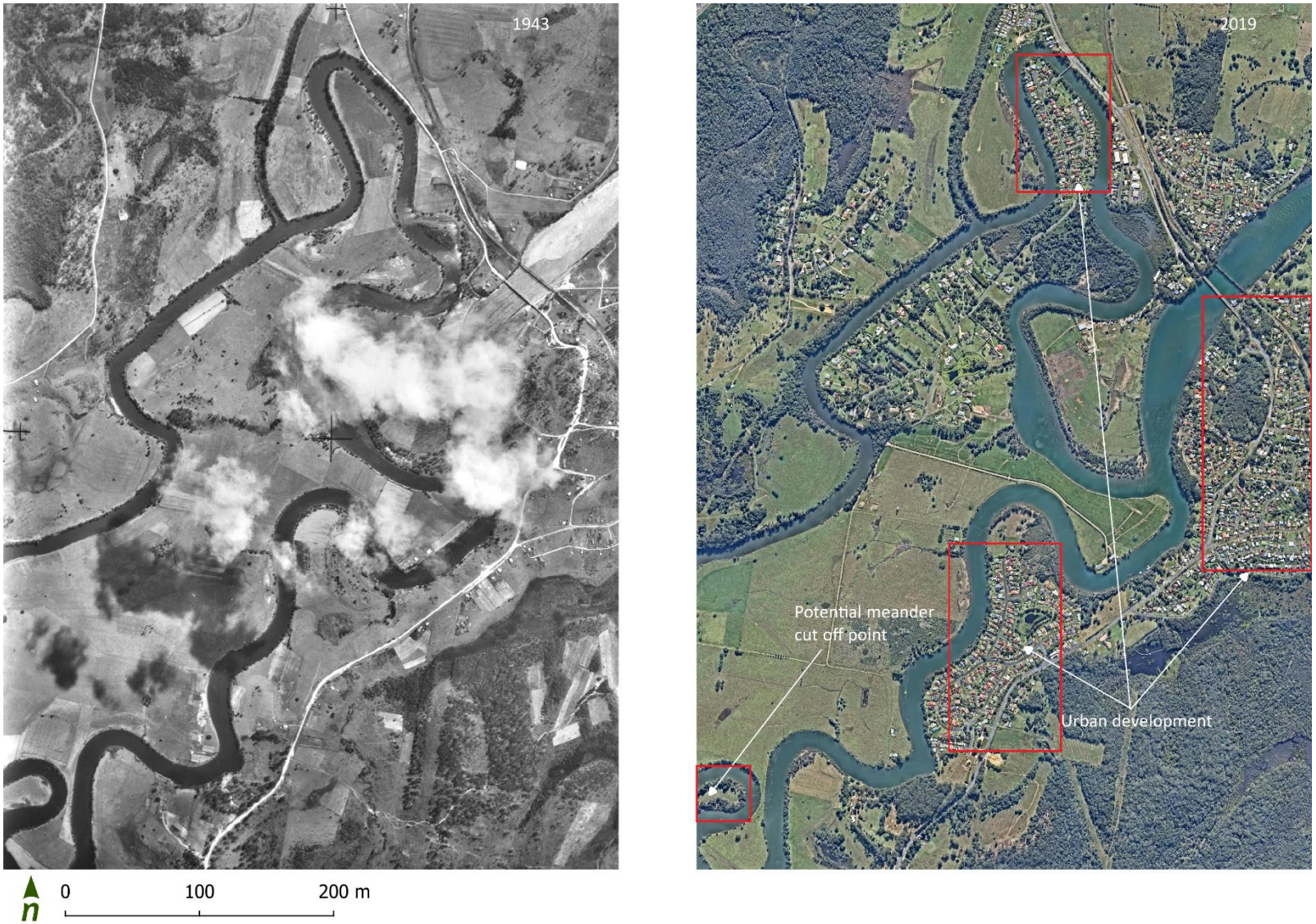


Figure 15. *Historical imagery comparison of the Bellinger River catchment near Newry Island between 1943 and 2019.*

3.4 Land use

Key points

- The natural environment is highly valued in the Bellingen Shire and there has been an increase in the area reserved for nature conservation over time.
- There has been a decrease in the marsh / wetland area.

Dominant land use

Bellingen Shire is considered to be a predominantly rural and natural area, with over half of the total catchment area designated to National Parks, State Forests, Nature Reserves and Crown Land (ABS 2018). In the coastal zone there is Crown Land dedicated for public use at Urunga, in the dune areas between the estuary entrance and Mylestom, and along the Mylestom foreshores (Lawson & Treloar 2003).

Land use in the catchment has changed since it was settled by Europeans in the 1840s. Presently, much of the area in the upper catchment is preserved under National Parks and for nature conservation (Figure 16). The land in this part of the catchment is used for production forestry or has residual native cover. Over the lower floodplains, land is primarily used for grazing on native vegetation and modified pastures, and residential and farm infrastructure. The agricultural practices primarily include dairy and beef farming and potato growing although these land uses are currently transitioning to profitable intensive horticulture (i.e. blueberries, avocados etc.).

The natural environment is highly valued in the Bellingen Shire and there has been an increase in the area reserved for nature conservation over time.

Trends in land use change

Land use data from 2007 (OEH 2010a) and 2017 (OEH 2019) which covers the Bellinger River catchment has been used for this scoping study to identify landscape changes which may be of significance to the CMP development. As different classification schemes were used for the 2007 and 2017 datasets, direct comparisons are difficult. However, Table 3 provides a summary of the land use changes throughout the catchment using standardised categories.

The major changes between 2007 and 2017 are summarised below:

- Residential and farm infrastructure increased from 0.99 % (2007) to 1.83 % (2017)
- Nature conservation area increased from 28.75 % (2007) to 32.54 % (2017)
- Grazing on modified pastures decreased from 18.93 % (2007) to 12.56 % (2017)
- There has been a decrease in marsh/wetland areas between 2007 (0.23 %) and 2017 (less than 0.15 %).

Table 3. Comparison of land use data for the Bellingen region from 2007 and 2017

2007 Land use			2017 Land use	
Area (km^2)	%		Area (km^2)	%
460	28.75 %	Nature conservation ↑	520	32.54 %
303	18.93 %	Grazing, modified pastures ↓	201	12.56 %
202	12.62 %	Production forestry ↑	341	21.30 %
0	0.00 %	Grazing, native vegetation ↑	140	8.72 %
16	0.99 %	Residential and farm infrastructure ↑	29	1.83 %
26	1.60 %	Water ↑	36	2.27 %
4	0.23 %	Marsh/wetland ↓	2	0.13 %
4	0.22 %	Seasonal horticulture ↓	0.1	0.00 %

NB. Percentages displayed as the proportion of total catchment area. Different land use classification schemes were employed for 2007 and 2017, meaning that the percentage difference between the standardised categories used in this table may not be reflective of actual land use change (trend only). Land use practices that generally increased in percentage are highlighted with green text (red for decrease).

Urban growth

It is assumed that there will be a slight population growth within the Bellingen Shire over the next two decades (ABS 2018). Population is expected to increase in the Mid-North Coast region, however, most of this is likely to occur in larger urban centres such as Coffs Harbour, Port Macquarie and Great Lakes area/Taree (DP 2009). There is a lower likelihood in the Bellingen Shire due to protection of much of the coastal zone under Crown Land, Nature Reserves and National Parks.

According to the BSC Economic Development and Tourism Plan 2015-2020 (2015), there is approximately 1,200 lots that could potentially be used for residential development, each covering a minimum of 600 m^2. These lots are located within the existing rural residential areas of the Shire. The Bellingen Shire had the greatest land yield, suggesting that much of the coastline will remain undeveloped. An increase in the population may place stress on the already limited resources in the region, such as the town water supply that is sourced from the borefield and is dependent on river flows (further discussed below). Population increases, coupled with climate change may place increased demand on the water supply, exceeding the licensed annual extraction limits (NSW Water Solutions 2012a).

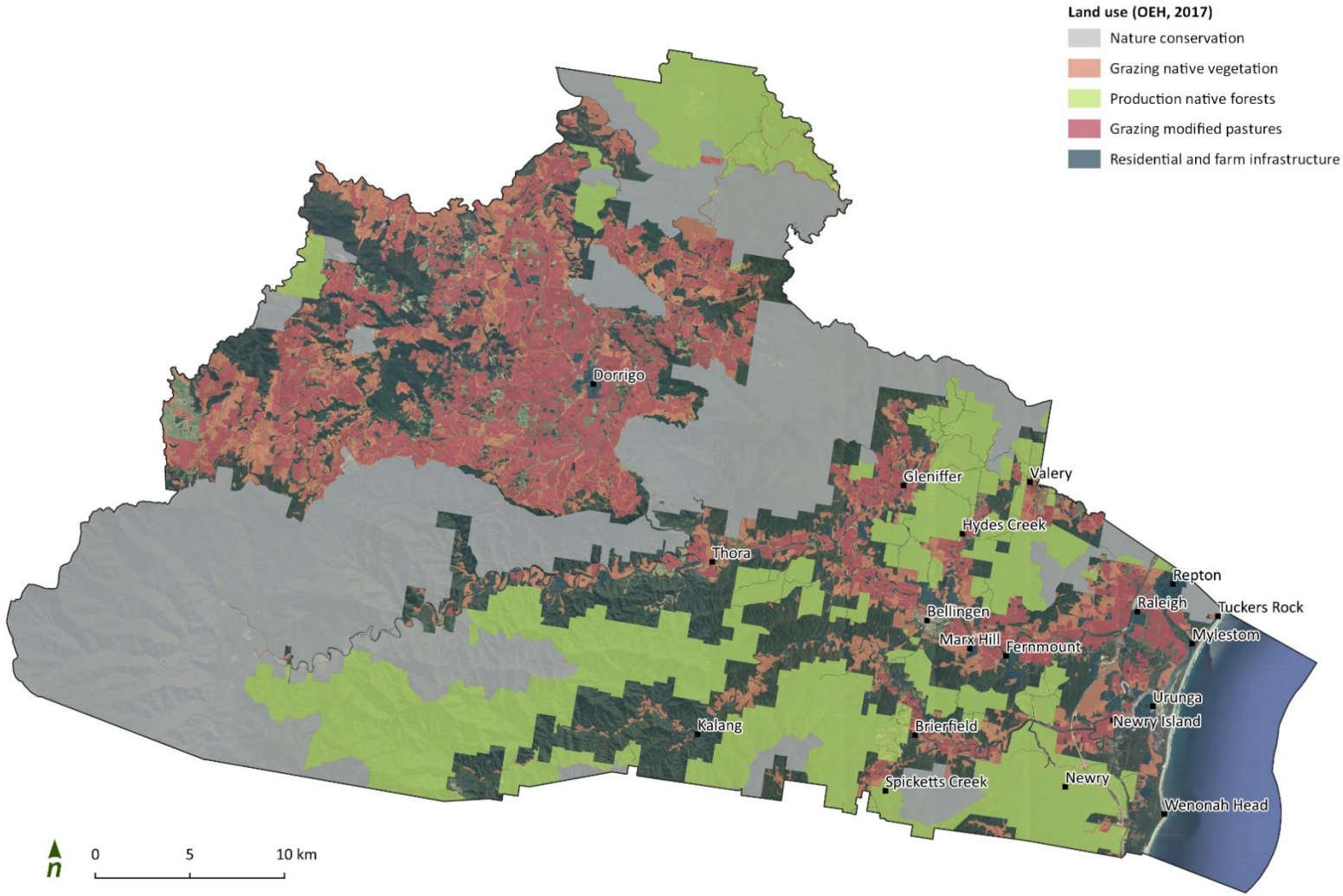


Figure 16. *A summary of simplified land use categories within the Bellingen Shire and its catchment (OEH 2017).*

3.5 Groundwater

Key points

- There is adequate information to inform the location of the groundwater aquifers and the connectivity to surface water stores.
- There is uncertainty on how climate change, particularly tidal inundation, will affect groundwater stores.

Groundwater dynamics in the Bellinger River catchment have an important role in protecting water-dependent environmental, indigenous, cultural and heritage values within the catchment. Groundwater also influences surface water quantity and quality. There are four aquifers within the Bellinger River catchment. These are:

- Coastal sands
- Up-river alluvial
- Coastal floodplain alluvial
- Fractured rock.

The aquifers are all managed and protected by water sharing plans under the *Water Management Act 2000*. The main water sources in the Bellingen Shire LGA are an infiltration well and three bores that are located upstream of the town of Bellingen on the Bellinger River.

The town water supply bore field is located under an alluvial flat and there is a strong hydraulic connection between the Bellinger River and the bores (DWE 2008; Water Solutions 2012b). The Bellinger up-river aquifer is considered to be highly connected to the Bellinger River and is situated upstream of the tidal limit (Water Solutions 2012b). The aquifer has a high impact on instream values due to its influence on base flows (DWE 2008).

The up-river alluvial aquifer is 1 km upstream of the tidal limit and is vulnerable to sea level rise (BMT WBM 2015). Water is currently drawn from the Bellinger up-river aquifer. If sea level rises and tidal inundation of the aquifer becomes a regular occurrence, it is unclear how this will impact groundwater stores and the Shire's water supply. There is presently little information available to further inform the groundwater processes and stores within the Bellingen Shire.

3.6 Ecology

Key points

- There are several ecological communities and species that are vulnerable to changing catchment and coastal processes, land use and climate change impacts.
- Seagrass, mangrove and saltmarsh communities are particularly vulnerable to sea level rise and coastal inundation.

Threatened, protected and migratory species

The 'Protected Matters Search Tool' was employed to identify species protected under the Environment Protection and Biodiversity Conservation Act 1999 within the Bellingen Shire. This search identified 95 threatened species and 57 migratory species within the catchment and its immediate surrounds (1 km buffer). This includes five threatened ecological communities; Coastal Swamp Oak, Littoral Rainforest and Coastal Vine Thickets, Lowland Rainforest, New England Peppermint Grassy Woodlands, and Subtropical and Temperate Coastal Saltmarsh (DEE 2019). It also includes a number of threatened migratory shorebirds.

Threatened ecological communities within the Bellingen Shire coastal area include:

- Littoral rainforest
- Coastal vine thickets
- Migratory shorebirds
- Grey-headed flying fox

NSW BioNet was also used to identify species that are classified as critically endangered or endangered within the Coffs Coast and Escarpment IBRA sub-region, which encompasses the shire of Bellingen (2020). Seven species were identified to be critically endangered, including the Bellinger River Snapping Turtle (BRST) and Beach Stone-curlew. An additional 53 plant and animal species were identified to be endangered, including the Pied Oystercatcher, Southern Giant Petrel, and loggerhead and leatherback turtles.

Ecology

Flora

There are five endangered ecological communities identified within the coastal zone of the Bellingen LGA. Littoral Rainforest and Coastal Vine Thickets communities are of most concern to this CMP. The Dalhousie Creek to Hungry Head Headland Vegetation Management Plan sets out objectives and directives for the management of the vegetation in the Hungry Head precinct of Bellinger Heads State Park (BBR 2019).

There are four patches of Littoral Rainforest spread over Tuckers Rocks, Urunga Lagoon, and Hungry Head on the sheltered sites at the base of the dunes (BBR 2019). A patch located behind Hungry Head SLSC is in poor condition compared to the other sections. The spatial extent of the Coastal Vine Thickets is not clear. The vegetation management plan offers a number of construction works including:

- Permanent fencing and signage to reduce trampling of vegetation and formation of informal pathways
- Erosion control works at Hungry Head Headland to mitigate topsoil and vegetation loss
- Assisted regeneration to various levels
- Weed control
- Maintenance and monitoring program

This plan was a requirement of the superseded CZMP and should thus be incorporated into this updated CMP to ensure the continued management of these vulnerable vegetation communities and associated management of other issues related to the Bellingen Shire CMP.

The largest contiguous zone of protected native vegetation is contained within the New England National Park, which makes up 15 % of the total catchment area. Within the coastal zone, Bongil Bongil National Park is the main protected area. Mapping suggests that the main vegetation within the National Park is wet sclerophyll forest comprised of blackbutt, flooded gum, turpentine and tallowwood species.

Recent state-level vegetation mapping has determined the extents of both Coastal Wetlands and Littoral Rainforests within the Bellingen Shire under the Coastal Management SEPP. Approximately 3.1 km^2 is classified as Coastal Wetland within the Bellingen Shire. This includes large areas of the Bellinger-Kalang Rivers estuary. Four small areas of Littoral Rainforest areas comprising of less than 1 km^2 are located in the catchment near Tucker Rocks, Urunga Lagoon and Hungry Head on sheltered sites at the base of the dunes (Figure 17).

Fauna

Within the Bellinger-Nambucca coastal corridor, the grey-headed flying fox and coastal shorebirds have been identified as key faunal species that are most vulnerable to climate change (DE & CC 2007). It is unclear which specific shorebird species are most at risk, however, as the entire coastline is considered to be under threat, it is likely that most or all shorebird species are vulnerable. DEE (2019) lists a number of threatened shorebird species - bittern, sandpiper, albatross, petrel, godwit, noddy, swift, shearwater, frigatebird and tern.

Koala populations in NSW are in decline (BSC 2017a), with range contraction and loss of habitat considered to be the main threats to koalas. Key areas of range contraction include south-west of Bellingen town, south and west of Urunga and along the coast of the southern extent of Bellingen Shire (BSC 2017a). Core koala habitats that still remain are located on the northern side of the Bellinger River, near Mylestom on the coast (Figure 17). It is believed that a decline in suitable habitat has occurred, however, the cause of the decline trend is uncertain. Threatened species recorded in Bongil Bongil NP also include koala and grey-headed flying fox.

Aquatic ecology

As mentioned above, NSW BioNet has identified the Bellinger River Snapping Turtle to be critically endangered. Other aquatic species that are vulnerable or endangered include Black Rockcod and a number of frogs. The Bellinger River Snapping Turtle population has been affected by water quality issues, which is discussed in further detail in Section 3.7. A virus reduced the population by around 90 % but captive breeding has increased the numbers. Following the disease outbreak, around 20 unaffected turtles were collected from the Bellinger River for the captive breeding program at Taronga Zoo. Ten turtles have since been released back into the wild to increase local population numbers. Funding for the breeding program has been given through the Saving Our Species Fund and efforts have been coordinated locally by OzGREEN, which is an Australian citizen science organisation.

Additionally, there have been sightings of loggerhead turtles and leatherback turtles along the coast of Bellingen Shire (BioNet 2020). The dune systems would provide suitable habitat for nesting and are therefore crucial to manage against coastal hazards in the future that may result in important habitat loss. Turtle nesting in southern regions may increase in the future as temperatures warm under climate change and the breeding habitat expands southward. Other threatened aquatic species that may occur within the estuary or around the coastline include grey nurse sharks, great white sharks and black rock cod (Lawson & Treloar 2003).

Bellinger River Snapping Turtle that is part of the captive breeding program at Taronga Zoo in an effort to increase population numbers following a virus outbreak in the Bellinger River. Source: https://www.abc.net.au/news/2019-05-23/rare-endangered-bellinger-river-turtles-returned-to-wild/11141358

Seagrass, saltmarsh and mangrove communities

Seagrass, mangrove and coastal wetland communities have been considered high value ecological assets that are susceptible to sea level rise and coastal inundation. There remains small areas of mangroves, saltmarshes and seagrasses within the estuarine area which are illustrated in Figure 17. All three estuarine macrophyte communities are protected under the *Fisheries Management Act 1994.*

There are several seagrass communities, the largest of which is in the shallow waters of Urunga Lagoon. Other communities are located along the Bellinger River near Urunga Island and Newry Island. These seagrass communities provide food and shelter for fish and invertebrate species of economic significance.

Vegetation clearing following European settlement, has seen a significant loss of estuarine wetlands in the Bellingen Shire. The remaining mangrove habitats provide refuge for high-value fisheries, as well as bank stabilisation and nutrient cycling. The largest communities exist along the Bellinger River, at Back Creek and Urunga Lagoon, and at Newry Island along the Kalang River.

Coastal saltmarsh communities of northern NSW provide habitat for fisheries species of value and conservation significance. The largest area of saltmarsh in the Bellinger-Kalang estuary is at Urunga Lagoon. There are smaller patches of saltmarsh along Back Creek, and at Urunga Island and Newry Island.

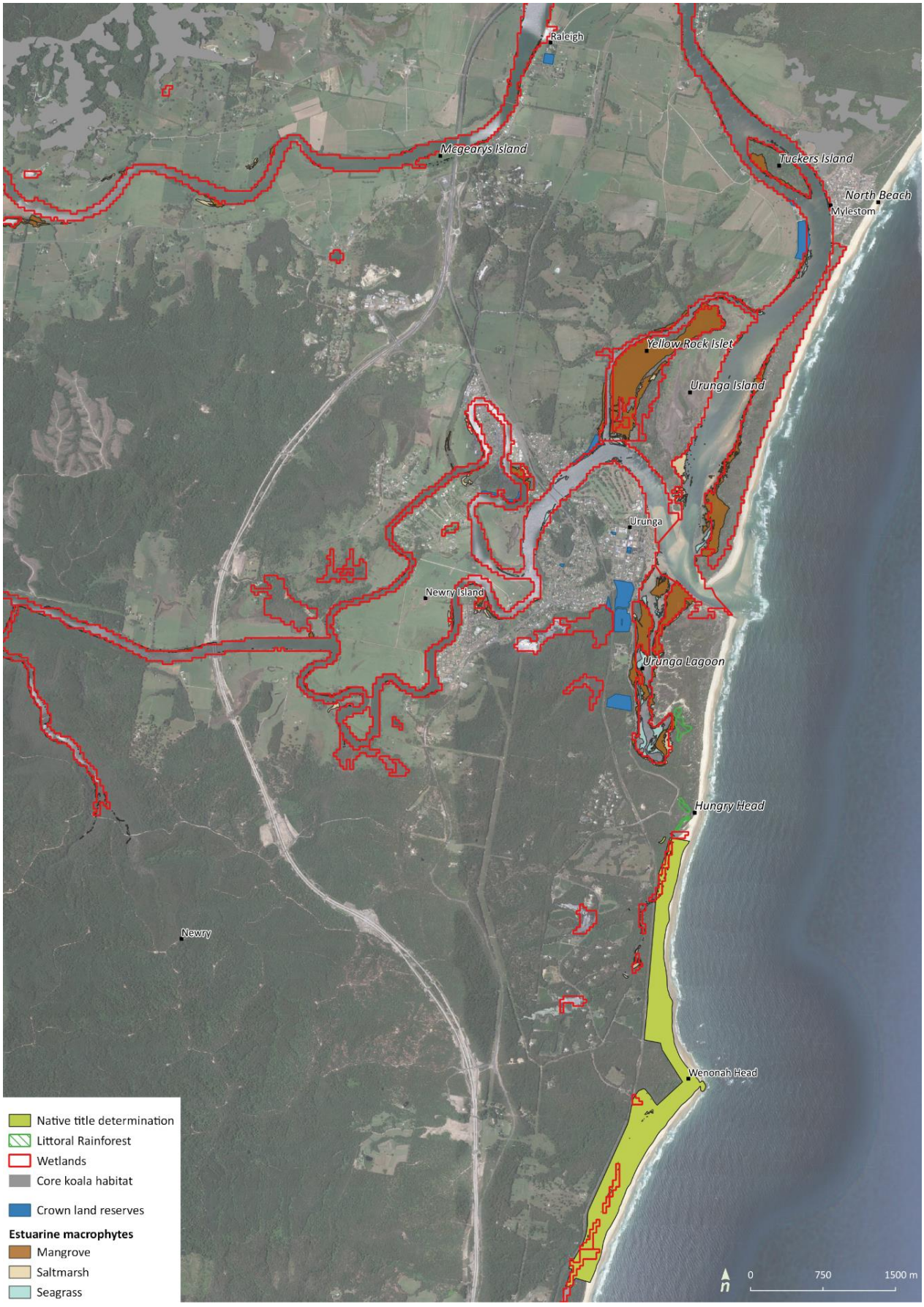


Figure 17. *Summary of ecological values for the Bellingen Shire Coastline (OEH 2010b; OEH 2018)*

3.7 Water quality

Key points

- The waterways in the Bellingen Shire have faced numerous water quality issues, and notable events have led to the closure of the oyster farms and the die-off of the Bellinger River Snapping Turtle.
- Sites in upstream sub-catchments of the Bellinger River are significant contributors of nutrients, including TN and TP.
- Recently, the Bellinger Riverwatch program commenced regular water quality monitoring at 24 sites along the Bellinger River and Kalang River.
- Improving the water quality and having low turbidity streams will continue to be key management challenges for the Bellingen Shire and the Bellinger-Kalang Rivers and estuary.

The waterways in the Bellingen Shire are highly valued by the community and visitors. The coastline and estuaries are used extensively for swimming, surfing, canoeing, sailing, aquaculture and fishing (BMT WBM 2007). Water quality has been a persistent issue for waterways within Bellingen Shire LGA. Poor water quality has led to the closure of oyster farms in the estuary and may have also contributed to a disease outbreak that killed a large number of Bellinger River Snapping Turtles (BRST). Following the mass death of BRST, Bellingen Riverwatch was established to consistently monitor water quality in the Bellinger River and Kalang River catchments.

Impacts on water quality

Water quality within the Bellinger River catchments is influenced by stock access, bank erosion and riparian condition, runoff from farms, drain management and waste disposal. The majority of water quality issues stem from diffuse source pollution, and include sediments, nutrients, pathogens, chemicals, acidity, salinity and rubbish (BSC 2010a). The key water quality issues that have been identified area are elevated levels of:

- nutrients (nitrogen (N), phosphorus (P)) concentrations
- Chlorophyll *a* in the upper estuary reaches
- faecal coliforms
- sediment levels (BSC, 2010a).

Key water quality management issues identified in the literature review are discussed below.

Disease outbreaks

Oyster farming is the dominant aquaculture industry within the Bellingen Shire estuaries. Closures of oyster harvesting areas began in December 2007 after a disease outbreak occurred (DPI 2017). The disease, known as QX disease, has affected numerous waterways in south-east Queensland and northern NSW and resulted in the closure of oyster farms on the Bellinger River until 2016 (DPI 2019; Schulenberg 2016). While the presence of the infective organism is the main cause of the disease, it may also be caused by environmental factors that increase the susceptibility of the oyster to infection (DPI 2017). The DPI (2017) now sets water quality guidelines for oyster aquaculture areas, which includes monitoring for faecal coliforms, pH, salinity, suspended solids, aluminium and iron.

Large number of adult Bellinger River Snapping Turtles (*Myuchelys georgesi*) were observed to be dead or dying in February 2015. This is a species that is only found in the Bellingen LGA, with a smaller population in captivity at Taronga Zoo (OEH 2019c). The cause of the large snapping turtles' die-off remains unclear (Spencer et al. 2018; Zhang et al. 2018). Spencer et al. (2018) hypothesise that environmental conditions and poor water quality were likely to have contributed to the event, making the snapping turtle more susceptible to the novel

nidovirus that was identified on the affected animals (Zhang et al. 2018). The water levels in the Bellinger River and Kalang River were extremely low and elevated water temperatures were reported (Spencer et al. 2018). These conditions may have stressed the animals and made them more susceptible to contracting the virus. A conservation strategy has been developed by OEH (2019) to prevent such events occurring again. This includes collecting water quality data on a monthly basis, monitoring to ensure:

- Specific macroinvertebrate populations are present
- High dissolved oxygen
- Low sedimentation and turbidity levels
- Good riparian health

Measuring and modelling water quality parameters
The following section is based on a review of the Bellinger-Kalang Rivers Ecohealth Project (Ryder et al. 2011) which was conducted prior to the establishment of Bellinger Riverwatch in 2017. Monthly water sampling was undertaken during the study period between October 2009 and September 2010 at 12 sites along the Bellinger River and Kalang River. Ryder et al. (2011) used the following parameters as indicators of water quality:

- pH
- Temperature
- Salinity
- Dissolved oxygen
- Turbidity
- Total nutrients (nitrogen (N), phosphorus (P))
- Chlorophyll *a*
- Total suspended solids (TSS)

The following discussion will only consider nutrients, dissolved oxygen, turbidity/sediments, temperature, pH and salinity.

Nutrients: Nutrient levels in the estuary, including Total Nitrogen (TN) and Total Phosphorus (TP) are a major concern for water quality. The Bellinger River upstream of the estuary has been shown to be the key contributor of nutrients to the system (Ryder et al. 2011; OEH 2018b). Trigger values were exceeded for both TN and TP at nearly all sites along the Bellinger River and in the estuary, with fewer sites of concern along the Kalang River. Over the study period it was observed that the greatest nutrient values coincided with the highest discharge events in November and March. It was found that TN was higher than TP on all sampling occasions, which is consistent with most coastal river systems. This study was conducted during a period of lower flow. During a flood-dominant regime, the nutrient levels in the catchment may be higher.

OEH (2018b) modelled TN, TP and TSS run-off values (reported as kg/ha) for NSW as a first-pass assessment to aid prioritisation of catchment management actions (Figure 18). TN values were higher along the Bellinger River compared to the Kalang River and values were typically higher in upstream sub-catchments compared to the estuary. A similar pattern is evident for TP, where values were higher in the Bellinger River (see Figure 19). Results from the Bellingen Riverwatch program indicate that water quality may be improving, however, some monitoring results show that there are still sites, mostly along the Bellinger River, that regularly exceed trigger values for TP readings (Figure 21).

The Bellinger River and its tributaries dominate TSS loads with more than 4,320 tonnes entering the estuary annually in contrast to sediment loads of 86 tonnes annually from the Kalang River.

Suspended sediment: Total suspended sediments (TSS) is an indicator of turbidity and sedimentation in the stream. Ryder et al. (2011) demonstrated that freshwater turbidity was in exceedance of the trigger values only once at a site along Spicketts Creek. The values for turbidity, however, were higher in the tributaries than the main river. This is most apparent in the Bellinger River and its tributaries, which dominate the TSS loads with an annual load of more than 4,320 tonnes entering the estuary during the sampling period. In contrast, sediment loads entering the estuary from the Kalang River is only 86 tonnes annually. OEH (2018b) modelling of TSS values were also highest in the Bellinger River catchment, with the highest values in the same sub-

catchments that reported the highest TN values (see Figure 20). The modelled TN, TP and TSS values suggest that land uses within the mid to lower Bellinger River catchment are resulting in significant pollutant generation.

pH and dissolved oxygen and sediment: Estuary pH readings record by Ryder et al. (2011) ranging from 5.88 to 9.03. These exceed the trigger value range of pH 7 to 8.5. An increase in salinity downstream was expected and demonstrated in sampling. The salinity trigger value was never exceeded at any of the sites. The trigger value for dissolved oxygen (DO) is 80 % saturation. Estuarine sites in the study were consistently measured to be below this value. There was also a pattern of decreasing DO with distance downstream in both the Bellinger River and Kalang River systems. Temperature was measured to be higher in the estuarine reaches compared to the upper reaches, likely due to the shading effect from the greater riparian extent along the upper reaches. According to Ryder et al. (2011), temperature ranged from 16.3°C in Spicketts Creek to 30.1°C in the Bellinger salinity zone.

Critically endangered Bellinger River snapping turtle – Source: https://www.nsw.gov.au

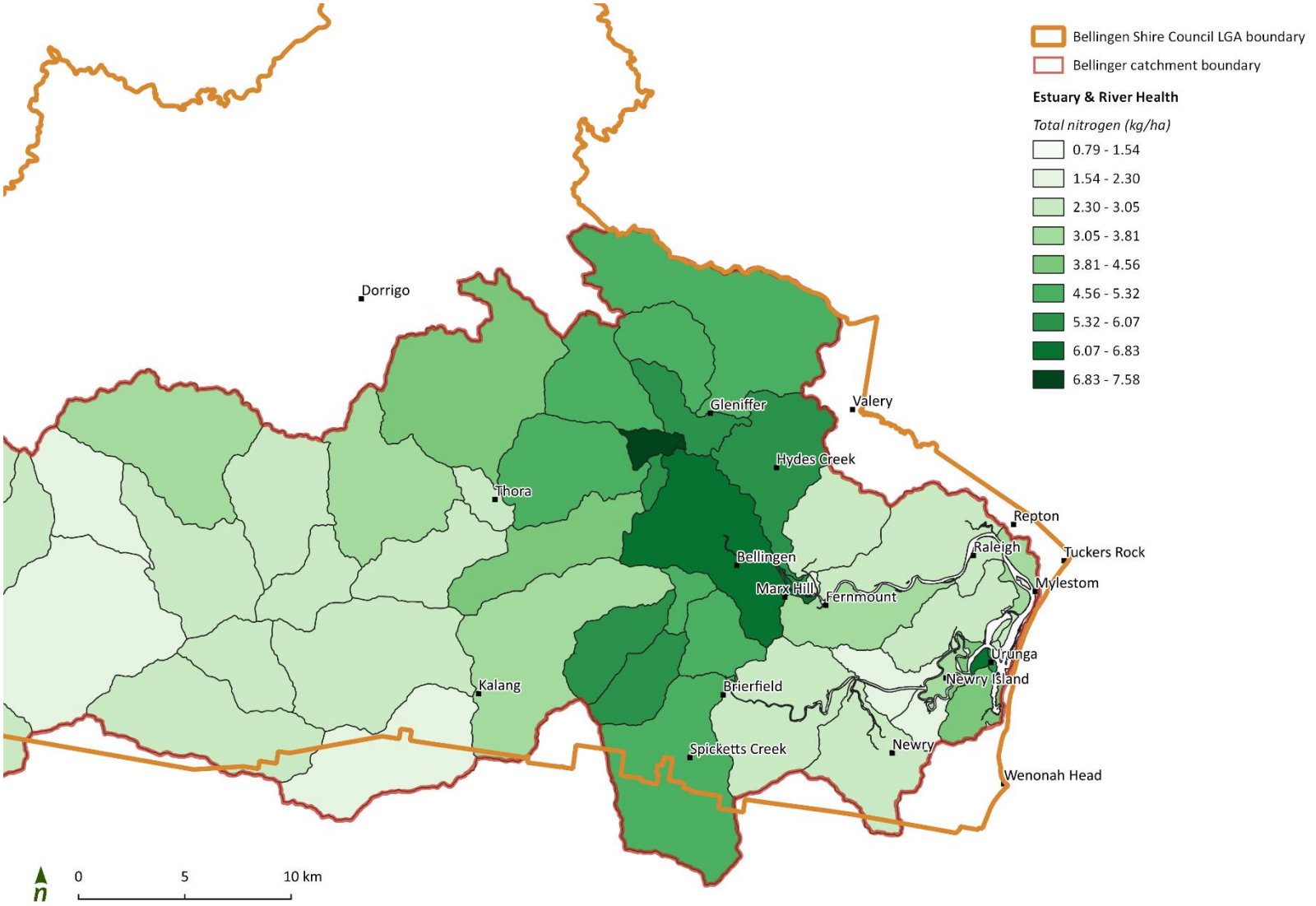


Figure 18. *Modelled total nitrogen (TN) (kg/ha) for the Bellingen Shire sub-catchments along the Bellinger River and Kalang River (OEH 2018b).*

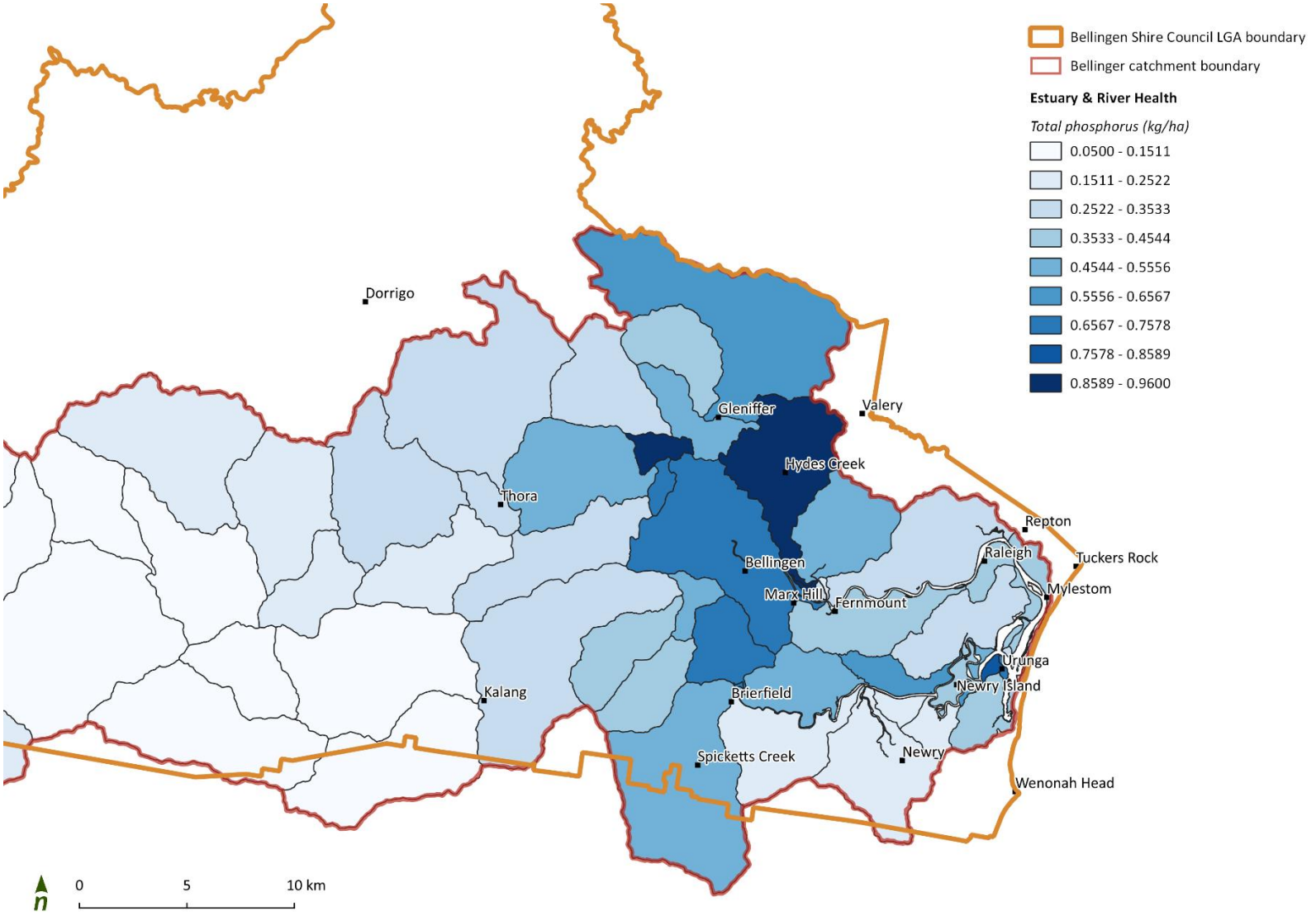


Figure 19. *Modelled total phosphorus (TP) (kg/ha) in the Bellingen Shire sub-catchments along the Bellinger River and Kalang River (OEH 2018b).*

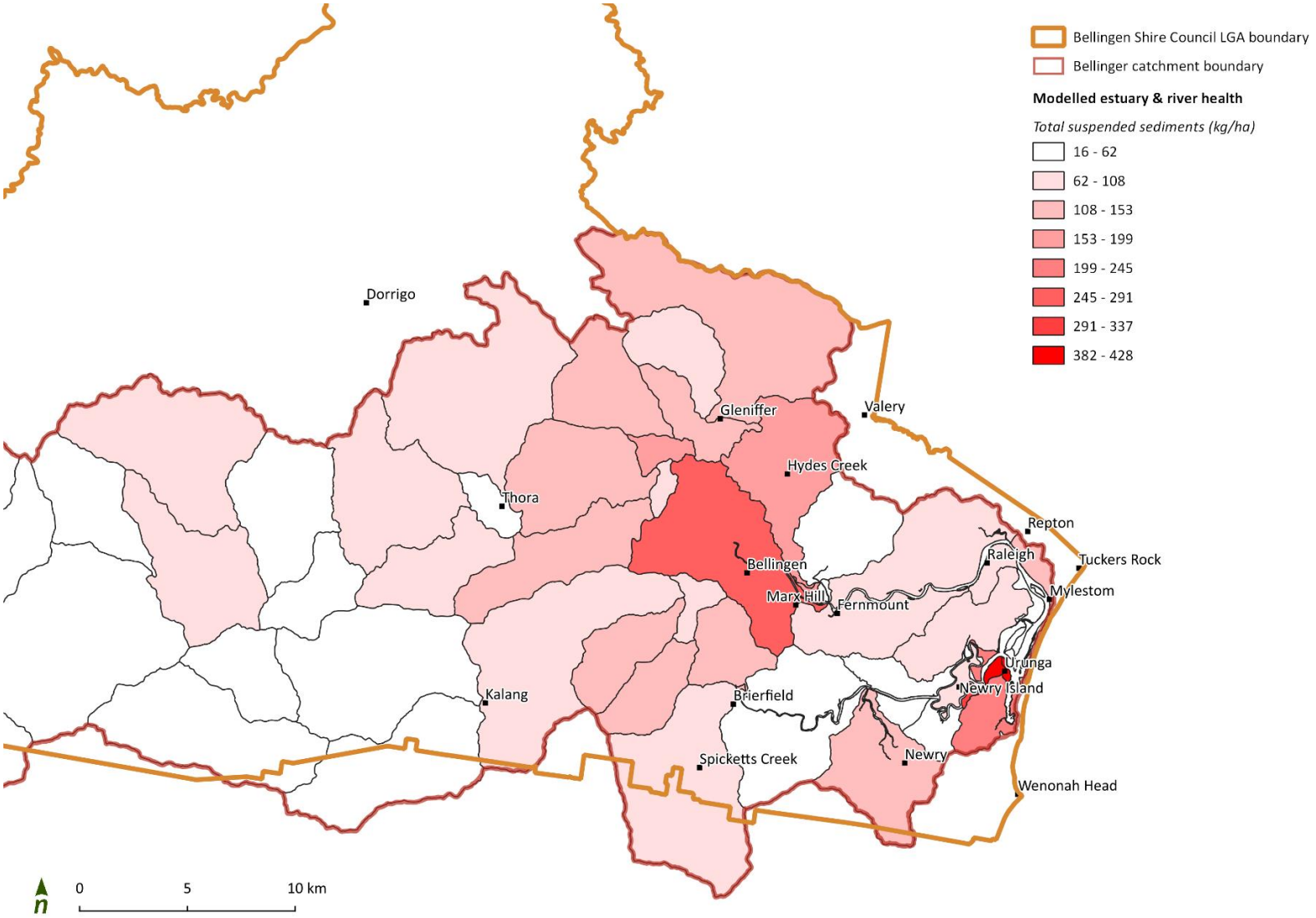


Figure 20. *Modelled total suspended sediments (TSS) in the Bellingen Shire sub-catchments along the Bellinger River and Kalang River (OEH 2018b).*

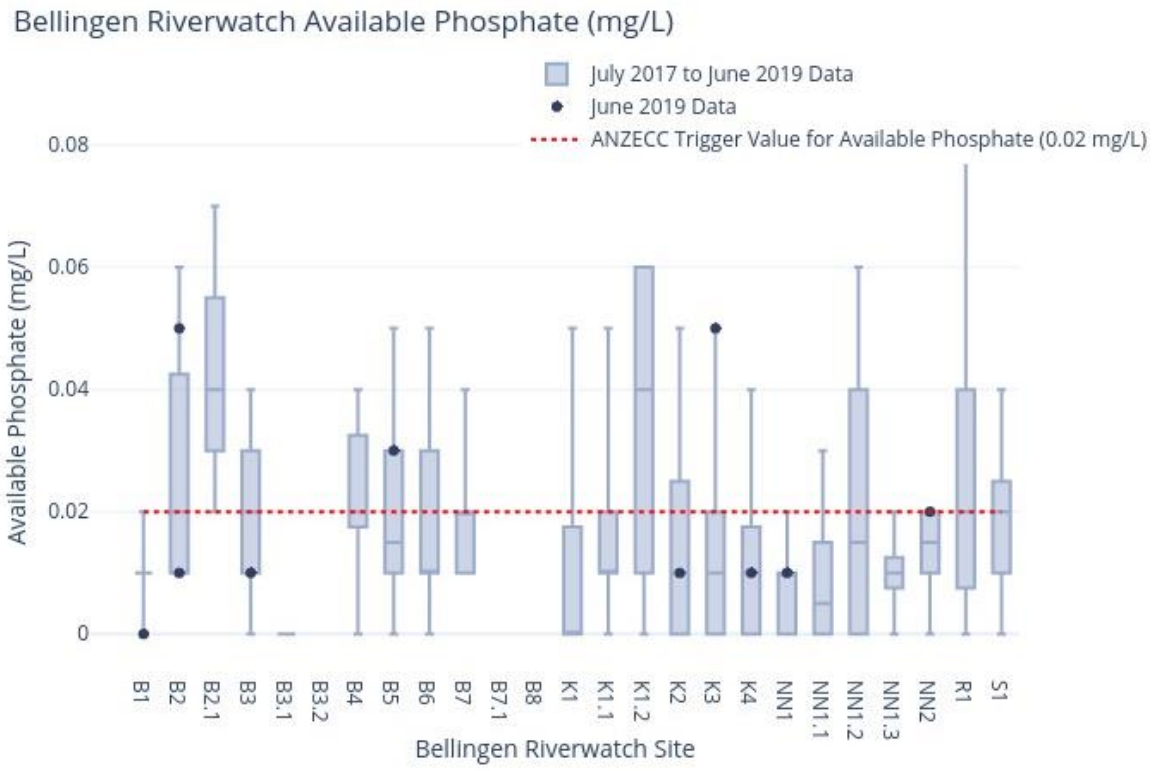


Figure 21. *Riverwatch water quality results for phosphate at monitoring sites along the Bellinger River and Kalang River (OzGreen 2019).*

Monitoring

The Bellingen Shire Council (BSC) does not have water quality monitoring objectives in place for the Bellinger-Kalang Rivers estuary and catchment. A target for water quality has been suggested to maintain a sustainable oyster farming industry (BMT WBM 2007). However, following the BRST disease outbreak discussed above, the Bellinger Riverwatch program commenced regular monthly monitoring of a number of parameters in 2017 across 24 sites. The sites were chosen based on existing monitoring locations and where it was easy for volunteers to access. This is a community-run endeavour that relies on volunteers to collect samples, however, it is a joint venture between a range of partners, including Council and state government. The sampling sites were chosen based on existing monitoring sites and safe access for volunteers. A map of the sampling sites within the Shire is given in Figure 22. It is evident from the map that there is a lack of waterway monitoring closer to the coastline, particularly within the lower estuary.

Water quality remains an ongoing management challenge for the catchment and estuary areas. An enhanced monitoring program including areas in the lower catchment and estuary would be of benefit for future management.

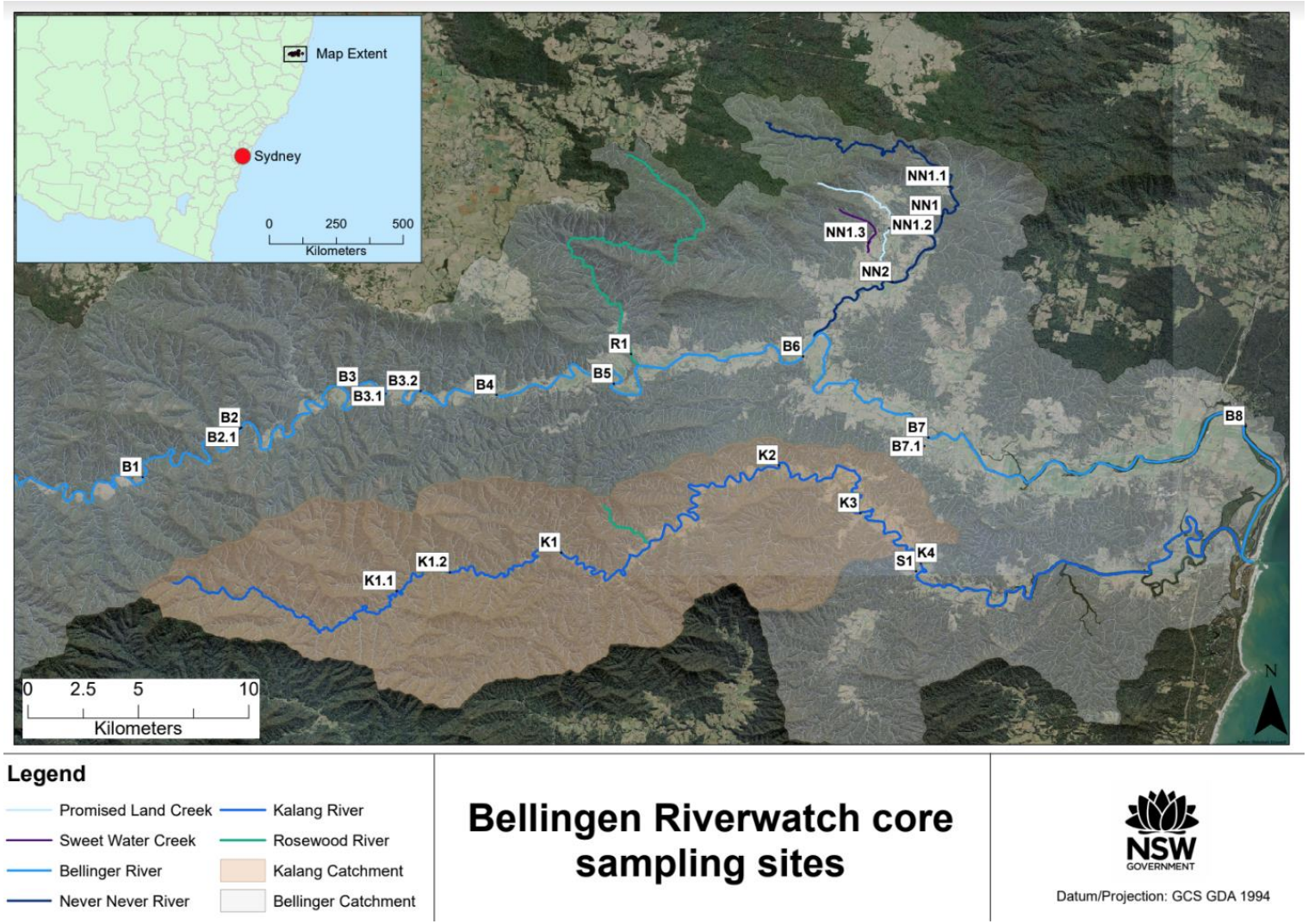


Figure 22. *Map of the 24 monthly sampling sites within the Bellingen Shire as part of the Riverwatch water quality monitoring (OzGreen 2019).*

3.8 Dredging

Key points

- One location is currently dredged in the Bellinger catchment for the purpose of providing material for construction, and limited gravel extraction is also permitted.
- Management measures are in place to limit any impacts of dredging and gravel extraction.

Dredging

Dredging of the Bellinger River commenced during the early stages of European settlement in order to maintain entrance conditions that were suitable for commercial vessels for timber transport (BSC 2010a). This practice was discontinued in 1929. However, there remains one dredging site within the Bellinger-Kalang Rivers estuary, an area known as Raleigh Shoal. An average of 20,000 m^3 of material is dredged from this site annually which is used for construction in the Coffs Harbour region. There is concern that dredging practices could affect sensitive ecosystems such as seagrasses. However, silt screens are used to manage sedimentation and no adverse effects on seagrass communities have been reported.

Gravel extraction

Gravel has been extracted from the Bellinger River for over 30 years for the purposes of road construction (BSC 2010a). In 2010, the annual gravel extraction was estimated to be 50,000 m^3, and extraction is currently ongoing at one site along the river at Waterfall Way in the upper reaches of the catchment. Channel widening in the reaches of the Bellinger River below the confluence of Never Never Creek has limited gravel extraction practices (BSC 2010a). Limits have also been placed on extracting material below the low flow levels in order to maintain water quality and avoid disturbing aquatic habitats.

3.9 Drainage and stormwater management

Key points

- The natural drainage system has been altered for agriculture.
- Drainage paths through Urunga are less well defined than Bellingen as the town is of lower topographic relief.
- It is uncertain how drainage will be affected by climate change, including sea level rise and coastal inundation.

The natural drainage system of the Bellingen Shire has been significantly altered to allow for agricultural development across the lower reaches of the system (BAES 2008). Topography varies over the study area, however, the lower reaches have been characterised as having wide, shallow channel dimensions, a result of extensive riparian vegetation clearing (BAES 2008). The system is unregulated, meaning there are no dams or weirs in place to control the flow through the channel. The main structures controlling flow in the system are the training walls emplaced along the estuary entrance which have previously been discussed (Section 3.1).

There is limited information regarding the extent of drainage works within the Bellingen Shire LGA and catchment area. The 'Central Urunga Flood Study' by de Groot & Benson (1999) outlines the capacity of the pipework to manage flooding and the data provided by the Bellingen Shire Council (BSC) details the location of drainage works in the Shire, with the two largest towns of Urunga and Bellingen shown in Figure 23. de Groot

& Benson (1999) remark that tidal action influences the level of the river under the prevailing conditions. The ability of the drainage system to manage flood waters is influenced by the water level in the Bellinger River.

Details of the present stormwater management practices within the Bellingen Shire LGA have been taken from the Bellingen and Urunga Stormwater Management Plans (BMT WBM 2013) and council data (Figure 23). The Bellinger River catchment has varying topography which influences the stormwater drainage patterns. Bellingen township is centred around the Bellinger River within a valley setting. Therefore, much of the urban areas in Bellingen are above the alluvial river flats at elevations of between 10 and 50 m AHD. As a result, there are generally well-defined drainage paths for stormwater flow in Bellingen and it is less flood prone.

The town of Bellingen is less flood prone than others within the shire as the urban areas are above the alluvial river flats and there are well-defined drainage paths.

It was identified in the Central Urunga Flood Study (de Groot & Benson 1999 in BMT WBM 2013) that the majority of street drainage in Urunga is undersized. Overflows during flood events occur regularly and are typically high. Existing pipes in the west and east catchment were undersized and larger flood events exceeded their capacity. Presently, there are several stormwater controls implemented in the Bellingen Shire. These are sedimentation basins (dry and wet) and ponds. A number of informal controls may also be present; including swales, rainwater tanks and vegetated, low-lying areas. These devices can serve to mitigate flood waters, as well as improve the water quality.

Urunga is situated closer to the coast and is located at the edge of a coastal plain. Consequently, the topography is lower and the urban areas have been developed on land with elevations between 5 and 25 m Australian Height Datum (AHD). The lower drainage slope and less defined flow paths results in a larger flood prone urban area within Urunga.

The above findings should be taken into consideration when reviewing the next stormwater management plan and the effects of climate change will also need to be considered. Modelling estimates that there will be an increase in rainfall intensity with larger storm and flood events, where additional capacity of existing infrastructure will be required. Sea level rise will also affect the operation of existing drains. Infrastructure that is located in low-lying areas will be susceptible to tide and storm surge inundation, thus limiting the ability to drain efficiently. Given the age of the de Groot & Benson (1999) study, it is recommended that a revision of this information is required to inform the capacity of the drainage systems in the future.

Additional capacity of existing stormwater infrastructure will be required to cope with estimated increases in rainfall intensity with storm and flood events in the future.

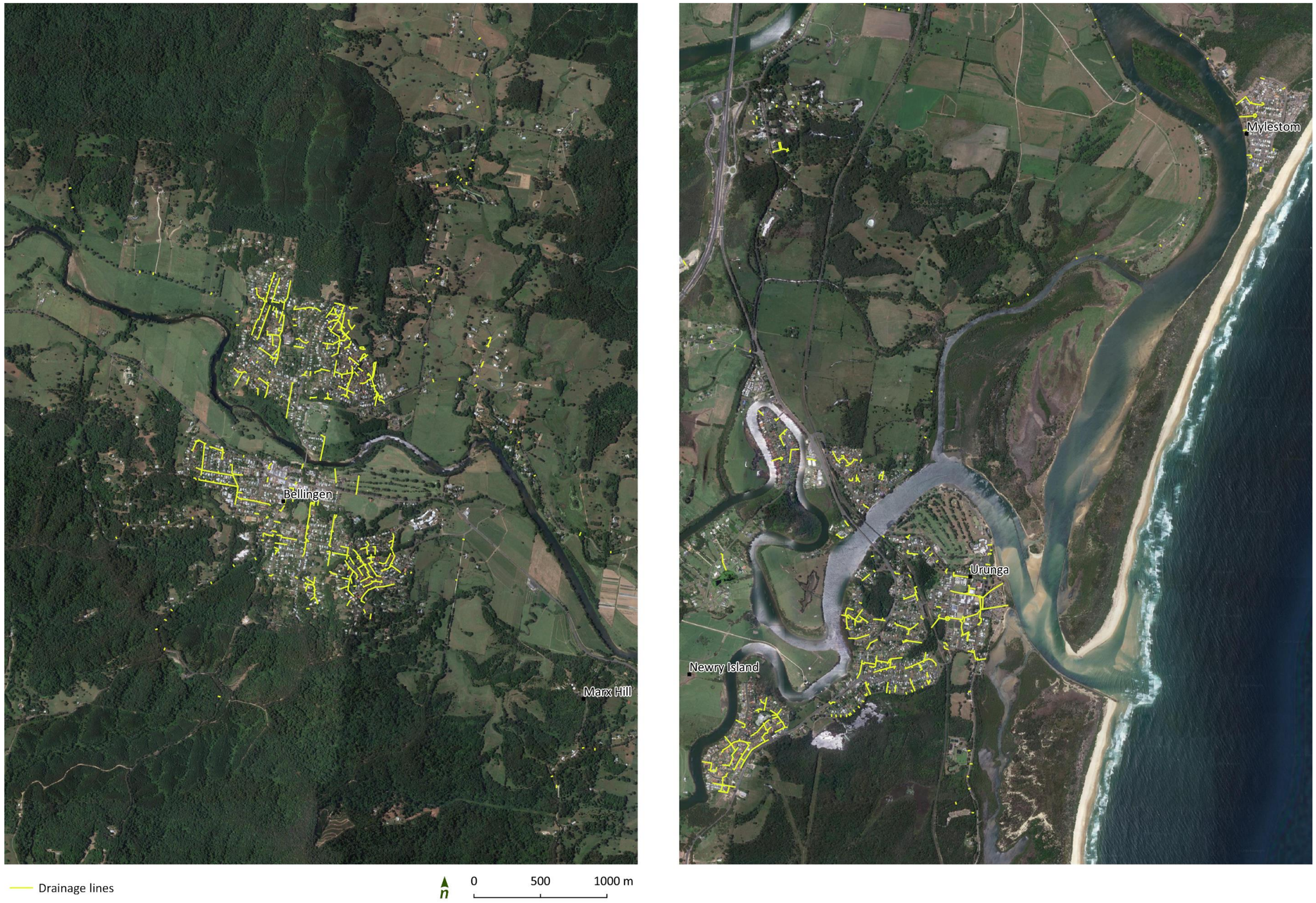


Figure 23. *Drainage works in the towns of Bellingen (left), and Urunga and Mylestom (right) based on data supplied by the Bellingen Shire Council (BSC 2019).*

3.10 Catchment and waterway processes

Key points

- Numerous studies have been undertaken to inform the behaviour of the Bellinger River and Kalang River.
- The tidal influence and limit on the waterways is approximately 1 km upstream of the town of Bellingen on the Bellinger River and to Brierfield on the Kalang River.
- Dominant erosional processes are well defined, however priority sites have not been reassessed since 2010.
- Maintaining the waterways in good condition, including stable and well-vegetated banks, improving the water quality and having low turbidity streams, will continue to be key management challenges for the Bellingen Shire and the Bellinger-Kalang Rivers estuary.

Physical processes context

Climate is a substantial driver in the physical changes of the Bellinger-Kalang River estuary (Lawson & Treloar 2003). The Bellingen Shire and region has experienced distinct periods of drought and flood dominance which have influenced the planform of the Bellinger River and Kalang River. Between the townships of Bellingen and Thora, the channel dimensions are thought to be twice to three times that of pre-European dimensions (Telfer & Cohen 2010). The capacity of the channel increased during the flood-dominated regime between 1943 and 1973, remaining high despite a reduction in flood frequency since 1977. The resulting changes to channel planform and dimensions are believed to be largely a function of degraded bank vegetation due to clearing during the initial settlement period.

Erosion potential

The Bellinger and Kalang River Estuaries Erosion Study undertaken in 2010 (Telfer& Cohen 2010) divided the fluvial system into the following process zones (Figure 24):

- fluvial-dominated
- fluvial transition
- marine-tidal process zones.

The length and severity of bank erosion was assessed as part of the erosion study. The findings of the bank erosion survey are summarised in Table 4.

Table 4. Results of the erosion study bank erosion survey (adapted from Telfer & Cohen 2010)

Bellinger River					
Length of bank surveyed (km)	**Stable banks (km)**	**Minor erosion (km)**	**Moderate erosion (km)**	**Major erosion (km)**	**Erosion control works (km)**
Total (60.3)	32.4	19.5	4.8	3.6	5.9
Fluvial-dominated A (12.8)	4.8	5.1	1.6	1.3	21 %
Fluvial-dominated B (15.5)	5.3	7.2	1.1	1.9	2 %
Fluvial transition (15.5)	15.0	0.4	-	-	22 %
Marine-tidal delta (16.5)	7.3	6.8	2.1	0.4	21 %
Kalang River					
Length of bank surveyed (km)	**Stable banks (km)**	**Minor erosion (km)**	**Moderate erosion (km)**	**Major erosion (km)**	**Erosion control works (km)**
Total (60.5)	41.2	12.8	3.8	2.7	5.2
Fluvial-dominated A (16.7)	9.1	4.7	2.0	0.9	<0.1 %
Fluvial-dominated B (11.6)	9.5	2.2	0.03	-	-
Fluvial transition (26.9)	18.4	4.9	1.8	1.7	22 %
Marine-tidal delta (5.3)	4.3	1.0	-	-	28 %

Figure 24. *Map of the geomorphic process zones within the Bellingen Shire area (adapted from Telfer& Cohen 2010)*

The following discussion is based on the Bellinger and Kalang River Estuaries Erosion Study by Telfer & Cohen (2010) unless otherwise stated.

Fluvial-dominated processes zone

In the western part of the Bellinger River catchment, the confined headwaters flow from the Great Dividing Range, east towards the coast. Within the fluvially-dominated reaches of the Bellinger River, there is gravel bar formation and a distinct macro-channel extending from Fernmount to Bellingen where the highest overbank velocities are experienced. This reach has been subject to ongoing fluvial erosion and deposition (Figure 25). The findings of the erosion study indicate that the fluvial-dominated zones experience the most erosion (Table 4 and Figure 24).

Figure 25. *Major bank erosion within the Bellinger River upper estuary*

Between McGeary's Island and Fernmount there is a less -pronounced macro-channel and greater bed scour. In the Bellinger River, the macro-channel becomes less defined in the downstream reaches of the Bellinger River with channel depths of up to 12 m. Floodplains sit up to 7 m above the mean tide level. The lower reaches of the Bellingen River downstream of Thora were identified as being particularly degraded, with little aquatic or riparian habitat in its current state (Lawson & Treloar 2003).

The uppermost fluvially dominated reach of the Kalang River, between Brierfield Bridge and Pine Creek, demonstrates variable floodplain topography resulting from a confined valley floor that produces bed scour in the downstream end and discontinuous floodplain development. As such, most of the erosion is observed in this fluvial-dominated zone A and the transition process zone (Table 4 and Figure 24). This is a result of high-energy overbank flow and floodplains that sit up to 4 m above the mean tide level. Channel depths in the Kalang River are as much as 12 m. The laterally partly confined and unconfined streams along the lower reaches drain the agricultural development on the floodplains.

Vegetation mapping reveals that there is a limited extent of riparian vegetation along the Bellinger River in this zone as it is dominated by agricultural land. There are small areas of camphor laurel, remnant native vegetation, grassy open forest comprised of River Oak, exotic vegetation (species not specified), and dry sclerophyll forests comprised of tallowwood and small-fruited grey gum. The vegetation is similar along the Kalang River although in general it is in a much better condition. Agricultural land dominates the riparian zone. However, sub-tropical rainforests with River Oak emergents and small areas of wet sclerophyll rainforests comprised of flooded gum exist within this zone (Figure 26). There are small extents of grey mangrove along both the Bellinger River and Kalang River towards the easternmost limits of this zone.

Figure 26. *A healthy riparian zone within the Kalang River upper estuary*

Fluvial transition processes zone

The fluvial transition zone is where fluvial processes dominate but there remains some influence from the coast. The fluvial process transition zone on the Bellinger River demonstrates a reduced floodplain topography where the channel depth along the Bellinger River reaches 10 m and the floodplains sit at a reduced elevation compared to the upper reaches of the catchment, which is characteristic of an infilled mud basin. There is an increased frequency of overbank flow in this reach of the Bellinger River due to a reduced bank height.

This zone on the Kalang River experiences an increase in valley width resulting in low floodplain relief and an anabranching channel. Overbank flow frequently occurs as a result of the lower bank height. It is believed that there is localised Pleistocene terrace remnant sediment controlling rates of bend migration. The south branch of the channel experiences greater scour and bend migration as the dominant forms of energy dissipation.

Agricultural land remains the dominant feature of the riparian zone within the fluvial transition zone. Wet sclerophyll forests, mangroves, remnant native vegetation and exotic vegetation are present within the riparian zone of both rivers. There are rushlands and lowland rainforests comprised of giant water gum on the alluvial floodplains on the Bellinger River. Along the Kalang River, there are also coastal swamp forests comprised of swamp mahogany, willow bottlebrush and broad-leaved paperbark.

Marine tidal processes zone

The estuary is influenced by marine processes and constitutes the marine process zone of the catchment. The Bellinger-Kalang River estuary extends from Newry Island and the confluence of Bellinger River with Back Creek to the mouth at Urunga. The estuary includes Urunga Lagoon. The channel depth in this zone is fairly shallow, reaching maximum depths of 4 m. The floodplain height is approximately 1.5 m above the mean tide level and there is tidal inundation of the saltmarsh and mangrove flats. This lower reach is still affected by fluvial processes, flushing sediments from the shoals during large flood events. However, it has been estimated that there is a net annual influx of 40,000 m^3 of sand that is transported during the flood tide to form the shoals. The training walls that were emplaced during the initial stages of European settlement appear to have stabilised much of the coast and estuary, minimising migration of the estuary mouth (BMT WBM 2012).

The Bellinger River and Kalang River estuaries have been classified as a wave-dominated system where there is constant replenishment of sand from the coast (Telfer & Cohen 2010). The extent of the tidal influence extends approximately 24 km upstream to the Bellingen Bridge in Bellingen and approximately 20 km up the Kalang River to Brierfield (BMT WBM 2012). The estuarine system also includes the main tributaries of Back Creek, Urunga Lagoon, Picket Hill Creek, and saltmarsh and saline wetland areas on Urunga Island.

The present geomorphic condition of the Bellinger-Kalang River estuary is relatively stable, assisted by the training walls which have also offered stabilisation of the dunes (See Figure 27). However, the overall riparian

condition is moderate, with better condition along the Bellinger River compared to the Kalang River (Ryder et al. 2011).

Figure 27. *A section of rock training walls at the Bellinger-Kalang River estuary entrance*

A variety of bank stabilisation works have been undertaken in the Kalang and Bellinger estuaries. There are a range of informal structures, many constructed by landholders, using a diverse range of materials including rocks, sheet pile, tyres, timber, rubble. Boat speed restrictions are used to control boat-wake induced erosion.

Figure 28. *Historic bank stabilisation works to protect a landholder pontoon within Bellinger River upper estuary*

More formalised works undertaken by state government and Council, have aimed to improve bank stability and support mangrove establishment. Recent works in the Kalang River have included the construction of fillets, combining rocks and tree stumps to establish mangroves (Figure 28, Figure 29 and Figure 30). Stabilisation works on the Bellinger River have also used various rock and timber fillets, to encourage mangrove growth and areas for fish habitat, with some structures also incorporating fish balls (Figure 31) .

Figure 29. *Rock fillet bank stabilisation works recently implemented in Kalang River lower estuary*

Figure 30. *Rock fillet bank stabilisation works recently implemented in Kalang River lower estuary*

Figure 31. *Fish ball and rock fillet bank stabilisation works recently implemented in Bellinger River lower estuary*

Mangrove and saltmarsh communities are largely concentrated around Urunga Lagoon and Back Creek. Dry and wet sclerophyll forests are also present. There are also small areas of native and exotic vegetation around the townships of Urunga and Mylestom. Along the coastline, there are littoral rainforest communities and heathlands, as well as spinifex, bitou bush, grasslands and native species plantings on the dune systems.

Maintaining the waterways in good condition, including stable and well-vegetated banks, improving the water quality and having low turbidity streams, will continue to be key management challenges for the Bellingen Shire and the Bellinger-Kalang Rivers estuary (BSC 2010a & b).

3.11 **Coastal processes**

Key points

- The management of coastal process and coastal hazard impacts along the open coastline, estuary and low-lying coastal land continues to be an ongoing management challenge for the Bellingen Shire.
- Sea level rise and coastal/storm tide inundation currently impact assets and infrastructure, and the extent of this impact is projected to increase up to 2100, with additional implications for land use and ecosystems.
- Existing actions from the CZMP (BMT WBM 2017) will be brought forward into the CMP process, and opportunities for additional studies have been identified to update coastal hazard information with leading practice approaches.
- Presently 46 properties along the Bellinger River are affected by inundation at current sea level. Up to 11 km of road in the Bellingen Shire will be affected by 1 m of sea level rise.

Much of the information in the following coastal processes section has been summarised from the Bellingen Coastal Processes and Hazards Definition Study by BMT WBM (2012) unless otherwise referenced.

There is approximately 10 km of coastline within the Bellingen Shire LGA, much of which is contained within the Bellingen Coast Regional Crown Reserve (RCR) which preserves the land from development, retaining land in the public space for social, economic and environmental needs. This includes approximately 8,000 hectares of beach area preserved by the RCR. In general, the NSW coastline is largely bedrock-controlled, which influences coastal processes and sediment dynamics. However, there are fewer headlands northward along the coast. Figure 32 provides a summary of the coastal processes and nearby assets.

Coastal geomorphic processes and zones

Coastline, storms and waves

The Bellingen coastline generally faces in an east-south-east direction and receives wave energy predominantly from the south-east. The regional average significant wave height (measured at Coffs Harbour) is 1.57 m, with the largest waves generally occurring during autumn months. Storm activity is typically generated by east coast lows and tropical cyclones. Wave climate seasonality and wave direction can vary throughout the year. During summer months, tropical cyclones further north can generate waves from a north-easterly direction. Summer onshore breezes can also generate winds from the north-east. These wave climate shifts influence phases of sediment erosion or accretion along the coast.

Tidal processes

Tides along the NSW coastline are micro-tidal and semi-diurnal. There are no permanent tidal gauges in the Bellingen Shire, therefore tidal information is inferred from the Coffs Harbour gauge. The tidal range for the NSW coastline is less than 2 m. Tide gauge measurements taken in the Bellinger-Kalang Rivers estuary during a previous study demonstrate a mean spring tidal range of 1.3 m (MHL 2002 in Lawson & Treloar 2003). In addition to catchment flows, entrance currents driven by rising and falling tides influence sediment transport processes.

Sediment and beach compartments

Australian shorelines are classified into sediment compartments, based on sediment processes and coastal features. The Bellingen Shire shoreline sits within one main sediment compartment named the Coffs-Nambucca sediment compartment (NSW Govt. 2018). This compartment is comprised of rocky headlands, prograded and stationary barriers, beaches and foredunes (NCCARF 2018).

Features along the coast are predominantly depositional, including the beaches, dunes, barrier dunes, and estuarine and alluvial plains. Rocky headlands and outcrops form the erosional features (LPMA 2010). A narrow dune ridge diverts the flow of the Bellinger River to the south, and there are narrow barriers south of

Urunga. There is also a rocky outcrop and headland near Nambucca Heads at the southern end of the compartment. Within this sediment compartment, there is little evidence of open coast erosion and the seabed mapping indicates rocky reefs and minimal sediment (NCCARF 2018).

BMT WBM (2012) further classified the shoreline into three beach sub-compartments Figure 32:

- Northern end of Valla Beach from Oyster Creek to Wenonah Head
- From Snapper Beach to Hungry Head Beach
- North Beach extending to Tuckers Rocks.

Figure 32. *Summary of the coastal compartments, features and assets along the Bellingen Shire coastline (after BMT WBM 2012; GHD 2018; Hydrosphere 2018).*

Dalhousie Creek and Oyster Creek intermittently closed and open lakes or lagoons (ICOLLs)

In addition to the beach compartments, there are also intermittently closed and open lakes or lagoons (ICOLLs) including Dalhousie Creek (Figure 33), Oyster Creek and a smaller ICOLL at Tuckers Rocks. The entrances to these ICOLLs are exposed to coastal processes, with onshore and alongshore sediment transport driving closure.

The entrance at Dalhousie Creek was previously dredged to maintain the opening; however, this practice has since ceased, and the entrance now typically opens once or twice a year in response to rainfall events. During significant storm events, coastal inundation of the creek has occurred, resulting in scour of Hungry Head Beach to the north.

Figure 33. *Dalhousie Creek, an intermittently closed and open lakes or lagoon (ICOLL), near Hungry Head*.

Hydrosphere (2018) proposed a management strategy for Dalhousie Creek entrance which recommended options to maintain the beach by controlling the creek entrance position. Stakeholders consulted during the Hydrosphere study expressed the desire for options to help manage beach access, beach width, erosion buffers, dune stability, water pooling and to remain in keeping with the natural values. The recommended stabilisation options use a staged approach, progressing from beach scraping and dune stabilisation, through to geofabric containers and then to rock, based on routine monitoring and trigger points.

Sediment supply and movement

There is a general northward transport of sediment along the coastline, estimated to be approximately 60,000 m^3/year (BMT WBM 2012; BMT WBM 2014; NCCARF 2018). Sediment transport is relatively unimpeded along the coast. However, there can be variations in short-term sediment supply, particularly related to transport around headlands.

The Bellinger River and Kalang River supply sediment to the coastal zone, particularly north of the training wall. Shoals within the estuary mouth and bars in the surf zone are present, formed by interactions between longshore sediment transport and tides.

There are rock reefs visible in aerial photographs of the nearshore zone off Hungry Headland, Second Headland and Wenonah Head. These reefs dissipate wave energy and may reduce sediment in the nearshore zone. Aeolian sediment transport can also occur, however, it is expected to be minimal as the dunes are stabilised by vegetation. Sediments have previously been observed to be transported by wind across Mylestom Spit into the river channel but this has since been increasingly intercepted by dune vegetation assisting to stabilise the spit.

Assets

There are public and private assets along the coast and within the estuary that have been identified to be at risk from coastal hazards. Figure 32 gives an indication of some of the assets within the immediate vicinity of the coast and potentially threatened by coastal processes and Table 5, provides further summary of the assets at each beach within the shire. Those at greatest risk are the surf life-saving club (SLSC) buildings at North Beach and Hungry Head Beach. Part of the scope of later Stages of this current CMP is a more detailed assessment of assets that are at risk within the Bellinger-Kalang River estuary.

The beach profiles have very gentle slopes that are believed to be around 1:100 in the nearshore zone. A summary of the beach compartments and their morphology, hazards, facilities and level of access for the Bellingen Shire LGA coastline is given in Table 5.

Table 5. Summary of the Bellingen Shire LGA beach assessments (after BMT WBM 2012)

Bellingen Shire LGA Beach	Beach morphology, compartments and hazards[3]	Hazards	Access, facilities and management
Valla Beach	• Transverse bar and rip morphology • Outer bar develops during storm conditions • Low vegetated dunes with several EECs	• No erosion studies to date • Recession estimates of 55-65 m by 2100 under 0.9 m SLR scenario • Inundation of Oyster Creek	• Limited access by unsealed road to Wenonah Head • Picnic facilities, car parking, boat launching
Snapper Beach	• Continuous bar • Rips forming under higher wave energy conditions • Vegetated dunes • Presence of bedrock behind shoreline	• Protection from reef off Wenonah Head limits wave energy • Erosion following 2009 storms, affecting beach access and revegetation • Recession estimates of 35-70 m by 2100 • Minor natural drainage point	• Access for four-wheel drives at Wenonah Head • Boat launching, parking, picnic facilities • Part of Native Title Claim
Hungry Head Beach	• Transverse bar and rip morphology • Moderately sized waves • Single sand bar with widely spaced rips • Vegetated dunes	• Mouth of Dalhousie Creek exits at northern end of beach • Little evidence of erosion during 1974 and 2009 storms • Recession estimates of 60-65 m by 2100	• Urunga-Hungry Head SLSC at northern end • Park and picnic spot • Part of Native Title Claim
North Hungry Head Beach	• Continuous beach • Single sand bar cut by numerous rips • Lower wave energy on southern end due to reefs at Hungry Head • Wide trough forms at northern end where wave energy is higher • Urunga Sandmass, vegetated and unvegetated dunes	• Extends to southern training wall, which has stabilised the beach • Erosion occurred during 1974 and 2009 storms • Recession estimates of 20-65 m by 2100 under 0.9 m SLR scenario; possible accretion	• Access by roadway behind Urunga Lagoon, track across dunes and Urunga Boardwalk • Urunga Lagoon, located behind the Sandmass, was formed by training walls. These walls resulted in the prograding of Urunga Sandmass • EECs, seagrass, mangroves and saltmarsh in lagoon
North Beach	• Vegetated sand spit separating Bellinger River from ocean • Double barred morphology • Inner bar has a transverse bar and rip morphology • Outer bar has rhythmic bar and beach morphology • High energy beach	• Significant erosion following 1974 and 2009 storms • Recession estimates of 20-35 m by 2100	• Access at Tuckers Rocks and via accessways across dunes

[3] Some areas are covered by State-wide coastal erosion database http://www.nswbpd.wrl.unsw.edu.au/photogrammetry/nsw/ beach profiles.

Existing coastline management and maintenance

Training walls were constructed between 1890 and 1905 and have influenced the present-day coastline morphology and river entrance dynamics. In a 2012 study of the Bellingen Coastal Processes and Hazards, BMT WBM summarised the construction of the training walls and their effect on the coastline. The northern training wall is contained almost completely within the estuary entrance, with shoals forming in front of the wall. The southern training wall protrudes into the surf zone with evidence of longshore sand bars bypassing the wall. Prior to their construction, the Bellinger River entrance is believed to have migrated along the coast between Mylestom and Hungry Head. The training walls are also thought to have promoted stabilisation and growth of the dunes, particularly at North Hungry Head Beach (i.e. formation of the "Urunga Sandmass").

Coastal hazards

Coastal hazards include (OEH 2018c):

- Beach erosion
- Shoreline recession
- Coastal lake or watercourse entrance instability
- Coastal inundation (storm tide inundation)
- Coastal cliff or slope instability
- Tidal inundation (due to sea level rise)
- Erosion and inundation of foreshores caused by tidal waters and the action of waves, including the interaction of those waters with catchment floodwaters (edge effects of tidal inundation).

The dominant existing and emerging threats to the Bellingen Shire coastline include:

1. Beach erosion and recession
2. Tidal inundation due to sea level rise and edge effects
3. Coastal / storm tide inundation.

Information from the Bellingen Coastal Processes and Hazards Definition Study for each of these hazards has been summarised in Table 6 (BMT WBM 2012). Table 6 outlines the current knowledge and where there are gaps that should be updated through additional studies to inform the final CMP. Further discussion on coastal hazards is provided below.

Table 6. Summary of the coastal hazards that currently pose a risk to the Bellingen coastline (after BMT WBM 2012)

Coastal hazard	Current knowledge	Knowledge gaps
Beach erosion	• Average annual wave direction is SE • Significant beach erosion in first half of 2009 by a number of storms rather than one design event • Immediate beach erosion hazard (Hungry Head and North Hungry Head Beach = 15m; North Beach = 10m) from 4m contour • North Beach is exposed to more SE waves than Hungry Head • Reef in nearshore off Hungry Head may dissipate wave energy	• Photogrammetric data is limited to ~600m either side of Hungry Head and a section of North Beach 1.5km either side of Mylestom • Analysis of future wave climate indicated that future changes are within existing variability • Period of enhanced storminess in 1970s is more extreme than wave climate projections for future
Shoreline recession	• Net longshore sediment transport is northward • Decades prior to and during the 1970s - observed to be enhanced erosion of beaches • Photogrammetric analysis suggests beach recession • Accretion observed from 1970s to 2008 • Increased wave heights and elevated water levels in storms cause sand to be eroded from upper beach/dune system and transported offshore	• There are no wave run-up measurements on Bellingen beaches • SLR, storm surge and wave height changes may increase wave run up • Existence of hind dunes of 6-9m along Bellingen coastline is an important factor in the response to SLR (model results) – sand volume is released into active beach system and recession is limited

Coastal hazard	Current knowledge	Knowledge gaps
	• Bellingen beaches are not experiencing long-term recession – appear to be stable over time • Training walls have allowed for some stability along Hungry Head Beach and some setback immediately north of North Beach • No significant long-term recession of Mylestom shoreline in response to training wall construction	• Uncertainty relating to the extent of SLR, timeframe over which it may manifest and how it would affect the shoreline
Coastal lake or watercourse entrance instability	• Training walls have promoted stability and growth of dunes • Growth of dune vegetation to stabilise Urunga Sandmass and Mylestom spit • No effects of training walls directly observed or documented • Urunga Sandmass, between the shoreline and Urunga Lagoon, is receiving wind-blown sands • Accretion in front of the training wall inside the estuary mouth • Sand bars in the surf zone bypassing the end of the southern wall • From 2001-02 aerial photos it seems as though bypassing has fully recommenced • Entrance shoals are extensive • Training walls have done little to modify the formation of shoals • Incoming tidal flows are greater than ebb flows • Marine sediment is transported into the entrance to form a flood tide delta and associated shoals • Coastal entrance hazard refers to existing and future berm height and closure characteristics of coastal lagoons	• No data to assess average or maximum berm height at entrances – can't reliably estimate probability of coastal entrance hazard
Coastal inundation (storm tide inundation)	• Increase in storm intensity and associated wave height may mean greater erosion • Compounded by sea level rise • Storm surge may increase severity of coastal erosion – move wave impact and swash zone further up beach face and inundation of low-lying area • Almost certain, unlikely and rare inundation levels have been modelled for immediate, 2050 and 2100 timeframes	• Potential for storm surge levels greater than predicted – SLR, extreme climatic conditions • Aerial laser survey data not available for coastal creeks other than Bellinger/Kalang entrance • Coarse DEM used for modelling
Coastal cliff or slope instability	• Few protruding headland outcrops along the Bellingen coastline • Notable features are Bellinger river mouth and Wenonah Head	
Tidal inundation	• In estuary entrance, currents may occur in the surf zone, driven by tidal volume on falling and rising tide	• Uncertain how tidal inundation due to sea level rise will influence erosion and coastal inundation estimates.
Erosion and inundation of foreshores caused by tidal waters and the action of waves,	• There may be a small amount of fluvial sediment supply from Bellinger River, supplying north of the training wall • 1967 series of storms – extreme wave heights, erosion	• Unclear how storms and wave energy will vary with climate change

Coastal hazard	Current knowledge	Knowledge gaps
including the interaction of those waters with catchment floodwaters	• Tropical cyclones in 1974 causing beach erosion • Known events = storms in Feb 1954, 1974 and June 1967 • May 1974 • May 1997 • May 2009 • High storm activity during 1970s is typically associated with greatest beach erosion extents in historical record on NSW beaches • Series of storms in 2009 and significant beach erosion was recorded along Bellingen coastline – near to same extent as evident after 1974 storms.	• Climate change predictions suggest future wave climate will be similar to present

1. Open coast / beach erosion and shoreline recession

Open coast / beach erosion is the episodic loss of sand caused by coastal storms, which can cause damage to infrastructure, properties and facilities. It is anticipated that the NSW coast will be exposed to increased coastal erosion by 2100 (OEH 2017c).

Beach erosion (or storm bite) is the loss of sand from a beach due to a storm event. Over time natural processes will work to move sand back on-shore and re-build the beach. Shoreline recession is the cumulative, long-term loss of sand as a result of ongoing erosion processes, typically due to an imbalance in the coastal sediment transport system (OEH 2017c).

Estimates of future beach erosion and recession have previously been made based on a proximity analysis, regional-scale modelling analysis and local government hazard line analysis. The most up to date information is the hazard assessment completed in 2012 by BMT WBM (Table 7), which was utilized for the CZMP (completed in 2014 and re-issued in 2017).

Table 7. Coastal erosion hazard information

Study	Approach	Areas at risk	Assets exposed/at risk
BMT WBM (2012)	Erosion hazard modelling for 1% Annual Exceedance Probability storm event. • Present day • 2050 (+0.4m) SLR • 2100 (+0.9m) SLR	Potential shoreline recession along the coast of between 50 and 70 m by 2100. The shoreline may retreat by as much as 90 m under the most extreme sea level rise scenario of 1.4 m. Hind dunes along the coastline offer some reprieve to sea level rise as they will slow the rate of recession and supply sand for longshore transport. The locations at greatest risk from erosion are North Beach, Tuckers Rock and Hungry Head. Further site-based recession estimates noted in Table 5).	A range of beach and foreshore assets are at risk from coastal hazards by 2100 (WBM BMT 2017, refer to CZMP for detailed assessment).

Further geotechnical assessment has been recommended (BMT WBM 2017) to improve hazard definition at Hungry Head and Wenonah Head.

Best practice erosion hazard modelling typically considers a probabilistic approach and multiple AEPs (event likelihoods, e.g. 10%, 1%, 0.2% AEPs) along with multiple planning horizons (e.g. present day, 2050, 2100). It would be beneficial to update the coastal hazard modelling to incorporate additional AEPs into the existing body of information for erosion prone areas. This is particularly relevant for the Mylestom spit, where a

potential breakthrough would place public and private assets at risk, and may require substantial investment in coastal protection works.

2. Tidal inundation due to sea level rise and edge effects

Sea level along the Bellingen coastline is projected to rise between 0.38 m and 0.66 m by 2090, depending on the RCP climate change scenario (NCCARF 2018, Figure 34). This rise is expected to increase the extent of tidal ingress along the Bellinger River, bringing increased management challenges. Sea level rise may interrupt the supply of sediment alongshore as depth and wave conditions are altered. Erosion of the southern end of the beach compartments and accretion to the northern end of the beach compartments. As sea levels rise, rock reefs along the Bellingen coastline will have less effect on wave energy dissipation, with the potential for increased shoreline erosion.

The NSW Sea Level Rise Policy Statement (2009) provided state-wide benchmarks of projected sea level rise to ensure consistent adaptation by coastal councils, namely a 0.9 m increase by 2100. In the recent NSW coastal legislation reform, the 2009 Policy has been adjusted in favour of flexibility for councils to determine their own sea level rise projections. Likely global mean sea-level rise by 2100 has been projected to exceed the 0.9 m benchmark (by 0.08 m) under the highest emissions scenario. The IPCC also suggest the possibility of greater rises should unfavourable conditions prevail, such as ice sheet collapse (OEH 2018d).

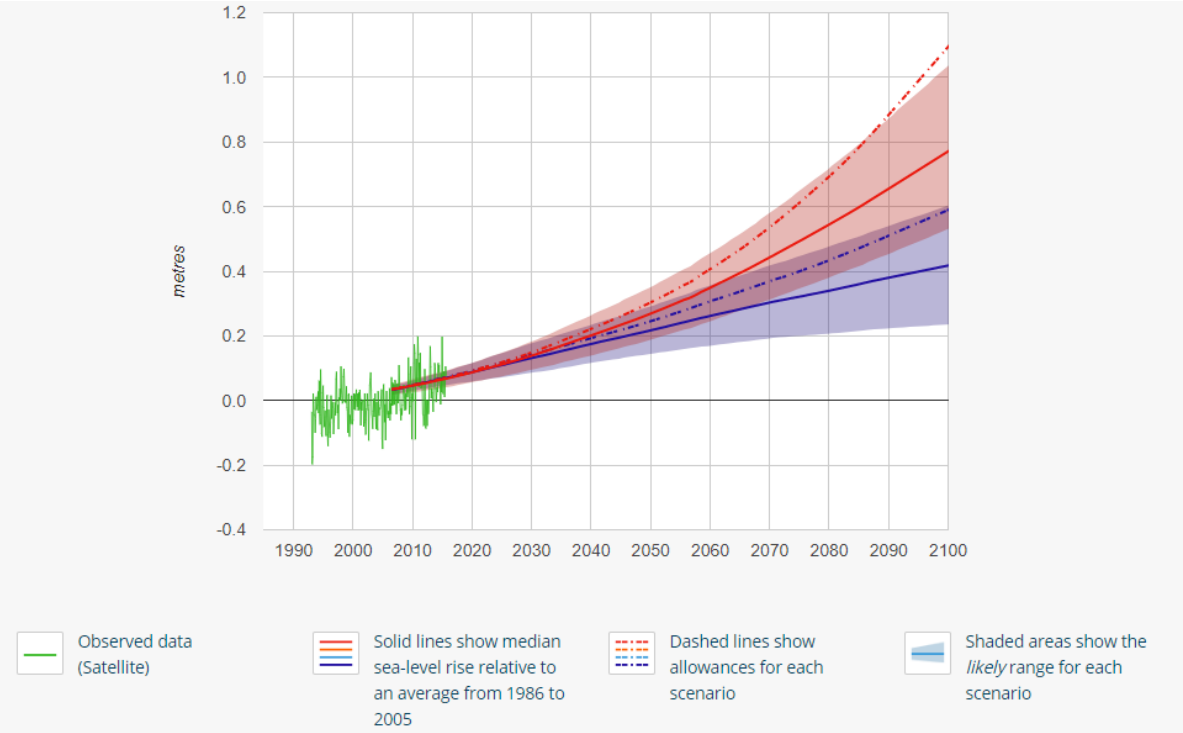


Figure 34. *Predicted sea level rise scenarios under very low to very high greenhouse gas scenarios (NCCARF 2018). The blue lines represent RCP2.6 and the red lines represent RCP8.5.*

A summary of predicted sea level rise from 2030 to 2090 along the Bellingen coastline is provided in Table 8.

Table 8. Predicted sea level rise along the Bellingen coastline relative to an average calculated between 1986 and 2005 (NCCARF 2018)

	Greenhouse Gas scenario (RCP)			
Date (unit)	Very Low (RCP 2.6)	Low (RCP 4.5)	High (RCP 6.0)	Very High (RCP 8.5)
2030 (m)	0.09 - 0.18	0.10 - 0.18	0.09 - 0.17	0.10 - 0.19
2050 (m)	0.15 - 0.30	0.17 - 0.32	0.15 - 0.30	0.19 - 0.36
2070 (m)	0.19 - 0.42	0.24 - 0.48	0.23 - 0.46	0.32 - 0.59
2090 (m)	0.22 - 0.54	0.31 - 0.65	0.32 - 0.66	0.46 - 0.88
Rate of change at 2100 (mm/yr)	1.4 - 6.3	3.0 - 8.6	4.6 - 10.5	7.6 - 16.1

The regional sea level rise projections for Australia presented by CoastAdapt are based on probabilistic regional projections of sea level rise provided in the IPCC's most recent fifth assessment report. These regional projections require the combination of multiple different component models to produce results at the scale applicable to Bellingen Shire. While the component models have been evaluated individually, a thorough evaluation of the ability to combine these models to project future regional sea level change is still required (Church et al. 2016).

Limitations of the regional projections of sea level rise along the Bellingen Shire coastline are noted below (Church et al. 2016):

- Current generation of global climate model resolution is not fine enough to resolve the details of ocean currents such as the East Australian Current. This introduces uncertainties in the coastal response of sea level to climate change in addition to those associated with atmospheric/climate response.
- The sea level projections represent the likely range (66 % probabilities). The projections do not consider the additional allowance of several tenths of a metre rise if there was a significant collapse of the Antarctic ice sheet.

With awareness of the limitations of the regional projections and the possibility of further increases in sea level rise, the CoastAdapt framework provides the best available information for the first pass risk assessment of the inundation and climate risk facing the Bellingen Shire. CoastAdapt recommends that coastal managers plan for the possible outcomes as provided but bear in mind the possibility that the rates of change may be greater than the current estimates. CoastAdapt also provides the framework for second and third pass assessments of climate and inundation risk at the catchment scale.

The CoastAdapt has inundation mapping for Bellingen Shire for RCP 8.5 2050- and 2100-time frames (NCCARF 2018). A "bathtub" model uses projected sea level rises, added to highest astronomical tide, overlaid on 1 m resolution Digital Elevation Model (DEM) of Australia's coastline. This approach has limitations for assessing inundation extents as it does not consider tidal flows in estuaries, protection from sea walls and other structures, wind and waves and consequently storm surge or the impact of rainfall and runoff. These factors can increase water levels significantly particularly during extreme events, increasing the inundation risk.

The available information and hazard mapping for tidal inundation in estuaries (OEH 2018e), as well as coastal/storm tide inundation for multiple planning horizons (BMT WBM 2015), provides a more complete assessment of areas that may be prone to short or long term inundation by 2100 for the Bellingen Shire coastal zone. These assessments are described in the following sections.

Tidal inundation in estuaries

The level of exposure to estuary tidal inundation has been assessed for NSW and the information in this sub-section is taken from that report and accompanying appendices (OEH 2018e). Increased ocean water levels will likely result in higher water levels in lakes and estuaries and increased flooding in coastal rivers.

For the OEH (2018e) assessment, water levels were generated for multiple SLR scenarios (Table 7), using the High High Water Solstice Springs (HHWSS) tidal planes based on measured tidal data for the region. This approach, which included interpolation of tidal planes, variation in water levels between and along estuaries, but excluded non-tidal processes such as storm-tides, is considered an improvement on simple bathtub methods.

Table 9. Tidal inundation in estuaries information

Study	Approach	Areas at risk	Assets exposed/at risk
OEH (2018e)	Tidal inundation in estuaries based on HHWSS tidal planes, excluding storm tides.	The Bellinger-Kalang Rivers estuary and Dalhousie Creek ICOLL are likely to be increasingly affected by tidal inundation as a result of sea level rise. There is some	Properties and infrastructure in the Bellingen Shire are already experiencing tidal inundation, and the number of impacted properties will increase as sea level rises.

Study	Approach	Areas at risk	Assets exposed/at risk
	Multiple SLR scenarios: • Current • 1 m • 1.5 m	protection against inundation offered by dunes on the open coast. However, stormwater drainage is likely to become less effective.	For the Bellinger River (OEH 2018e): • 46 properties are affected by inundation at current sea level • 297 properties will be affected by a 1 m sea level rise • 11 km of road will be affected by a 1 m sea level rise. For Dalhousie Creek: • 5 properties are affected by inundation at current sea level (20 % of properties) • 7 properties will be affected by sea level rise of up to 1.5 m (28 % of properties).

3. Coastal / storm tide inundation

Extensive inundation of foreshores, estuaries, lagoons and low-lying coastal plains can occur as a result of elevated water levels during storms, which will differ between storm events depending on a number of variables. BMT WBM (2015) conducted a separate, detailed inundation study for the Bellinger-Kalang Rivers estuary, which identified areas and assets at risk from coastal/storm tide inundation from now to 2100.

Table 10. Coastal / storm tide inundation information

Study	Approach	Areas at risk	Assets exposed/at risk
BMT WBM (2015)	A hydrodynamic model was used to estimate the inundation extents for the Bellinger River and Kalang River estuaries under four sea level rise scenarios for a 1% Annual Exceedance Probability Event: - present-day - 0.4 m (2050) - 0.7 m (2070) - 0.9 m (2100) Extents are shown in Figure 35.	Considerable areas of land adjacent to estuaries and coastal waterways is prone to inundation at present, increasing notably with 0.4m and 0.7m sea level rises (and a smaller increase in affected area after that up to 0.9m).	A range of beach and foreshore assets are at risk from coastal inundation by 2100 (WBM BMT 2017, refer to CZMP for detailed assessment).

Best practice erosion hazard modelling considers a probabilistic approach and multiple AEPs (event likelihoods, e.g. 10%, 1%, 0.2% AEPs) along with multiple planning horizons (e.g. present day, 2050, 2100). It would be beneficial to update the coastal hazard modelling to incorporate additional AEPs into the existing body of information on storm tide prone areas.

Combined impacts of coastal hazards

The combined impact of erosion, tidal inundation and coastal/storm tide inundation are yet to be comprehensively assessed. The combined socioeconomic costs of coastal hazards within the study area are likely to be significant, however further analysis is required and is an opportunity for the CMP. Co-incident catchment and coastal flooding extents are also yet to be assessed – either through a combined mapping approach or coupled dynamic modelling – and associated exposure/risk impacts. This could be a further opportunity for the CMP.

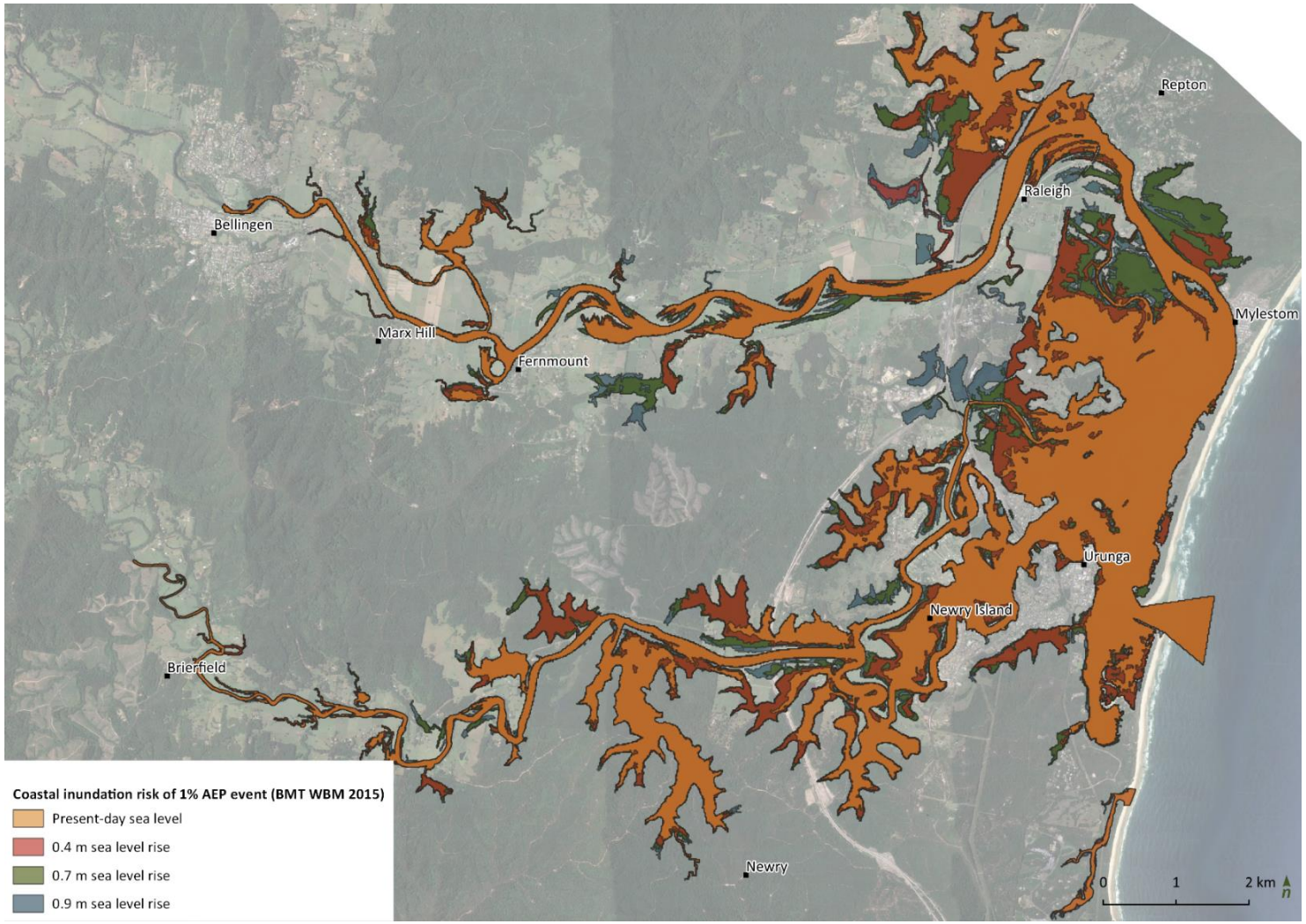


Figure 35. *Modelled coastal inundation extents for Bellinger and Kalang River under a 1% AEP event for sea level rise scenarios of present-day, 0.4 m, 0.7 m* and 0.9 m (BMT WBM 2015).*
*NB. The spatial extent of the 0.7 m SLR scenario representing a 1 % AEP inundation event for 2070 appeared to be less than expected in some areas when compared to the lower, previous SLR scenarios. At these locations, the 0.4 m extent has been used to provide an indication of potentially impacted areas under the 0.7 m SLR scenario. However, it is recommended that the accuracy of the 0.7 m scenario is explored in more detail as part of later CMP stages to increase the confidence of this analysis.

Sand drift

Sand drift is not presently an issue for the Bellingen coastline as aeolian transport has largely been mitigated by vegetated dunes, particularly in Mylestom where there was previously a history of sand drift. Wind regimes may change in the future, affecting aeolian transport of coastal sediments. However, it is difficult to predict such changes and thus an accurate assessment of sand drift cannot be made but it is presently not considered a management issue.

Mylestom Spit

Mylestom Spit is a vegetated sand dune system backing North Beach, adjacent to the Bellinger River near the township of Mylestom (Figure 36). The spit feature acts as a barrier to waves on the lower Bellinger River estuary (BMT WBM 2014). The placement of training walls has since encouraged the stabilisation and growth of Mylestom Spit. In the past, efforts have also been made to establish vegetation on the dune to prevent aeolian sediment drift and encourage the growth of the dune. However, it is at risk of becoming breached in the future as a result of beach recession (BMT WBM 2012). The narrowest point of the spit is just south of Mylestom township. A breakthrough of the spit at this location would likely result in significant changes to the estuary dynamics, potentially dividing sections of the meander. Further investigation of this site has been previously recommended (BMT WBM 2012) and would be beneficial to inform the CMP.

Figure 36. *Mylestom Spit*

Summary

The management of coastal process and coastal hazard impacts along the open coastline, estuary and low-lying coastal land continues to be an ongoing management challenge for the Bellingen Shire. Sea level rise and coastal/storm tide inundation currently impacts assets and infrastructure, and the extent of this impact is projected to increase up to 2100. Land use and ecosystem function is also likely to be impacted as sea levels rise. The CZMP began to address many of these challenges, and those recommendations will be brought forward into the CMP process.

The current combined information on coastal hazard areas, including beach erosion, recession, predicted tidal areas with sea level rise, and coastal inundation extents, are considered to be adequate to update coastal vulnerability area mapping as part of the CMP process. Given the relatively low number of assets at risk within these hazard extents, additional detailed studies are not recommended for inclusion in Stage 2 of the CMP development.

However, recommended tailored studies for the CMP include to update the coastal hazard information to include leading practice approaches (e.g multiple AEPs) and new information from the last 5 years, and additional detail for high risk sites (Hungary Head and Wenonah Head, and Mylestom Spit). Coincident catchment and coastal flooding scenarios, and combined socio-economic impact assessments, would also be beneficial to boost the leading practice approach in the CMPs. This is particularly true for coastal catchments like the Bellingen where the fluvial and coastal processes are both significant drivers of change in the coastal zone.

Recommended tailored studies for the CMP Stage 2 or beyond that are relevant to specific knowledge gaps include:

- Geotechnical assessment and update to hazard assessments for Hungry Head and Wenonah Head
- Estuary foreshore erosion study at Mylestom Spit

- Update all coastal hazard information (erosion and inundation hazard areas) to include multiple AEPs (leading practice probabilistic assessments) – targeted to higher risk areas/segments
- Co-incident flooding scenario assessment (mapping and/or modelling – fit for purpose)
- Develop coastal monitoring plan including suitable trigger to signal management response.

3.12 **Social context**

Key points

- The Gumbaynggirr people are the traditional owners of the land, and the coastal area between Dalhousie Creek and Oyster Creek is held as part of a Native Title.
- The population of Bellingen Shire is unlikely to grow significantly in the future as there is limited land for infrastructure expansion.

Population

The population of the Shire at the time of the 2016 census was 12,893 (ABS 2018). Most of this population is concentrated in the major town centres of Bellingen and Urunga. Village settlements include Raleigh, Mylestom, Fernmount and Repton. Census data for Bellingen Shire provides an indication of the demographics of the region. At the time of the 2016 census, the median age of people in Bellingen Shire was 49 years, and:

- Children aged 0 - 14 years made up 17.4 % of the population compared to the State average of 18.5 %
- People aged 65 years and over made up 23.8 % compared to the State average of 16.2 %.

Of occupied private dwellings in Bellingen Shire:

- 45.5 % were owned outright (compared to State average of 32.2 %)
- 26.4 % were owned with a mortgage (compared to State average of 32.2%)
- 24.6 % were rented (compared to State average of 31.8 %).

Figure 37 shows the population numbers for the residential areas in Bellingen Shire LGA at the time of the 2016 census. The main population growth areas in the Bellingen Shire are around the townships of Bellingen and Urunga as there is limited opportunity for growth in the smaller village settlements or along the coast. There is a predicted population increase to 2021, then a decline (Figure 38). Overall, it is predicted that there will be a population decline of 0.16 % by 2036 (ABS 2018).

However, these population decreases for the Shire do not align with large predicted population increases across eastern Australia in the coming decades. The vast majority of existing and new Australians (i.e. migrants) are likely to choose to live in the coastal fringes of the east coast. As a result, population pressures on the Bellingen Shire and the surrounding coastal regions are likely to increase in coming decades. Although there are no new urban development areas proposed within the Shire there is still significant opportunities for higher density residential developments within existing residential areas. The predicted population decreases for the Shire should be viewed with caution given the large-scale population increases projected for Australia.

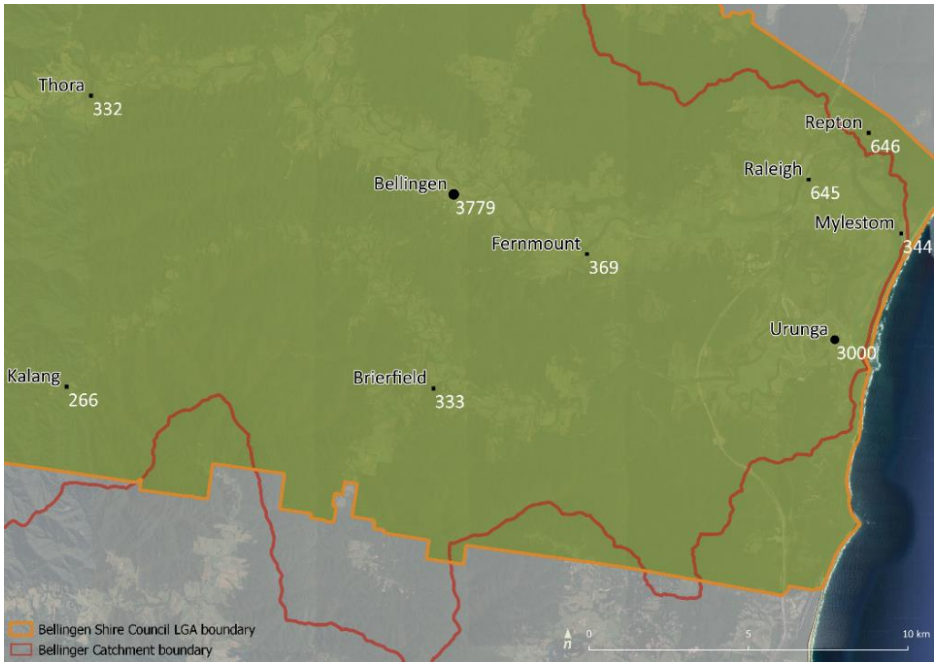


Figure 37. *Population count from 2016 census within the residential centres of Bellingen Shire LGA*

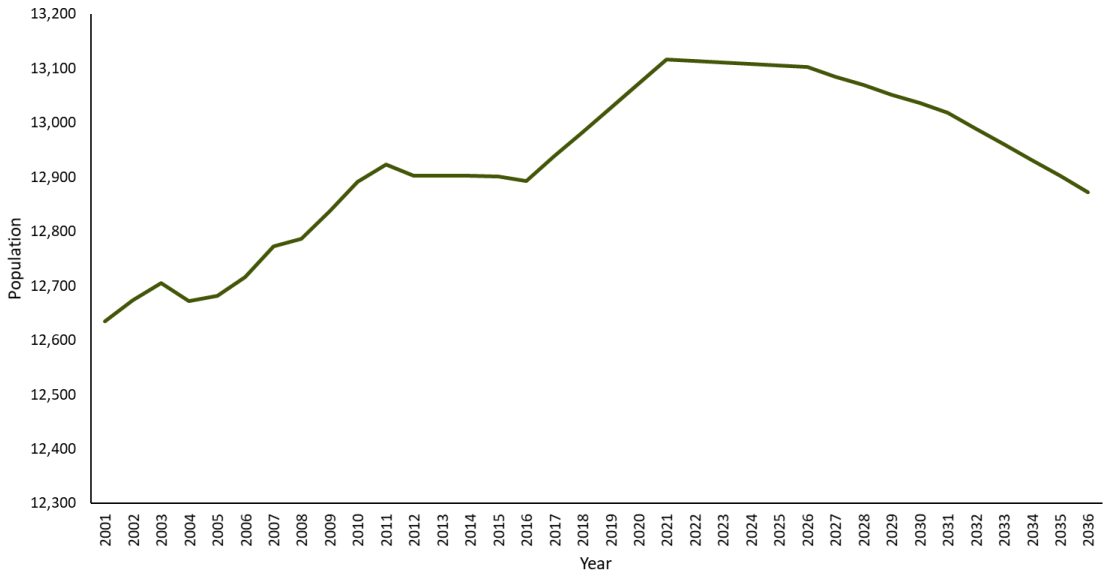


Figure 38. *Population projections for the Bellingen Shire to 2036 based on 2016 census data (ABS 2016). Available information does not extend beyond 2041.*

Employment

The top employment industries in Bellingen Shire at the time of the 2016 census were hospitals (4.6 %) and aged care residential facilities (3.6 %). Other major industries included primary (3.2 %) and secondary education (3.5 %), and cafes and restaurants (3.1 %). The most common occupations were professionals (21.4%) and technicians and trade workers (14 %) (ABS 2018).

Tourism is also an important part of the Bellingen Shire economy due to the largely untouched coastline and natural beauty. The Shire receives more than 223,000 visitors annually and the population can increase dramatically during the peak tourism seasons such as Christmas and Easter (DP 2009; BSC 2017b). However, employment numbers in the tourism sector go unreported as people are often employed in other industries such as sales and arts.

Diversity
The most common ancestries in Bellingen Shire at the time of the 2016 census were English 31.8 %, Australian 30.2 %, Irish 9.9 %, Scottish 8.8 % and German 3.5 % (ABS 2018). In addition:

- The percentage of Aboriginal and/or Torres Strait Islander people in the Bellingen Shire was 3.5 %, compared to a State average of 2.9 %.
- The majority of residents, 80.5 %, were born in Australia, compared to the State average of 65.5 %.

Aboriginal cultural heritage
Prior to European settlement in the area, the Coffs Harbour region was the traditional home of the Gumbaynggirr people who have resided in the region for thousands of years. The Bellinger Valley was occupied by two of the seven clans of this Aboriginal nation (Blewitt 2011). The coastal area around Wenonah Head, between Dalhousie Creek and Oyster Creek, is held as part of a Native Title. An additional Native Title claim has been submitted for a parcel of land south of Hungry Head and is awaiting determination.

The Gumbaynggirr people valued the Bellinger Valley and its coastline as an abundant food source, taking the opportunity to trade resources with neighbouring nations (Blewitt 2011; Thomas 2013). They frequently migrated between the valley and the plateau, taking advantage of the seasonal availability of various resources. Food was abundant in the estuaries, swamps, wetlands, woodlands and rainforests. Seafood was highly valued and was a primary source of food. Midden sites along the coastal dunes in the Bellingen Shire demonstrate that the coast was an important place for the Aboriginal people, both in terms of a food source and meeting place (NPWS 2010). There are also remnants of stone fish traps in the tidal areas.

Following European settlement to the area, the indigenous way of life was overwhelmed, and the population was frequently displaced by settlers and natural events (Bellingen and Urunga Museums 2019). A reserve was established on Urunga Island but was later moved to Yellow Rock after a flood event.

European heritage
The following information is largely based on the erosion study by Telfer & Cohen (2010) unless otherwise stated. Permanent European settlements in the Bellingen Shire began as early as the 1840s, originally establishing the area for timber logging between Raleigh and the coast. Logging was initially cedar, followed by other rainforest species, including pine, when cedar supplies were exhausted (BAES, 2008; Telfer & Cohen, 2010). Settlement in the lower Bellinger valley was formalised by the end of the 1840s when a ship was built to transport the timber for sale. These practices continued until the early 20th Century, when most of the land had been cleared.

The Crown Lands Act, introduced in 1861, saw extensive clearing of land by owners. The floodplains in the estuary were cleared for maize cultivation, shifting away from subtropical rainforests by the end of the 1800s. Following a drought period during the early 20th Century in the Bellinger valley, cropping gave way to beef and dairy cattle grazing on native vegetation, and sown pastures. Following the declaration of National Parks, over half of the Bellingen catchment area is now covered by National Parks, State Forests and Nature Reserves. This helps to preserve and maintain the natural beauty of the region.

3.13 **Economic context**

Key points

- The economy of the Bellingen Shire is driven by construction, health care, manufacturing, and agriculture, forestry and fishing.
- Dairy and beef cattle remain the largest agricultural sectors.

Key industries

The economic value-added (a measure of the value generated by business activity) by different industry sectors in the region has been based on available economic data at the Local Government Area (LGA) scale. The total economic value-added in FY2017-18 to the Bellingen Shire was approximately $62 million. A breakdown by sector is shown in Figure 39.

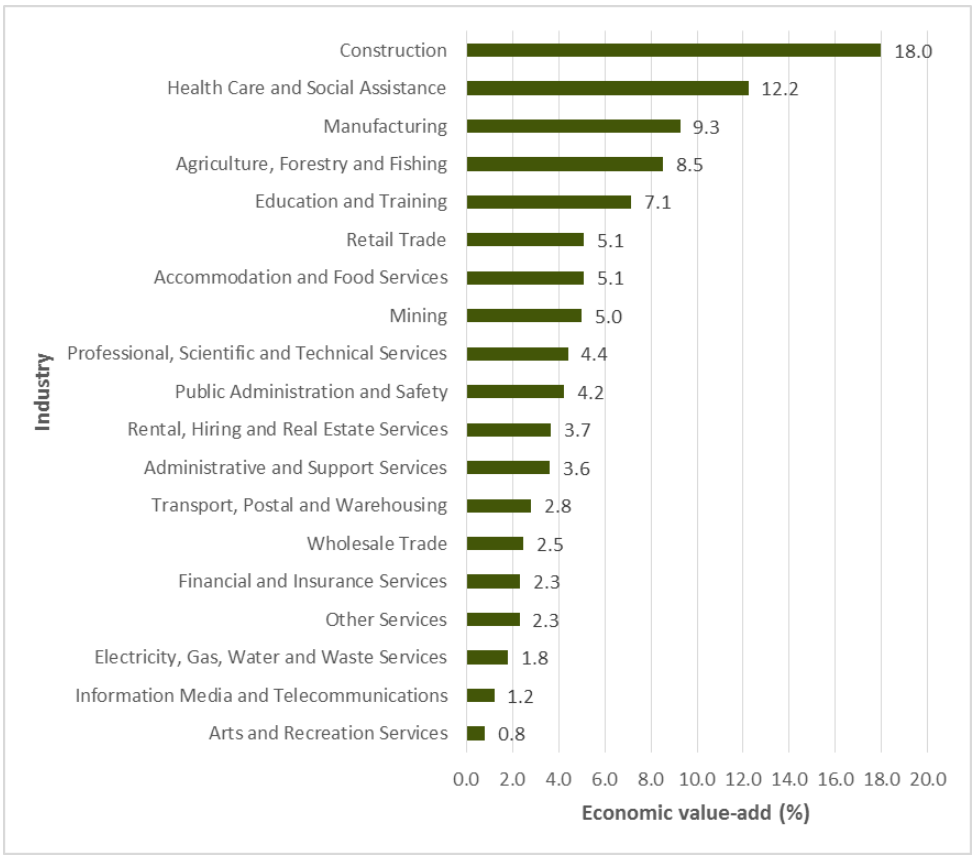


Figure 39. *Graphic representation of the largest industries in the Bellingen Shire LGA during 2017/18 with their economic value-added along the y-axis and the percentages indicating the proportion that the industry makes up (NIEIR 2018).*

The four biggest sectors in the Shire are construction, health care, manufacturing and agriculture/aquaculture (Figure 39). Together these sectors total to approximately 48.0 % of the regions total economic value-add.

The concentration ratio when considering the top eight contributing industries in Bellingen Shire is 70.4 %, compared to 64.3 % for New South Wales. This signals that industry in the Bellingen Shire is significantly concentrated and at risk of instability if one or more of the major industries encounter substantial problems (e.g. resulting from coastal inundation and erosion).

Tourism
Tourism is an emerging industry in the Bellingen Shire, with efforts being made to maintain the natural amenities, preserving community values and drawing tourists to the region. The value of tourism within the Shire is typically disaggregated across multiple industries, with the total value added by tourism and hospitality in the Bellingen Shire in 2016/17 estimated at $58.9 million (BSC 2018). This contrasts a total value of $24.8 million added to the economy during 2017/18 (NIEIR 2018).

Agriculture, forestry and fishing
Following European settlement and land clearing for logging, agriculture became the primary industry in the region. Land areas of the lower floodplains were cleared for cropping and grazing. Many of the residents in the Shire also maintain hobby farms. Dairy and beef cattle remain the largest agricultural sectors, contributing almost 90 % to the total agricultural production value. Smaller sectors include vegetables (3.8 %), fruit (2.4 %) and cereal crops (1.4 %) (NIEIR 2018).

During the 2017/18 financial year, $29.6 million was contributed to the Bellingen Shire economy from agriculture, forestry. Of this contribution, over 90 % of the value was attributed to agriculture (approximately $27 million). The remainder of the value is added by forestry and logging ($2.3 million), with $100,000 contributed by aquaculture; fishing, hunting and trapping; and agriculture, forestry and fishing support services. Lower values of aquaculture may be related to the oyster farm closures that have occurred in recent times due to disease (see further discussion below).

The floodplains of the Bellinger River catchment are predominantly used for grazing of beef and dairy cattle, which are the two main agricultural industries. The value of dairy and livestock in the Bellingen Shire was $8.2 million and $6.8 million (respectively) in 2015/16, which when combined accounted for 88 % of the Shire's total value of agricultural production.

Agriculture has experienced a decline in the Bellingen LGA over the five years from 2012/13 to 2017/18. There was a value loss of $10 million or 3.2 % over this time. This loss is also reflected in the decrease of grazing land between 2007 and 2017 (see Section 3.7). There was a significant loss in aquaculture, which saw value decrease from $1.2 million to $0.1 million over the five years. However, these changes were coupled with an increase in the value of forestry and logging, which increased by $2 million.

Oysters
The oyster harvest area in the Bellingen Shire was closed for over eight years (Section 3.9). Harvesting has since recommenced in the estuary, however, with less than five oyster harvesters with permits operating, DPI NSW cannot release economic production data due to confidentiality concerns. Consequently, it is difficult to determine the exact economic value contributed by oyster production in the Bellinger River. The overall percentage change in value and production of oysters in a range of NSW coastal areas is provided in Table 11 as a guide to oyster industry trends in the broader region.

Table 11. Comparison data for the productivity of and value of the oysters harvested within Bega River, Bellinger River, Bermagui River, Botany Bay, Clarence River, Nelson Lagoon, Patonga Creek, Richmond River, Shoalhaven River, Tweed River and Wooli Wooli River (catchments with less than 5 permit holders whose productivity has been combined to maintain confidentiality) (DPI 2019)

Summary Period	Quantity % change from previous year	Value ($) change from previous year
2007/08 to 2008/09	3.3 % increase	2.1 % increase
2008/09 to 2009/10	18.5 % decrease	10.4 % decrease
2009/10 to 2010/2011	25.8 % decrease	30.6 % decrease
2010/2011 to 2011/12	22.5 % decrease	22.6 % decrease
2011/2012 to 2012/13	6.8 % increase	17.5 % increase
2012/13 to 2013/14	39.5 % increase	48.1 % increase
2013/14 to 2014/15	26.1 % decrease	28.4 % decrease
2014/15 to 2015/16	10.7 % increase	19.5 % increase
2015/16 to 2016/17	6.8 % increase	7.7 % increase
2016/17 to 2017/18	36.8 % decrease	32.3 % decrease

3.14 Stakeholder and community values

Key points

- The coast is highly valued by the local community.
- More than 50 % of people live within 10 km of the coast or estuary and another 80 % of people visit at least twice a week.
- The community survey identified that over 50 % of people would like to remain involved in the CMP process, highlighting the community interest in what happens in the Shire.
- Residents feel that riverbank erosion and loss of vegetation along waterways are among the top threats to the coast.

Community and Stakeholder Engagement Plan

The Community and Stakeholder Engagement Plan (C&SEP) developed for the Bellingen Shire CMP process is provided in the attachments to this document (Attachment A). The C&SEP provides a summary of the key catchment context, engagement objectives, and actions to guide engagement with the community and other stakeholders in the development (and later the implementation) of the CMP.

The C&SEP actions during the scoping stage of the CMP (Stage 1) have included:

- Establishment of a Working Group, and initial meeting to launch the CMP process
- Identification of stakeholders and key interests
- Phone / email interviews with key stakeholders
- Online survey
- A focus on gathering community and stakeholder feedback on catchment values and perceived issues/threats.

Agency Reference Group

A key component of the engagement process is the establishment of the Agency Reference Group (ARG) to provide guidance on the study and also latter stages of the CMP. The Agency Reference Group for the Bellingen Shire CMP includes representatives from:

- Bellingen Shire Council
- NSW Office of Environment and Heritage (OEH)
- NSW Parks and Wildlife
- NSW Transport, Roads and Maritime Services
- Coffs Harbour Local Aboriginal Land Council
- Forestry Corporation NSW
- Department of Industry – Crown Lands
- NSW Department of Primary Industries – Fisheries
- Bellingen Landcare

The ARG convened early in the scoping study to discuss the desired project outcomes, share knowledge and explore the vision for the Bellingen Shire coastal area. Discussion included past management processes, engagement, water quality and ecological health as key elements to include in the CMP process. Minutes from the first ARC meeting are provided in the attachments (Attachment C).

Traditional Owners
Engagement with Traditional Owners is an important part of the CMP development process, as recognised in the Community and Stakeholder Engagement Plan (Attachment A). Stage 2 of the CMP process will include further dialogue with Traditional Owners to identify engagement preferences and ways to inform/shape each Stage of the CMP, and the subsequent CMP implementation.

Initial stakeholder interviews
The WG members provided a list of key stakeholders with interests in the catchment. These stakeholders had a diverse range of interests in the Bellingen Shire and broader coastal zone and included:

- Bellingen Heads State Park Trust
- Local Aboriginal Land Council
- OzGreen
- Urunga Surf Live Saving Club
- Bellinger River Sailing Club
- Agrisense
- Australian Lifeguard Service
- Bellingen Bush Regenerators
- Urunga Anglers Club
- Urunga Sail Training Club
- North Beach Community Alliance
- Reflections Holiday Park, Urunga

An attempt to contact each stakeholder by phone and/or email was made early during the development of this scoping study. Key questions were asked including:

- What is your interest/concern in the Bellingen Shire and coastal area?
- Do you know of any data/information which should be included in the scoping study?
- What level of engagement would you like through the CMP process?

An overview of the responses from each stakeholder is provided in the Attachment B.

Community interests
The broader catchment community has been engaged through several avenues during the scoping study.

An information flyer was also produced and shared through the BSC website (Figure 40). The flyer content was produced to inform the community of the recent NSW coastal legislation reform and how they can be involved in shaping the future of management in Bellingen Shire through the CMP process.

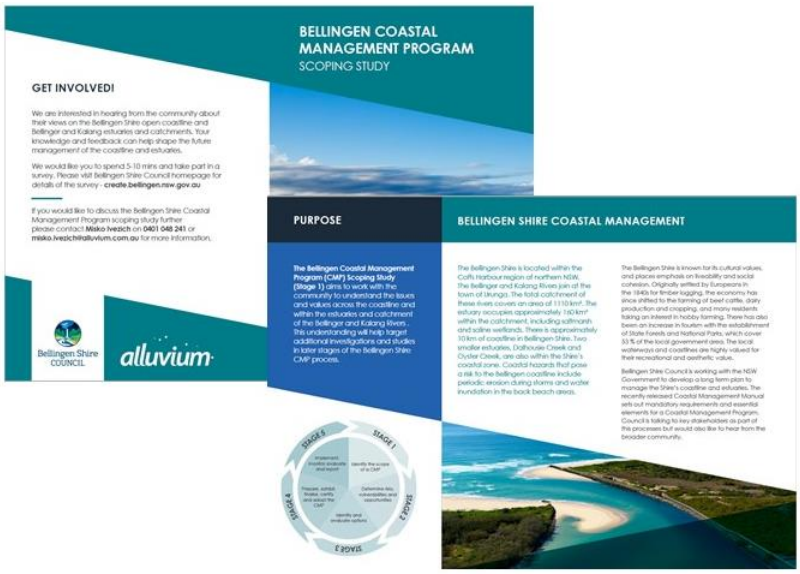


Figure 40. *The information flyer distributed as part of the Bellingen Shire CMP scoping study.*

An online survey was also made available to the Bellingen community via the Bellingen Shire Council website and shared through various stakeholder's social media platforms. The online survey was designed to draw out the social, economic and environmental values and issues within the catchment, as outlined in the following section.

Online survey

The survey was open to the public from June to September 2019. During this period 97 responses were collected. The survey comprised of 20 questions to complete. Questions aimed to capture the demographics of the respondents, their values, concerns, interest and observations within the catchment over time.

The results from key sections of the survey are provided in Table 12. Graphical representation of the results is provided in Attachment B.

Kalang River

Table 12. Summary of results from the Bellingen community survey

CMP theme	Results	Implication/message
Community demographics		
Age 	• More than half of respondents were aged over 55 years	• Age distribution has implications for the future economic and infrastructure development for the Shire • The community-drive nature of the Bellingen Shire is reflected in the level of club membership and can be viewed as a desire to be involved with projects, which is also reflected in the overwhelming response to being updated/involved in the CMP process
Occupation 	• Nearly 30 % of people surveyed are retired • The greatest proportion of respondents (12 %) are employed in education and training, and healthcare and social assistance (11 %)	
Club membership 	• Over 60 % of respondents indicated that they are a member of a group or club	
Community engagement 	• Almost 70 % of people were interested in keeping updated or attending future information sessions related to the CMP process	
Coastal values		
Proximity to coast 	• Greatest number of respondents (31 %) live within 1 km of the coast or estuaries • Residents between 1 and 10 km of the coast are the next highest respondents (26 %) • 22 % of residents live along the beach or waterfront	• The proximity and visitation rate of the residents to the coast, beaches and estuaries gives an indication of the community values • These values will inform future management strategies for the coastal area • Natural and built assets and infrastructure need to be adequately management to meet the values of the local community
Coastal visits 	• 42 % and 41 % of respondents visit the coast and estuary areas on a daily and twice to three times weekly basis, respectively • The most frequently visited locations were Urunga and Hungry Head • Other popular locations include Urunga Boardwalk, Mylestom, Bellinger River and Tuckers Rocks	
Important values 	• The most valued aspect of the coast within the Shire is natural ecosystems and wildlife (34 %) • Recreational opportunities and the unique landscape and natural beauty are also highly valued	
Coastal threats		
Community-identified threats 	• Top 5 threats to the coast: ○ Riverbank erosion ○ Pests (animals and weeds) ○ Loss of vegetation along waterways ○ Pollution ○ Climate change	• Important to gain community feedback to ascertain where there may be ongoing issues as there is a lack of monitoring • The community may also have photographs or other information to inform historical changes to the coast or catchment
Past experiences with coastal hazards or flooding 	• Half of respondents had never experienced or been affected by a coastal hazard or flooding within the Shire • Of those who had, 21 % had experienced an event on several occasions • 20 % had experienced an event once or twice	

3.15 Land use / tenure

Key points

- Multiple responsible authorities contribute to the complex management arrangements in the Bellingen Shire.

The Bellinger River catchment is host to a mosaic of public and private land tenure which is subject to numerous local, regional and state management arrangements. These arrangements have changed over time, leading to complexity when attempting to determine responsibilities as land management issues arise. A summary of the existing tenures and corresponding responsible authorities within the catchment is noted in Table 13, Table 14 and shown in Figure 41. Multiple responsible authorities contribute to the complexities in the existing management arrangements within the Bellingen Shire.

Table 13. An overview of the tenure categories found within the catchment and their corresponding responsible authorities

Property type	Responsible authority
National Park	National Parks and Wildlife (State Government)
Road Reserve	Bellingen Shire Council
Agricultural drain	Private landholders
Natural waterway	Crown Land Reserve Manager – Department of Planning, Industry and Environment (DPIE – Crown Lands) Department of Primary Industies (DPI) – Fisheries
Crown land reserve	Department of Planning, Industry and Environment – Lands (DPIE – Crown Lands) Bellingen Coast Regional Crown Reserve Bellinger Heads State Park Trust NSW Crown Holiday Park Trust
Native Forest	Bellingen Shire Council
Freehold	Private landholder

Table 14. Summary of land tenure by area and percentage of Shire (LGA Cadastre 2013)

Land tenure	Total area within shire (hectares)	Percentage of shire
Crown	2273	2.5 %
Freehold	69, 438	73.5 %
Local government authority	13	<1 %
NSW Government	22, 833	24 %
Unknown	1	<1 %

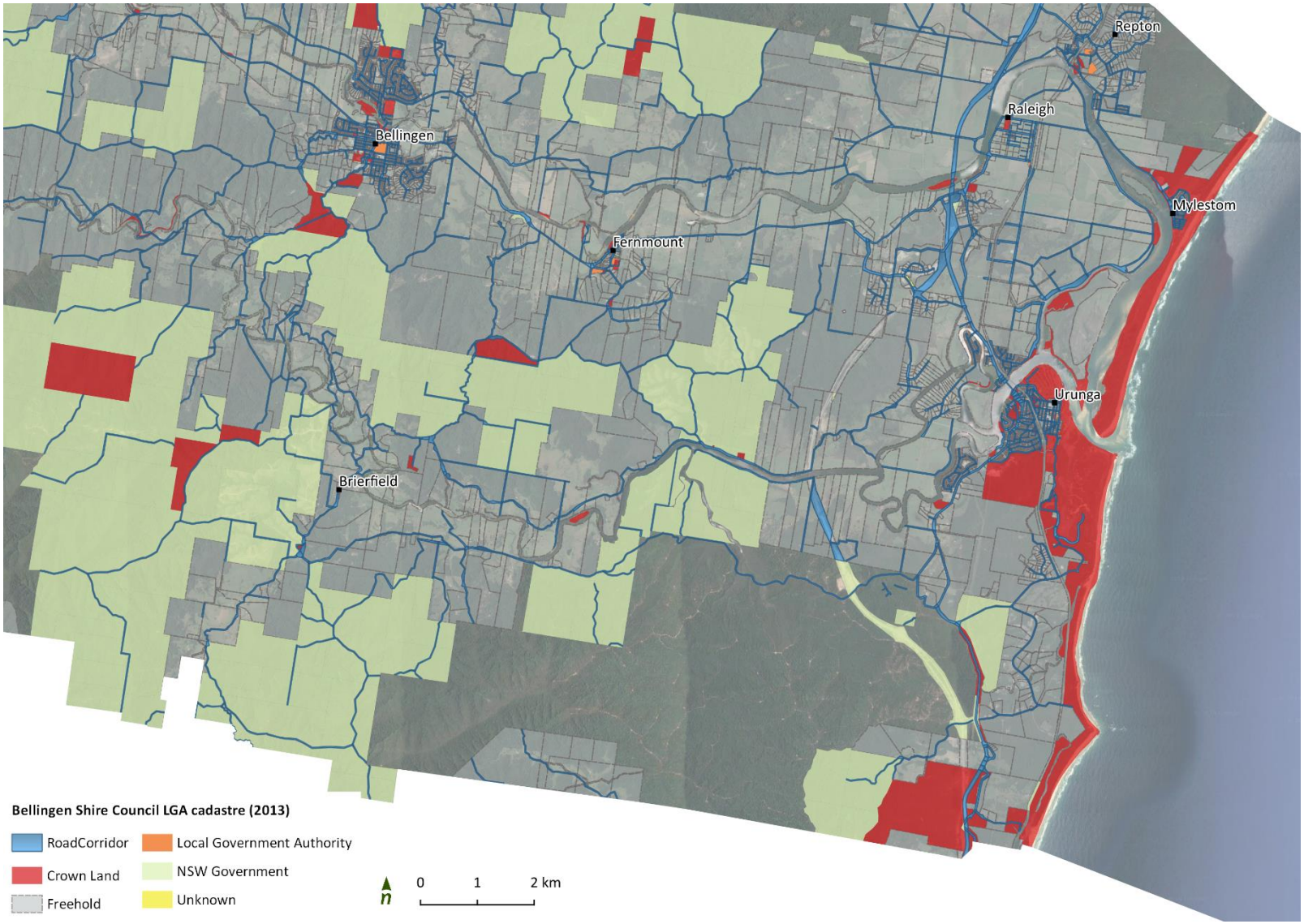


Figure 41. *Land tenure (LGA cadastre 2013).*

3.16 Coastal management areas

Key points

- The Coastal Environment Area for the Bellingen Shire extends from offshore, inland to the towns of Bellingen and Brierfield.
- Coastal Wetlands and Littoral Rainforests are given the highest priority for management; there is 3 km^2 of coastal wetlands and 0.03 km^2 of littoral rainforest
- It is possible that the boundaries of some coastal management areas will need to be revised as part of the CMP process

SEPP areas

The spatial extent of the coastal zone is comprised of a combination of coastal management areas which are mapped in the recently released Coastal Management State Environmental Planning Policy (SEPP) in accordance with the principles articulated in the CM Act 2016.

The four coastal management areas outlined in the Coastal Management SEPP include Coastal Wetlands and Littoral Rainforest, Coastal Use areas, Coastal Environment areas and Coastal Vulnerability areas. Specific management objectives for each coastal area are provided within the CM Act 2016.

The coastal environment area for the Bellingen Shire is the land that has been identified as containing coastal features, such as coastal waters of the State, estuaries, coastal lakes, coastal lagoons and land adjoining those features (NSW Govt. 2018). This area to around the town on Bellingen on the Bellinger River and near Brierfield on the Kalang River (See Figure 42). The coastal use area extends similar distances inland and between 300 and 500 m offshore. Coastal wetlands and littoral rainforest areas are discussed in Section 3.9 under Ecological Values. Coastal vulnerability is not mapped as each Council must consider their coastline's vulnerability to future sea level rise according to local projections.

If multiple coastal management areas apply to a single parcel of land, the CM Act imposes a hierarchy as to which coastal management objectives apply. The hierarchal order for coastal management areas is presented below (highest priority first):

- Coastal Wetlands and Littoral Rainforest Area
- Coastal Vulnerability Area
- Coastal Environment Area
- Coastal Use Area.

The Coastal Management SEPP, which provides development controls for each coastal management area, came into effect on 3 April 2019 (Hawley 2018). Further explanation of the intended effects of the Coastal Management SEPP is provided in explanatory notes available on the NSW State Government website. The extents of the coastal management areas provided in the Coastal Management SEPP are based on regional mapping which can change as new information becomes available. The mapped areas act as a starting point for councils in the development of their CMPs.

Changes in the extent to any of the coastal areas by a planning proposal will be subject to government and community consultation under the EP&A Act 1979. The CMP may cover areas outside of the mapped coastal zone if the management of external areas significantly impacts issues within the coastal zone. The extent of each coastal management area within the Bellingen Shire is discussed in the following section.

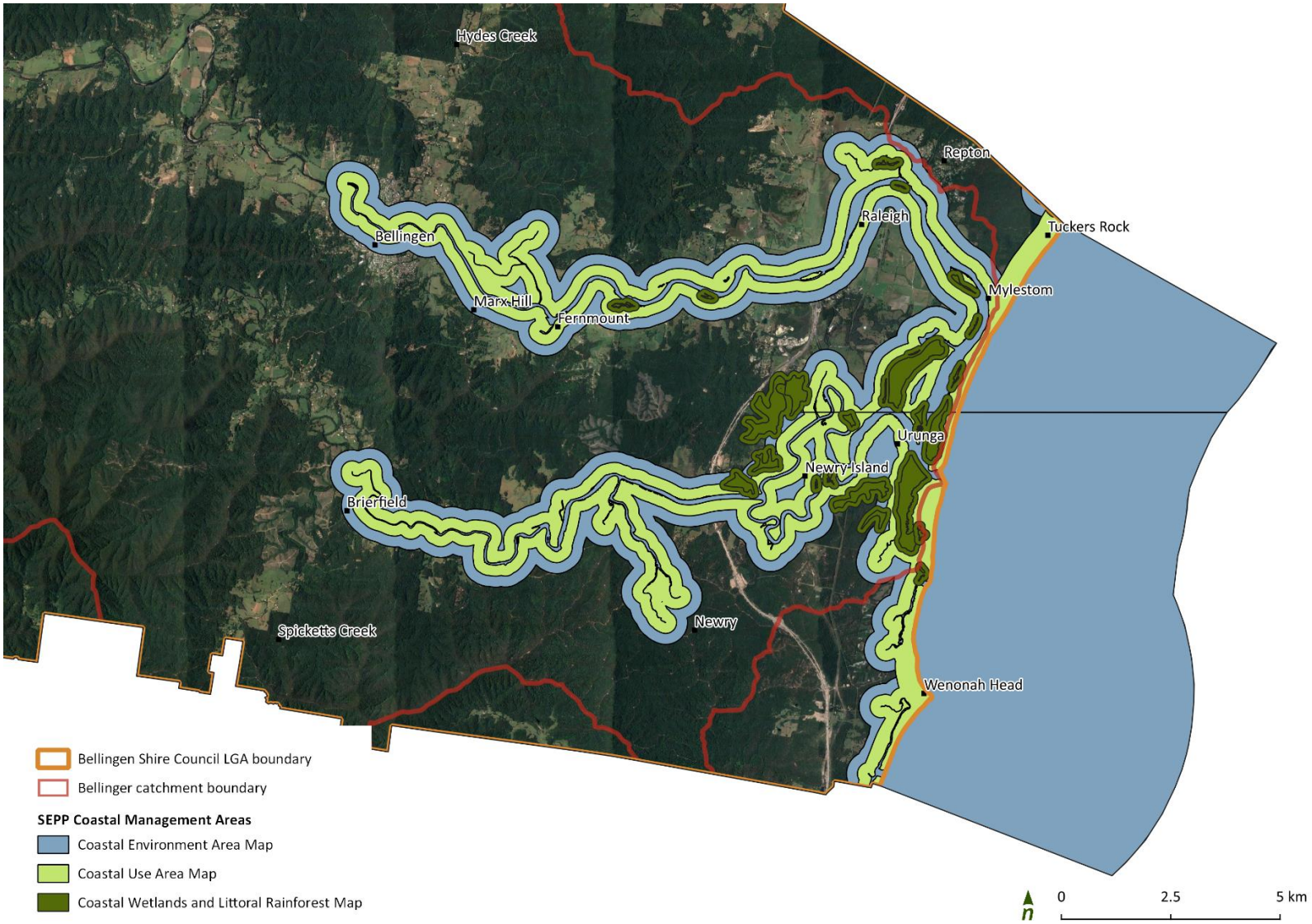


Figure 42. *State Environmental Planning Policy defined coastal management areas within Bellingen Shire (DPE 2018).*

Coastal Wetlands and Coastal Littoral Rainforests
The extents of both Coastal Wetlands and Littoral Rainforests within the Bellingen Shire are shown previously in Figure 42. These extents are based on recently improved state-level vegetation mapping.

Within the Bellingen Shire approximately 3 km² is classified as Coastal Wetland. This includes large areas of the estuary, Urunga Lagoon and Newry Island. Four small areas of Littoral Rainforest area comprising a total of 0.03 km² are located in the south of the estuary mouth near Hungry Head and Urunga Lagoon.

The NSW coastal management objectives for Coastal Wetlands and Littoral Rainforests areas are provided in Table 15.

Table 15. Management objectives for Coastal Wetlands and Littoral Rainforests as described in Section 6(2) of the CM Act.

Objective	Description
a	To protect coastal wetlands and littoral rainforests in their natural state, including biological diversity and ecosystem integrity
b	To promote the rehabilitation and restoration of degraded wetlands and littoral rainforests
c	To improve the resilience of coastal wetlands and littoral rainforests to the impacts of climate change, including opportunities for migration
d	To support the social and cultural values of coastal wetlands and littoral rainforests
e	To promote the objectives of State policies and programs for wetlands or littoral rainforests

Current management arrangements for critically endangered Littoral Rainforest areas are provided for by the Saving our Species program which supports the Biodiversity Conservation Act 2016. The Littoral Rainforests management area identified by this initiative for the Bellingen Shire is located between Tuckers Rocks and Bonville Creek (outside of the Bellingen LGA). The management objectives for Littoral Rainforests within the Bellingen LGA is provided in Table 16.

Table 16. Management objectives from the Saving our Species program for Littoral Rainforests across the Bellingen LGA.

No.	Objective
a	Exclude fire from part/all of the site
b	Minimise impacts of recreational activities
c	Reduce and maintain weed densities at low levels
d	Reduce impacts of tidal/wave activity or storm surges on species habitat
e	Track species abundance/condition over time

Coastal Use Areas
The extent of both Coastal Use and Coastal Environment areas within the Bellingen Shire are shown in Figure 42. Coastal Use areas include areas adjacent to coastal waters, estuaries, coastal lakes and lagoons where the impacts of development on the benefits of these areas need to be considered.

The extent of Coastal Use areas is based on set distances from coastal water bodies and are dependent on factors such as topography, local scenic amenity and the local development approach (OEH 2018c). Approximately 35 km^2 of the Bellingen Shire is classified as a Coastal Use area.

Management objectives for Coastal Use areas are provided in Table 17.

Table 17. Management objectives for Coastal Use Areas (as described in Section 9(2) of the CM Act 2016).

Objective		Description
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
	ii	Adverse impacts of development on cultural and built environment heritage are avoided or mitigated
	iii	Urban design, including water sensitive urban design, is supported and incorporated into development activities
	iv	Adequate public open space is provided, including for recreational activities and associated infrastructure, and
	v	The use of the surf zone is considered
b		To accommodate both urbanised and natural stretches of coastline.

Coastal Environment Areas

A similar perimeter-based approach is applied to the delineation of Coastal Environment areas. These areas include land and waterbodies which have been identified as ecologically sensitive to impacts from coastal development activity. Perimeter controls vary from 100m for estuaries/submerged lands and 500m for coastal lakes and lagoons. As it stands, Coastal Environment areas cover approximately 72 km^2 of the Bellingen Shire.

Development controls provide for the consent authority to consider the extent to which the development will meet management objectives and impact upon natural hazards and local cultural, ecological and amenity values.

Management objectives for Coastal Environment areas are in Table 18.

Table 18. Management objectives for Coastal Environment areas (as described in Section 8(2) of the CM Act 2016).

Objective	Description
a	To protect and enhance the coastal environmental values and natural processes of coastal waters, estuaries, coastal lakes and coastal lagoons, and enhance natural character, scenic value, biological diversity and ecosystem integrity
b	To reduce threats to and improve the resilience of coastal waters, estuaries, coastal lakes and coastal lagoons, including in response to climate change
c	To maintain and improve water quality and estuary health
d	To support the social and cultural values of coastal waters, estuaries, coastal lakes and coastal lagoons
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
f	To maintain and, where practicable, improve public access, amenity and use of beaches, foreshores, headlands and rock platforms.

Coastal Vulnerability Areas

No mapped Coastal Vulnerability areas are currently available through the Coastal Management SEPP mapping. Coastal hazards that have been mapped by previous coastal hazard studies may be used to guide the mapping of Coastal Vulnerability areas for all coastal hazards and are discussed earlier in Section 3.2. A number of management objectives are outlined in the CM Act and apply to land subject to coastal hazards. Considerations for mapping include the risk to public safety, maintaining the presence of natural beach systems and public access, avoiding degradation of biological diversity, adaptive capacity and tolerance of the community to coastal hazards.

The Bellingen Coastal Processes and Hazards Definition Study addresses the hazards and vulnerability associated with tidal inundation which is predicted to increase with climate change. The parameters modelled in this study were done under the CZMP Guidelines and the NSW Government *NSW Sea Level Rise Policy Statement* and *Coastal Planning Guideline: Adapting to Sea Level Rise*. These are no longer applicable under the CMP process and LGAs are now encouraged to adopt a regionally relevant sea level rise planning level in

planning documents henceforth. The Lower Bellinger and Kalang River Flood Study also models the flooding and inundation land in the area applicable to this study and identifies where the most at-risk areas are and the level of emergency response that may be required.

Modification of the spatial extents

Key issues of the new CMP are largely located within Coastal Use and Environment Areas as well as Coastal Wetland and Littoral Rainforest Areas. The management of many of the issues facing Bellingen Shire will require a catchment wide response. Given the extent of the issues and the potential solutions, it is possible that the boundary of Coastal Use and Coastal Environment Areas will need to be revised.

The technical studies required to fill knowledge gaps as part of Stage 2 of the CMP process will produce new understanding that may influence the spatial extents of existing mapped boundaries. Following completion of these studies and the Stage 2 work, the implications for modifying mapped areas can be confirmed.

Revising these areas so they encompass the broader contributing catchment will help to manage the issues at hand and balance the social, economic and ecological needs of the catchment.

Any proposed amendments to the mapping of these coastal management areas will be identified in the final CMP and include supporting evidence. The CMP must also identify the information about these amendments which can be used to support the preparation of planning proposals which inform the gateway determination process under section 3.34 of the EP&A Act (CMM 2018).

Kalang River

3.17 Existing management plans review

Key points

- There are six key existing management plans for the Bellingen Shire; the Dalhousie Creek Entrance Management Strategy, Coastal Zone Management Plan, Bellingen and Urunga Stormwater Management Plan (Draft), Bellinger River Health Plan, Kalang River Health Plan, and Bellinger and Kalang Rivers Estuary Management Plan.
- Governance over the implementation of these plans remains a challenge, as well as monitoring success.

The key existing management plans relevant to the Bellingen Shire coastal area include:

- Dalhousie Creek Entrance Management Strategy (2018)
- Bellingen Coastal Zone Management Plan (2017)
- Bellingen and Urunga Stormwater Management Plan DRAFT (2011)
- Bellinger River Health Plan (2010)
- Kalang River Health Plan (2010)
- Bellinger and Kalang Rivers Estuary Management Plan (2007).

This section provides a review of the intent and objectives of these plans, as well as implementation and outcomes to date (where sufficient information is available to provide comment), and any barriers and learnings noted. Only very limited information / monitoring has been available to inform an audit of these plans, as the majority of actions are in early stages of implementation (or were superseded by subsequent plans).

Table 19 provides a summary of the existing management plans and their objectives.

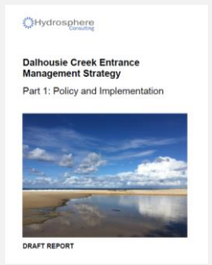
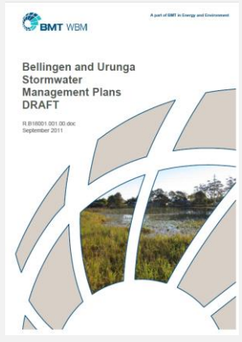
Summary

The existing management plans relevant to the management of the Bellinger River catchment and the broader coastal zone are generally in accord on the issues, challenges, objectives and management actions. As there are limited monitoring programs for the plans to date and, as such, it is difficult to track the implementation and progress of the adopted plans. However, these plans provide a good basis for the development of a focused CMP for the Bellingen Shire.

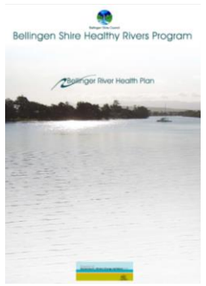
Complex governance arrangements, limited staff resources allocated to waterway management within Council, and limited funding opportunities have been a significant barrier to coastal management.

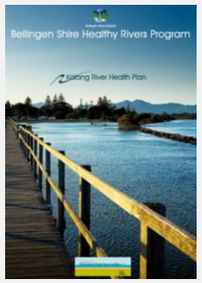
The Bellingen Shire CMP provides an opportunity to simplify governance arrangements and clearly specify the roles and responsibilities of Council and other agencies. With adequate funding the Bellingen Shire CMP will overcome many of the barriers which have limited coastal management arrangements to date.

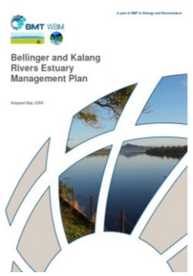
Table 19. Summary of the existing management plans for the Bellingen Shire

Plan name and date	Summary of the plan	Plan objectives	Key recommendations	Other observations
Dalhousie Creek Entrance Management Strategy (2018) 	• The strategy outlines the approach for the management of Dalhousie Creek entrance and Hungry Head Beach (Urunga SLSC precinct) of the Bellingen Shire coastline • Management of the entrance is approached in stages: ○ Stage 1 – beach scraping ○ Stage 2 – north bank of Dalhousie Creek controlled by geotextile sand containers (GSC) ○ Stage 3 – replacement of GSC with rock work	• Maintain Dalhousie Creek entrance and Hungry Head Beach in desired condition according to consultation with key stakeholders • There will be a staged approach to beach management with escalation to subsequent stages if current practice is ineffective	• Beach scraping to maintain a 'dry notch' at Dalhousie Creek entrance and inter-tidal zone • Sand from scaping used to nourish beach and dunes at emergency 4WD access, beach in front of SLSC and public access ways • Dune revegetation, and path/ramp maintenance and improvements • Artificial opening of Dalhousie Creek if trigger criteria are reached • Use GSC to train the northern bank of Dalhousie Creek • Replace GSC with permanent rock work if necessary (after 5-year review of strategy) • Monitoring of hydrological and metocean conditions to determine efficacy of measures	• Also includes monitoring measures • Bellingen Shire Council is responsible for the implementation of the plan with support from OEH and Bellinger Heads State Park Trust
Coastal Zone Management Plan (CZMP) for the Bellingen Shire (2017) 	• The current 10-year strategic plan based on the Bellingen Coastal Zone Management Study (BMT WBM 2014) • The plan identifies a number of priority actions: ○ Asset management ○ Beach access and use management ○ Dune and habitat management ○ Further studies, including precinct planning ○ Monitoring ○ Planning and development controls • Assets along the coastline have been prioritized for action based on erosion and inundation risk, assigning a risk level to each asset	• Details management options to address risks from coastal hazards along the coastline now and into the future • Update Council's Asset Management Plan with coastal hazard information, to ensure cost effective and appropriate asset management in coastal zone • Ensure safe beach assess is maintained • Manage sea level rise threat to high value natural habitats, including estuarine habitats • Prepare internal checklist, guideline or policy to guide Council officers to consider hazard zones and timeframes when building structures/facilities in the coastal zone (for which Council is the consent authority, REF required only) • Conduct internal training to ensure that coastal zone management is properly integrated into Council's operations • Incorporate coastal inundation into Council's Floodplain Risk Management Plan	• Continue, improve and extend dune rehabilitation and weed removal efforts • Conduct geotechnical investigations to improve hazard definition at Hungry Head and Wenonah Head • Undertake an estuary foreshore erosion study at Mylestom Spit to address long-term risks associated with combined estuary and beach recession hazards • The plan suggests yearly or more frequent intervals of monitoring • Includes monitoring of: ○ Beach access conditions, particularly after storms ○ Regular topographic beach surveys at targeted locations ○ Collect LiDAR topographic data across all beach and estuary foreshore locations	• The CZMP has only recently come into place and actions are only in early stages of implementation or transition to the CMP • The CZMP focus was on assets along the open coast, areas further inland, still considered part of the coastal environment area, may also be at risk to coastal processes • Most of the coastline in the Bellingen Shire is contained within Crown Land reserves where the Council will need to work closely with the Department of Industry – Lands (DoI – Lands) to relevant trusts to achieve management objectives. • The CZMP and actions do not consider the broader estuary area of the fluvial influences of the Bellinger River and Kalang River.
Bellingen and Urunga Stormwater Management Plans DRAFT (2011) 	• This plan provides an update to the previous SMP for the townships of Bellingen and Urunga • Future development is likely to occur around the urban centres and potentially increase pollutant export from the catchment to the Bellinger and Kalang Rivers • Urban loadings account for between 1 and 4 % of the total annual pollutant loading to the estuary • Stormwater loads are minor in comparison to total catchment loadings • Modelling considered an unmitigated catchment to determine pollutant exports, as well as integrating existing management controls into pollutant export models • Prioritisation has focused on sediments and nutrients, however gross pollutants should also be an important consideration	• The identification and assessment of potential new stormwater controls to improved urban stormwater quality • To provide a checklist of actions for nominated parties in respect to stormwater management • Prioritisation of actions to build into Council's budget forecasting • Key objectives: ○ Reflect contemporary conditions, and account for recent actions of Council ○ Establish water quality goals and terms of reference with stakeholders ○ Consistent with objectives and actions of Estuary Management Plan ○ Consistent with current best practice for Integrated Water Management ○ Integrate WSUD principles for future urban design • Consider future funding regimes to implement actions and maintain assets and infrastructure	• Establish aspirational targets for stormwater load reduction from existing catchments • Load reducing targets (distinct from targets identified in the Development Control Plan) for total nitrogen, phosphorus and suspended solids, and gross pollutants • Development of a hierarchy for consideration of new devices, including existing sites and new potential sites on publicly and privately owned land • Consideration should be given to the installation of gross pollutant traps in town centres • Council should consider introducing a stormwater levy and consult with state agencies for funding towards stormwater management • Update GIS based information specific to the existing stormwater system • Review/develop an asset maintenance system for management of stormwater quality controls • Coordination of flooding and stormwater management opportunities to ensure multiple objectives are tackled • Incomplete items from previous stormwater management plans should be reincorporated into the updated plan as appropriate	• A Water Sensitive Urban Design Guideline has been developed in association with the SMP • No specific observations have been completed for this plan to investigate the impacts of stormwater discharges on receiving waterways but a review of existing findings has been undertaken • Only diffuse pollutant loads have been considered in the plan • Catchment models have considered current and likely future landuse • Models did not consider lot scale devices such as rainwater tanks and raingardens • Some existing stormwater management devices may be compromised due to a number of factors, including weed growth and sedimentation • Acknowledged constraints to the inclusion of new stormwater treatment devices

Plan name and date	Summary of the plan	Plan objectives	Key recommendations	Other observations

Bellinger River Health Plan (2010)
 
	• Community-driven initiative developed under the Estuary Management Program
	• Plan was developed to address river health management following the closure of oyster harvesting in the Bellinger River
	• The plan is based upon the community's values and expectations for the river, which include:
	  ○ Tourism and recreation
	  ○ Relaxing, attractive to visitors
	  ○ Aesthetics
	  ○ Investment, sustainable rivers add value
	  ○ Important to use and sustain as a water source for multiple purposes – water supply for stock, agricultural production, drinking, showering and swimming, aquaculture
		• Summarises the issues that affect river health, including recommended actions to improve WQ
		• Key issues identified by the community and agencies (in order of priority):
		  ○ Agricultural practices
		  ○ Riparian and wetland management
		  ○ On-site sewage management systems (OSMS)
		  ○ Boating, tourism and recreational impacts
		  ○ Stormwater
		  ○ Rural roads and bridges
		  ○ Forestry, logging and clearing
		  ○ Oil, diesel and waste spills
		  ○ Wastewater treatment plants
		  ○ Water quality monitoring
			• Performance indicators were identified for each strategy to address the key issues
			• Timeframes were assigned to the objectives to determine whether the issue could be managed in the short-term (1-5 years), medium-term (3-7 years) or long-term (5-10 years)
				• As a community-driven initiative, it has not been developed under specific state or federal legislation
				• There is no requirement for the objectives to be addressed
				• The progress of the management of the issues identified under the plan remains unclear due to limited monitoring and information.

Kalang River Health Plan (2010)
 
	• Community-driven initiative that was developed in accordance with the Estuary Management Program
	• Developed from a community and agency perspective to address the issues that affect water quality and river health
	• Widely recognized that water quality in the Kalang River was impacted by human influences, which resulted in the closure of recreational areas and commercial harvesting of oysters
	• Key community values included:
	  ○ Aesthetics
	  ○ Added property value (fertility of river flats)
	  ○ Crucial habitat for living organisms
	  ○ High value for recreation
		• Key issues identified to improve water quality and river health:
		  ○ Agricultural practices
		  ○ On-site sewage management systems (OSMS)
		  ○ Riparian and wetland management
		  ○ Boating, tourism and recreational impacts
		  ○ Wastewater treatment plants
		  ○ Forestry, logging and clearing
		  ○ Stormwater and building construction
		  ○ Rural roads and bridges
		  ○ Water quality monitoring
			• No set targets for each objective, rather broad strategies to address the issues
			• Timeframes and responsibilities were assigned to the objectives to determine whether the issue could be managed in the short-term (1-5 years), medium-term (3-7 years) or long-term (5-10 years)
				• No set guidelines for implementation or monitoring of the plan
				• Progress on addressing management issues identified is uncertain to due limited monitoring and information.

Bellinger and Kalang Rivers Estuary Management Plan (2008)
 
	• The Plan was developed under the Bellingen Shire Coastline and Estuary Management Committee, Bellingen Shire Council and the NSW Department of Environment and Climate Change
	• Main goal of the Plan was to achieve an integrated, balance, responsible and ecologically sustainable use of the estuaries
		• The Estuary Management Study (BMT WBM, 2007) informed the development of the Plan
		• Management objectives were identified following consultation with the community and stakeholders, and review and further investigations
		• Key management areas identified were:
		  ○ Water quality
		  ○ Bank erosion
		  ○ Habitat management
		  ○ Waterway use
		  ○ Land management
		  ○ Community education
		  ○ Fisheries management
		  ○ Tourism management
			• The plan identified the agency responsible for completing the tasks associated with the management strategy, provided and approximate timeframe for completion and possible funding sources to fulfill the requirement
			• Proposed measures to improve management of the estuaries:
			  ○ Raising rates, which has taken effect under the Bellingen and Urunga Stormwater Management Plans (BSC, 2013)
			  ○ Water quality and river health monitoring programs
			  ○ The need to manage high value habitats, such as wetlands and littoral rainforest, which has been included in the updated SEPP framework
				• Access to funding requires an approved Plan, which requires public consultation

CZMP priority actions

The recent Coastal Zone Management Plan completed in 2014 (and re-issued in 2017) (BMT WBM 2017), included priority coastal zone management actions recommended for implementation (Table 20). These actions, along with the other key recommendations from existing studies (Table 19), will be carried forward into the Stage 2 and 3 CMP process.

Table 20. CZMP priority actions (after BMT WBM 2017)

Strategy Group	Key Actions	Action Summary
Asset Management *(AM: BSC Owned; NC: Non-Council)*	AM.1 NC.1	- Update Council's Asset Management Plan with coastal hazard information, to ensure cost effective and appropriate asset management in coastal zone - Provide hazard mapping to Australian Rail Track Corporation
Beach Access and Use Management	BA.2	- Ensure safe beach access is maintained, which may require accesses to be re-contoured following storm activity
Dune and Habitat Management	DH.1 DH.4	- Continue, improve and extend dune rehabilitation and weed removal efforts - Manage sea level rise threat to high value natural habitats, including estuarine habitats
Further Studies including Precinct Planning	FS.1 FS.3 FS.5	- Conduct geotechnical investigation to improve hazard definition at Hungry Head and Wenonah Head, as both areas have high value community assets located adjacent to (and potentially on) bedrock - Conduct precinct planning for Hungry Head and Wenonah Head, following outcomes of the geotechnical investigation(s) - Undertake an estuary foreshore erosion study at Mylestom Spit, to address long term risks associated with combined estuary and beach recession hazards
Monitoring	MO.1 MO.2 MO.3	- Conduct regular topographic beach surveys at targeted locations - Collect LiDAR topographic data across all beach and estuary foreshore locations - Monitor beach access conditions, particularly after storms
Planning and Development Controls	PD.1 PD.2 PD.3	- Prepare internal checklist, guideline or policy to guide Council officers to consider hazard zones and timeframes when building structures / facilities in the coastal zone (for which Council is the consent authority, REF required only). - Conduct internal training to ensure that coastal zone management is properly integrated into Council's operations - Incorporate coastal inundation into Council's Floodplain Risk Management Plan

3.18 Synthesis

Key points
The Bellingen Shire LGA has undergone rapid changes over the past century as an extensively forested catchment was largely cleared to accommodate agricultural and urban development, altering the catchment hydrology, channel stability and affecting water quality. These changes have put pressure on sensitive natural ecosystems and the ecosystem services they provide. Sea level rise and increased coastal hazard risk will also put increasing pressure on the coastal zone.

Despite these major land use changes, over half of the catchment remains preserved as National Parks and State Forests. There is unlikely to be any major land use changes within management planning horizons, and a well-funded and planned CMP presents an opportunity to improve catchment, estuary and coastline condition. Table 21 summarises the key points noted from the information that has been presented in across Section 3 of this scoping study.

Table 21. Summary of the background information presented in Section 3 of this report to inform the CMP process.

Section	Key points
Geology and soils	> The geology and soils in the catchment have been mapped using information from Geoscience Australia and the Australian Soils Classification system. > Soils within the lower catchment and estuary are highly erodible. > There is a high probability of ASS occurring along the length of the Bellinger River and Kalang River close to the upper tidal limits.
Climate	> A relatively short record of temperature and rainfall is available for the Bellingen Shire. Information has also been taken from a recording station located inland of the coast or outside of the Shire. > The climate is sub-tropical, with most of the rainfall occurring from January to June. > Climate change will have a range of implications for the Shire, including increased temperatures and extreme events (flooding, bushfire, erosion).
Historical changes to the catchment	> The Gumbaynggirr people are the traditional owners of the land. > Extensive land clearing since European settlement has led to a loss of riparian vegetation, contributing to bank erosion and sedimentation.
Land use	> The natural environment is highly valued in the Bellingen Shire and there has been an increase in the area reserved for nature conservation over time. > There has been a decrease in the marsh / wetland area.
Groundwater	> There is adequate information to inform the location of the groundwater aquifers and the connectivity to surface water stores. > There is uncertainty on how climate change, particularly tidal inundation, will affect groundwater stores.
Ecology	> There are several ecological communities and species that are vulnerable to changing catchment and coastal processes, land use and climate change impacts. > Seagrass, mangrove and saltmarsh communities are particularly vulnerable to sea level rise and coastal inundation.

Water quality	> The waterways in the Bellingen Shire have faced numerous water quality issues, and notable events have led to the closure of the oyster farms and the die-off of the Bellinger River Snapping Turtle. > Sites in upstream sub-catchments of the Bellinger River are significant contributors of nutrients, including TN and TP. > Recently, the Bellinger Riverwatch program commenced regular water quality monitoring at 24 sites along the Bellinger River and Kalang River. > Improving the water quality and having low turbidity streams will continue to be key management challenges for the Bellingen Shire and the Bellinger-Kalang Rivers and estuary.
Dredging	> One location is currently dredged in the Bellinger catchment for the purpose of providing material for construction, and limited gravel extraction is also permitted. > Management measures are in place to limit any impacts of dredging and gravel extraction in freshwater reaches.
Drainage and stormwater management	> The natural drainage system has been altered for agriculture. > Drainage paths through Urunga are less well defined than Bellingen as the town is of lower topographic relief. > It is uncertain how drainage will be affected by climate change, including sea level rise and coastal inundation.
Catchment and waterway processes	> Numerous studies have been undertaken to inform the behaviour of the Bellinger River and Kalang River. > The tidal influence and limit on the waterways is approximately 1 km upstream of the town of Bellingen on the Bellinger River and to Brierfield on the Kalang River. > Dominant erosional processes are well defined, however priority sites have not been reassessed since 2010. > Maintaining the waterways in good condition, including stable and well-vegetated banks, improving the water quality and having low turbidity streams, will continue to be key management challenges for the Bellingen Shire and the Bellinger-Kalang Rivers estuary.
Coastal processes	> The management of coastal process and coastal hazard impacts along the open coastline, estuary and low-lying coastal land continues to be an ongoing management challenge for the Bellingen Shire. > Sea level rise and coastal/storm tide inundation currently impacts assets and infrastructure, and the extent of this impact is projected to increase up to 2100, with additional implications for land use and ecosystems. > Existing actions from the CZMP (BMT WBM 2017) will be brought forward into the CMP process, and opportunities for additional studies have been identified to update coastal hazard information with leading practice approaches. > Presently 46 properties along the Bellinger River are affected by inundation at current sea level. Up to 11 km of road will be affected by 1 m of sea level rise.

Social context	> The Gumbaynggirr people are the traditional owners of the land, and the coastal area between Dalhousie Creek and Oyster Creek is held as part of a Native Title. > The population of Bellingen Shire is unlikely to grow significantly in the future as there is limited land for infrastructure expansion.
Economic context	> The economy of the Bellingen Shire is driven by construction, health care, manufacturing, and agriculture, forestry and fishing. > Dairy and beef cattle remain the largest agricultural sectors.
Stakeholder and community values	> The coast is highly valued by the local community. > More than 50 % of people live within 1 km of the coast or estuary and another 80 % of people visit at least twice a week. > The community survey identified that over 50 % of people would like to remain involved in the CMP process, highlighting the community interest in what happens in the Shire. > Residents feel that riverbank erosion and loss of vegetation along waterways are among the top threats to the coast.
Land use / tenure	> Multiple responsible authorities contribute to the complex management arrangements in the Bellingen Shire.
Coastal management areas	> The Coastal Environment area for the Bellingen Shire extends from offshore, inland to the towns of Bellingen and Brierfield. > Coastal Wetlands and Littoral Rainforests are given the highest priority for management; there is 3 km^2 of coastal wetlands and 0.03 km^2 of littoral rainforest. > It is possible that the boundaries of some coastal management areas will need to be revised as part of the CMP process.
Existing management plans review	> There are **six** key existing management plans for the Bellingen Shire; the Dalhousie Creek Entrance Management Strategy, Coastal Zone Management Plan, Bellingen and Urunga Stormwater Management Plan (Draft), Bellinger River Health Plan, Kalang River Health Plan, and Bellinger and Kalang Rivers Estuary Management Plan. > Governance over the implementation of these plans remains a challenge, as well as monitoring success.

The recent coastal reforms aim to help overcome these obstacles through the funding of integrated Coastal Management Programs. In the absence of a Bellingen Shire CMP, it is likely that maintaining the status quo would fail to meet the objectives of the existing management plans and a range of state and regional strategies, and fall short of fulfilling the expectations of local, regional and state-wide communities.

The community survey undertaken as part of this scoping study identified that the Bellingen Shire coastal area provides significant environmental, economic and social values to the community. This includes the natural environment and recreational opportunities. The Bellingen Shire has a proactive community. Protecting and enhancing these values will likely help to encourage community support for the management of the estuary and broader coastal area. Community support and stewardship can act as an enabler for catchment management initiatives through providing political pressure and motivation for collaborative partnerships.

Key issues/challenges

This scoping study provides an opportunity to identify management issues within the Bellingen Shire LGA that may impact the coastal area, in the present day or emerging in the future. Key management issues have been identified through the stakeholder and community engagement process (Section 3.14), which provides an appreciation of the important values and perceived threats, as well as the synthesis of previous work and research (the majority of Section 3), and highlights the wide range of management issues recognised within Bellingen Shire's coastal areas. This review informs the first-pass risk assessment (in Section 5) which assists to prioritise management issues for the later stage of the CMP process.

The key management issues or challenges of the Bellingen Shire CMP identified from the overall strategic context to the CMP (Section 3 narratives) are:

Implementation of existing management plans has been limited by real and perceived barriers, including resource limitations, challenges in building integrated governance across Council and relevant stakeholders, lack of ownership, and limited funding opportunities.

4 CMP vision and objectives

Developing a future vision and objectives for the Bellingen Shire coastal area is a strategic focus of the Bellingen Shire Community and Stakeholder Engagement Plan (C&SEP) (see Attachment A). This will be an ongoing participatory process that will be shaped over the course of the CMP development and informed by stakeholder interests as well as outcomes from any technical investigations.

A preliminary vision and objectives have been proposed following the initial consultation with stakeholders during the scoping study process. This vision will be built on and further refined during Stages 2 and 3 of the CMP development. A preliminary vision for the Bellingen Shire coastal area (including the Bellinger River catchment) that is intended to guide the implementation of the Coastal Management Program (i.e. what the CMP is trying to achieve) is:

"An accessible coastal zone with healthy waterways, estuary and shorelines, resilient ecosystems and balanced use".

The vision for the CMP process to achieve this is:

"Through evidence based, and dialogue-based collaboration with the catchment's key stakeholders and wider community, the CMP process will develop a shared understanding of the coastal and catchment values and management challenges for the Bellingen Shire and develop practical, achievable and adaptive management recommendations."

Preliminary objectives linked to the vision statement are provided in Table 22. These are preliminary and will be further developed as the CMP process progresses, with the intent of developing measurable objectives once the outcome of technical investigations is known and the detail of the CMP objectives can be further refined. During Stage 2 and 3 there will be a significantly improved understanding of the environmental, social and economic conditions, values and constraints within the catchment. Consequently, clear and measurable objectives will be able to be identified.

The health of the Bellinger River catchment and its streams, estuary and coastal zone is the Shire's greatest asset. Protecting and enhancing the health of the catchment and waterways is an integral component of a connected, sustainable and inclusive local community, economy and environment. This is reflected in the Bellingen Shire communities vision for the future, which is to protect the pristine natural beauty of their environment and to enhance their prosperous and safe community (BSC 2017b).

Table 22. Preliminary objectives for the Bellingen Shire CMP.

Value	Objective
Estuary health	Enhance the condition of the estuary by improving water quality entering from the catchment and protecting fringing ecosystems
Aquaculture	Improve the reliability of the industry through improving estuary water quality and health
Swimming	Improve water quality entering the waterways so swimming can be continued
Sustainable industries	Promote economically viable local industries which limit the impacts on ecosystems and are resilient to changes associated with climate change
Recreational access	Develop passive and active recreational access opportunities which protect the health of the waterways
Tourism	Promote tourism which is nature and adventure based and inclusive
Cultural values	Promote and protect cultural values and connections to land, water and the community

5 Scope of the CMP

This section includes assessments completed for this scoping study to assist in defining the forward scope of the CMP. This includes:

- A preliminary review of coastal hazard exposure and implications for selected data linked to social, economic and environmental values of the Bellingen Shire coastal zone.
- A first-pass risk assessment for the priority issues (as identified from Section 3)
- Prioritisation of issues and recommendations for the CMP forward work program over Stages 2 and 3.

5.1 Preliminary coastal inundation exposure review

Increasing coastal inundation exposure is one of the threats/drivers of change for land use, ecosystems and communities in the Bellingen Shire. Therefore, to assist with this scoping study, a preliminary exposure review has been undertaken to gain an appreciation for the relative impact of coastal inundation on environmental, social and economic values of the Bellingen Shire LGA. To do this a selection of existing data sets that span the range of values have been used, including coastal assets and infrastructure, land use planning, existing endangered ecological communities and agricultural productivity.

The inundation extents are based on the Bellingen Shire Estuary Inundation Mapping Final Report (BMT WBM 2015) and BSC spatial layers, and mapped under two different scenarios:

- A 1 % Annual Exceedance Probability (AEP) event under present-day sea level conditions
- A 1 % AEP event with 0.9 m sea level rise, representing a 2100 event.

Table 23 summarises the inundation exposure, which is used to inform the risk assessment in Section 5.2. The most notable increases in exposure include for recreational and cultural areas, aquaculture, endangered ecological communities and residential land.

Table 23. Summary of the exposure assessment on different elements

Data set/s	Key values	Level of exposure	
		1 % AEP under present-day sea level	***1 % AEP under 0.9 m sea level rise***
Coastal assets (includes boat ramps, boat sheds, SLSC, tidal pool, training walls, sailing club)	Social Economic Environmental	• All coastal assets were impacted by inundated except for North Beach and Urunga SLSCs and a boat ramp at Wenonah Head	• The same coastal assets are affected under this scenario
Recreational and cultural areas	Social Economic	• 3.5 % of total area affected	• 12.85 % of total area affected
Residential land (includes urban residential, residential with farm infrastructure, rural residential with/without agriculture)	Economic Social	• 1.4 % of residential property is affected (out of entire LGA)	• 2.85 % of total residential area affected
Aquaculture	Economic	• Less than 1 % of total area affected	• 5.60 % of total area affected
Nature conservation (includes nature reserves, national parks and conserved area)	Environmental Economy	• Less than 1 % of total area affected	• Less than 1 %of total area affected (greater proportion under 0.9 m SLR scenario)
Endangered ecological communities	Environmental	• 5.7 % of total LGA is affected	• 9.56 % of total LGA is affected

Data set/s	Key values	Level of exposure	
		1 % AEP under present-day sea level	*1 % AEP under 0.9 m sea level rise*
Coastal saltmarsh		• 86 % of total area affected	• 98.56 % of total area affected
Littoral rainforest		• 2.55 % of total area affected	• 7.2 % of total area affected
Swamp oak floodplain forest		• 69 % of total area affected	• 87.2 % of total area affected

5.2 First-pass risk assessment

Approach

The first pass risk assessment for the Bellingen Shire utilises a similar approach to the threat and risk assessment framework for the NSW Marine Estate (MEMA 2015) which is based on the AS/NZS ISO31000: Risk Management – Principles and Guidelines.

As per step 1 of the framework, the background review for this scoping study (strategic context to the CMP in Section 3) and community consultation process (through the survey) have been used to identify key social, economic and environmental values within the Bellingen Shire. The review process has also led to an understanding of the stressors which affect these values. The preliminary exposure assessment for coastal inundation (Section 5.1) provides additional appreciation on the emerging inundation hazard and associated impacts. This information forms the basis for the first-pass risk assessment.

The risk assessment was conducted for three planning horizons, present-day, 2050 and 2100, to consider the emerging hazards and risks. The trajectory for future planning horizons assumes no management action taken beyond current practices.

The likelihood and consequence of a negative impact from an issue or threat on key values was assessed using the criteria in Table 24 and Table 25. The consequence and likelihood were then used to assign the level of risk according the risk matrix in Table 26. Where the information was available, assets or values were overlain by hazard extents. For example, erosion and tidal inundation extents for various planning horizons from previous studies were used to assess the climate change threat, in addition to applying the information summarised in Section 3.2.

The risk to key environmental, social and economic values in the Bellingen Shire are provided in Table 27, Table 28 and Table 29 respectively.

Outcomes were cross-checked with the threat and risk assessment (TARA) conducted by NSW Marine Estate using their online tool, and with similar risk assessments for the Bellingen Shire. Given the broad spatial extent considered by TARA, adjustments were made to reflect the background review specific for Bellingen Shire region. Discretion was used to alter the prioritisation of issues based on their final ranking where an issue ranked above another, but management of the lower ranking issue was considered more complex.

Table 24. The likelihood scale adopted for the risk assessment (MEMA 2015)

LIKELIHOOD LEVEL	Description
Rare	This threat is extremely unlikely to be realised at a level that would impact on the benefit within a 20-year period.
Unlikely	This threat is not expected to be realised at a level that would impact on the benefit in a 10-year period, but could be expected in a 20-year period.
Possible	This threat is not expected to be realised at a level that would impact on the benefit every year, but could be expected in a 10-year period.
Likely	This threat is not expected to be continuous, but could be expected to be realised at a level that would impact on the benefit every year.
Almost certain	This threat is expected to be realised at a level that would impact on the benefit frequently throughout a year or more-or-less continuously.

Table 25. The consequence scale adopted for the risk assessment (MEMA 2015)

CONSEQUENCE LEVEL	Description
Insignificant	Realisation of this threat would not have a discernible impact on the benefit at a state-wide scale.
Minor	Realisation of this threat would have only a small or very temporary impact on the benefit at a state-wide scale.
Moderate	Realisation of this threat would significantly reduce the benefit over the medium term (5-10 years) at a state-wide scale, or have major consequences for a sensitive benefit at a regional level.
Major	Realisation of this threat would substantially reduce the benefit for an extended period (10-20 years), but not totally or permanently, at a state-wide scale, or would have catastrophic consequences for a sensitive benefit at a regional level.
Catastrophic	Realisation of this threat would effectively terminate delivery of the benefit either permanently or for a very extended period (>20 years) at a state-wide scale.

Table 26. Matrix used to determine level of risk as a function of consequence and likelihood of a threat being realised (MEMA 2015)

LIKELIHOOD	LEVEL OF RISK				
ALMOST CERTAIN	MINIMAL	LOW	MODERATE	HIGH	HIGH
LIKELY	MINIMAL	LOW	MODERATE	HIGH	HIGH
POSSIBLE	MINIMAL	MINIMAL	LOW	MODERATE	HIGH
UNLIKELY	MINIMAL	MINIMAL	MINIMAL	LOW	MODERATE
RARE	MINIMAL	MINIMAL	MINIMAL	MINIMAL	LOW
CONSEQUENCE LEVEL	INSIGNIFICANT	MINOR	MODERATE	MAJOR	CATASTROPHIC

Environmental values

Table 27 provides a first-pass risk assessment based on consideration of two key environmental values within the Bellingen Shire, estuary water quality and biodiversity. Water quality and biodiversity are also interlinked, so the results should also be viewed in terms of the combined/overall risk. Catchment runoff/poor water quality, poor riparian condition and climate change and sea level rise are understood to the be main present and emerging risks to key environmental values for Bellingen Shire.

Table 27. Risk assessment for the environmental values of the Bellingen Shire for the present-day, 2050 and 2100 planning horizons

Environmental values							
Issue/threat	Estuary water quality			Biodiversity			Overall risk
	Present	2050	2100	Present	2050	2100	
Streambank instability / erosion	Mod	Mod	High	Minimal	Minimal	Mod	Mod
Catchment runoff / poor water quality	High	High	High	High	High	High	High
Poor riparian condition	Low	Mod	High	Mod	High	High	High
Climate change and sea level rise	Minimal	Mod	High	Minimal	Mod	High	Mod - high
Pollution (rubbish)	Low	Low	Mod	Low	Low	Mod	Mod
Community access to coastal areas	Minimal	Minimal	Low	Minimal	Minimal	Mod	Low
Poor governance	Mod	Mod	Mod	Minimal	Minimal	Mod	Mod

Social values

A first-pass risk assessment for key social values within the Bellingen Shire, scenic amenity and recreation, is summarised in Table 28. Streambank instability/erosion, catchment runoff/poor water quality, poor riparian condition and pollution are understood to be the main present and emerging risks to social amenity and recreation values for Bellingen Shire.

Table 28. Risk assessment for the social values of the Bellingen Shire for the present-day, 2050 and 2100 planning horizons

Social values							
Issue / threat	Scenic amenity			Recreation			Overall risk
	Present	2050	2100	Present	2050	2100	
Streambank instability / erosion	Mod	Mod	High	Mod	Mod	High	High
Catchment runoff / poor water quality	Minimal	Mod	High	Mod	High	High	High
Poor riparian condition	Mod	High	High	Minimal	Mod	High	High
Climate change and sea level rise	Minimal	Minimal	Mod	Minimal	Low	High	Mod
Pollution (rubbish)	High	High	High	Minimal	Low	High	Mod
Community access to coastal areas	Minimal	Low	High	Low	Mod	High	Mod
Poor governance	Minimal	Low	Mod	Minimal	Low	Mod	Mod

Economic values

Table 29 outlines a first-pass risk assessment for key economic values of tourism, agricultural production and aquaculture. Catchment runoff/poor water quality, climate change and sea level rise, and pollution are understood to the be the main present and emerging risks to economic values for Bellingen Shire. Further economic assessment is also presented in Section 6.2.

Table 29. Risk assessment for the economic values of the Bellingen Shire for the present-day, 2050 and 2100 planning horizons

Economic values										
	Tourism			Agricultural production			Aquaculture			Overall risk
Issue / threat	Present	2050	2100	Present	2050	2100	Present	2050	2100	
Streambank instability / erosion	Minimal	Mod	High	Minimal	Mod	High	Minimal	Mod	High	High
Catchment runoff / poor water quality	Minimal	Mod	High	Minimal	Minimal	Mod	Mod	High	High	High
Poor riparian condition	Minimal	Low	High	Minimal	Minimal	Mod	Minimal	Minimal	Low	Mod
Climate change and sea level rise	Minimal	Low	High	Minimal	Minimal	High	Minimal	Low	High	High
Pollution (rubbish)	Low	Mod	High	Minimal	Minimal	Low	Minimal	Low	High	High
Community access to coastal areas	Minimal	Mod	High	Minimal	Minimal	Minimal	Minimal	Minimal	Minimal	Mod
Poor governance	Minimal	Minimal	Low	Minimal	Low	Mod	Minimal	Low	High	Mod

Final ranking of issues

Based on an appreciation of the risk rankings across social, environmental and economic key values, an overall priority ranking of management issues is shown in Figure 43. The purpose of this ranking is to provide an appreciation of which management issues have the greatest current and future potential impacts on the diversity of values in the Bellingen Shire. This enables an appreciation of how management effort and actions should be prioritised for the CMP, including studies required in Stage 2 of the CMP development, and evaluation / prioritisation of management options in Stage 3 of the CMP development.

Figure 43. *Final ranking of key management issues for the Bellingen Shire LGA.*

	Issue/threat	Environmental	Social	Economic
1	Catchment runoff / poor water quality	High	High	High
2	Climate change and sea level rise	High	Mod	High
3	Streambank instability / erosion	Mod	High	High
4	Poor riparian condition	High	High	Mod
5	Pollution (rubbish)	Mod	Mod	High
6	Poor governance	Mod	Mod	Mod
7	Community access to coastal areas	Low	Mod	Mod

This highest priority management issue for the catchment is runoff/poor water quality, as identified through the literature review and by stakeholders, with broad ranging impacts on environmental values of the catchment (and flow on social-economic impacts). It will be important to ensure a priority focus is given to managing vegetated parts of the catchment as part of water quality improvement initiatives.

Climate change and sea level rise will be an ongoing emerging threat, placing increased extents of built and natural assets at risk across the lower catchment, estuary and coastline. Streambank stability / erosion and

poor riparian condition are also key management issues that are interlinked with catchment runoff / water quality. Pollution, poor governance and access issues are of lower priority, however still include important management actions to be progressed over the life of the CMP development and implementation.

5.3 Priority issues and recommendations

The scoping study process across Section 3 – 5 of this document has provided an appreciation for:

- The technical studies and plans completed to date, and the state of current knowledge on coastal values and management challenges for Bellingen Shire (Section 3)
- The key management issues for the Bellingen CMP, and priority issues as informed by a first-pass risk assessment (Section 3 and Section 5)
- Recommendations in existing plans (including the CZMP) to be carried forward into the CMP (for evaluation of options in Stage 3) (Section 3)
- Gaps/opportunities for additional improvement to the knowledge base for the CMP development (Section 3 and Section 5).

A summary of key existing information sources relevant to the priority issues, and recommended gaps to fill as part of the Stage 2 CMP process is provided in Table 30. Additional opportunities to boost the knowledge base are also noted for consideration of inclusion into Stage 2 of the CMP development, or at a later date, potentially as part of the CMP actions. Recommended studies and indicative budgets are nominated for inclusion into the forward works program in Section 7.

Table 30. Summary of key issues, including gaps to fill for Stage 2 to ensure adequate information for CMP development

Key management issue	Definition	Key references/ data	Recommended gaps to fill for Stage 2 of CMP development	Potential inclusions for best practice / enhanced base for CMP development (in priority order for each issue)
1. Catchment runoff / water quality	Catchment runoff and poor water quality in waterways, estuaries and wetlands, in particular in coastal areas.	Riverwatch water quality monitoring (OzGreen 2019): 24 sites, community led. Limited runoff/water quality data available.	As a priority issue - Recommended studies for CMP Stage 2: Develop and implement a Water Quality Monitoring Strategy (WQMS) that builds on the Riverwatch program to also include event monitoring, targeting priority locations / known "hot spots" or takes a "Catchment to Coast" approach ($40,000). Includes components to identify the source of bacteriological, nutrient and turbidity loads, as well as reporting framework, sequencing and funding mechanisms.	• Evaluate existing and new data gathered using the WQMS to determine management options to improve water quality ($50,000)
2. Climate change and sea level rise	Sea level rise implications for coastal hazards including beach erosion, recession, tidal inundation, and coastal/storm tide inundation due to extreme events. Planning horizons including present day to 2100.	BMT WBM (2012) - Erosion AEP 1% event: Present day, 2050, 2100 (OEH 2018e) - Estuary tidal inundation from tidal planes: Present day, 1m, 1.5m BMT WBM (2015) – Inundation AEP 1% event: Present day, 2050, 2070, 2100		Beneficial inclusions for CMP Stage 2 (or later actions in the CMP): • Estuary foreshore erosion study at Mylestom Spit ($25,000) • Geotechnical assessment and update to hazard assessments for Hungry Head and Wenonah Head ($40,000) • Update coastal hazard information (erosion and inundation hazard areas) to include multiple AEPs (leading practice probabilistic assessments) for tailored / priority areas / scenarios ($60,000) • Co-incident flooding scenario assessment (mapping and/or modelling – fit for purpose) ($30,000) • Develop coastal monitoring plan including suitable trigger to signal management response ($15,000)
3. Streambank stability / erosion	Channel and streambank erosion along waterways, contributing sediment loads to downstream receiving waters and impacting on riparian condition.	2010 Erosion Study (Telfer & Cohen)		• Update 2010 Erosion Study (Telfer & Cohen) for priority 'hot spot' sites to determine any changes in bank erosion severity and extent ($20,000) • Explore management options to reduce bank erosion at priority sites ($25,000). E.g. Structural works (i.e. pile fields, log revetment, rock

Key management issue		Definition	Key references/ data	Recommended gaps to fill for Stage 2 of CMP development	Potential inclusions for best practice / enhanced base for CMP development (in priority order for each issue)
					protection etc), riparian vegetation management and stock control.
4.	**Poor riparian condition**	Condition of riparian vegetation zone along waterways (composition, width, health, connectivity).	2010 Erosion Study (Telfer & Cohen)		• Revisit and reassess identified priority sites in 2010 Erosion Study (Telfer & Cohen), to determine changes in riparian vegetation condition ($10,000) • Develop strategies to improve riparian vegetation condition ($5,000) Note: can be combined with recommended studies for streambank stability / erosion.
5.	**Pollution (rubbish)**	Point source pollutants and litter entering waterways, estuaries, wetlands and coastal zone areas.	Limited data available.	Information adequate for CMP progression.	• Investigation into the extent and impact of pollution on the waterways in the Bellingen Shire, including water quality and impact to fauna, and current gross pollutant treatment within the existing stormwater network ($20,000) • Community engagement in a litter reduction campaign, to promote clean and healthy waterways that resonate with the community values ($20,000)
6.	**Governance**	Governance structures within Council and across stakeholder groups that enable / inhibit integrated management of the Bellingen coastal zone.	Existing Council and stakeholder structure and processes.	Information adequate for CMP progression.	• Develop options for governance and staffing structure within Council ($5,000) • Develop a strong governance structure that provides the foundation for the continuity of management plans ($25,000).
7.	**Community access to coastal areas**	Areas where community access may have implications for coastal processes and ecosystems, and needs to be carefully managed to minimise disturbance and maintain safety.	Priority sites and recommended actions in CZMP (BMT WBM 2017) and Dalhousie Creek entrance management (Hydrosphere 2018).	Information adequate for CMP progression.	• Revisit and reassess identified priority sites and recommended actions as per 2017 CZMP and Dalhousie Creek entrance management (Hydrosphere, 2018) including key emergency access points ($7,500) • Develop specific improvement plan for access ($10,000).

6 Preliminary business case

This section introduces a best-practise approach for completing the full economic business case (to be undertaken in Stages 2 and 3 of CMP development) and provides preliminary risk (damages/losses) estimates for the Shire (under business as usual).

The full economic business case (over Stages 2 and 3 of the CMP) will estimate the existing and future risks (damages/losses) for Bellingen Shire, indicate the net benefits of each management option (or package of options) and will ultimately influence final program development. The economic business case augments the biophysical investigation (undertaken for this CMP and as part of previous regional studies), supplying decision-makers with additional information to inform opinion. The process presented is consistent with State investment frameworks.

The purpose of this preliminary business case is to support the economic case for investment in the CMP development, including priority investigations to be included in Stage 2.

The following sections of the preliminary business case include:

- Data to inform the economic assessment
- Defining the economic 'base case' (including preliminary estimates for some present/future risks)
- Determining the preferred management approach (the way forward for CMP development)
- Financing mechanisms.

The economic analysis is to directly address the priority issues that are explained in sections 3 and 5.

6.1 Data to inform the economic assessment

Economic estimates of risk (damages/losses) rely on availability and quality of suitable data, and how it is used. Given that the priority issues are wide ranging, data will be required from numerous sources.

A summary of the main data types that are likely to be required for the full economic business case have been listed in Table 31. This data can be sourced over Stage 2 and 3 of the CMP development.

Table 31. Data to inform the economic assessment

Priority issues	Potential impacts	Biophysical data (typically) required	Economic data (typically) required
Catchment runoff / water quality	Poor downstream water quality	Change in water quality parameters (e.g. TSS, TN, TP)	Pollution abatement costs
Climate change and sea level rise	Flood inundation of various land uses and infrastructure (incl. land loss)	Stage-damage assessment (built-assets)	Stage-damage curves from previous flood assessments
		Loss of productivity (e.g. yield reduction)	Gross margins for impacted agricultural outputs
		Area of natural asset by type	Value of ecosystem services (using a benefits-transfer approach)
		Loss of biodiversity (i.e. change in extent and condition of key biodiversity assets)	Values from primary studies
		Damage to tourism assets	Reduction in revenues to tourism operators
Streambank stability / erosion	Poor downstream water quality	Change in water quality parameters (e.g. TSS, TN, TP)	Pollution abatement costs
	Loss of land and infrastructure	Erosion assessment (land use areas)	Value of production / infrastructure / ecosystem services
Poor riparian condition	Poor downstream water quality	Change in water quality parameters (e.g. TSS, TN, TP)	Pollution abatement costs
	Poor biodiversity outcomes	Change in extent and condition of key biodiversity assets	Values from primary studies
	Recreation and amenity	Change in cultural ecosystem services	Travel cost method / values from primary studies
Pollution (rubbish)	Reduced visual amenity	Magnitude and extent of pollution	Benefit-transfer (e.g. willingness to pay to avoid polluted waterways)
	Poor water quality	Change in water quality parameters (e.g. TSS, TN, TP)	Pollution abatement costs
	Risks to fauna	Any available risk assessments	Benefit-transfer (e.g. avoided management cost)
Governance	Risk to achieving outcomes (positive / negative)	Efficient and effective governance arrangements	Value of efficiency gains / losses
Community access to coastal areas	Obstruction of access to recreation/amenity areas	Key assets impacted	Travel cost method
	Rapid access to vital services during hazard event (e.g. roads blocked to hospitals)	Vital access routes temporarily lost	Value of risk to health and human life

6.2 Defining the economic 'base case'

Defining the economic base case is a fundamental step in developing the full business case. For this analysis it enables an assessment of risk, estimating potential economic damage and loss from coastal inundation in the absence of intervention. It will provide foundational data that will be used to undertake the cost-benefit analysis (CBA) of the possible management and adaptation options. The base case can be thought of as a register of all relevant land uses and other components (e.g. access) that might be affected under different flood conditions and over multiple planning horizons. Figure 44 depicts how information derived from the base case analysis is used to determine the benefit of adaptation/management intervention. This approach to analysis is leading practise and will provide an informed basis for the development of the CMP.

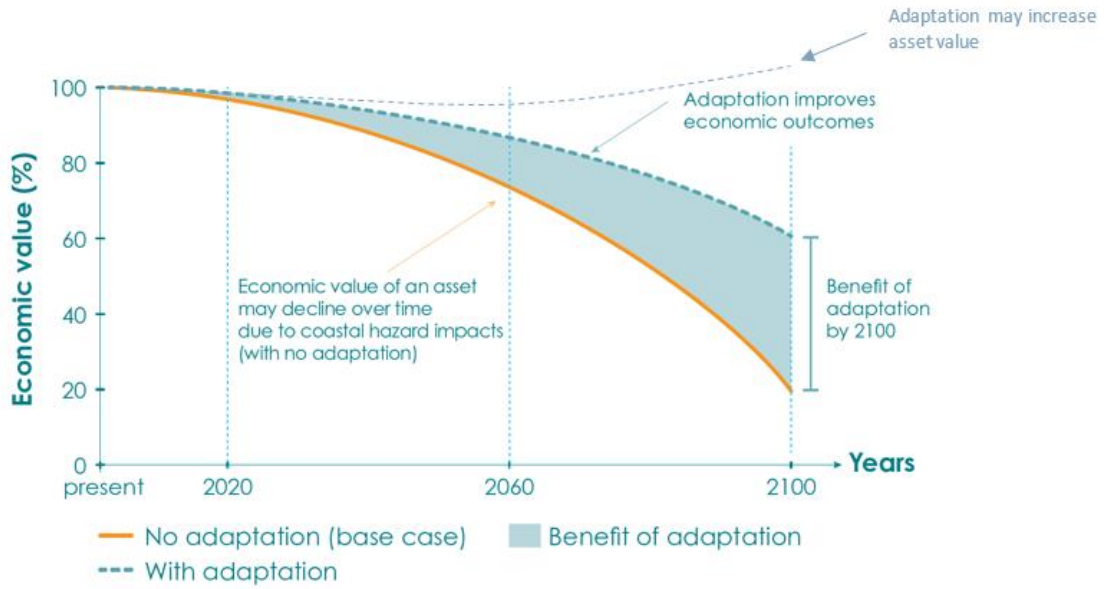


Figure 44. *Conceptual model of how base case information is used to determine the benefit of adaptation/management intervention.*

The base case is presented in terms of 'damages' (e.g. asset damage to buildings or infrastructure) and 'losses' (e.g. losses of economic value to key industries, such tourism because of loss of infrastructure). The damage or loss is assessed as the total sum of exposed assets (for a certain likelihood of AEP in a given year).

The timing of coastal risk events is not known and therefore the average annual damage (AAD) is estimated at each time period. AAD is the probability-weighted estimate of damage and loss. It can be understood using the standard risk equation:

$$Risk = 'expected\ damage' = \sum_{i=1}^{\infty} damage\ (of\ hazard\ event\ i)\ \times likelihood\ (of\ hazard\ event\ i)$$

where damage is a function of exposure and sensitivity of assets, and the likelihood of damage or loss occurring is based on the modelled annual exceedance probability. The AAD is the best-practise approach to estimate potential economic impacts of flood hazards (and for CBA of natural disasters).

A preliminary damage / loss assessment has been undertaken for this scoping stage of the CMP to provide an indication of the magnitude of damage and loss for some land use types in Bellingen Shire.[4] The estimates were determined using mapped inundation areas and estimates of ecosystem service values (by area) based

[4] The risk to only a select number of land use types was estimated. For example, the risk to commercial buildings and roads was not undertaken at this stage of analysis. The purpose of these initial estimates was to provide an indication – not complete a full analysis. This will be undertaken at a later stage of the CMP process.

on a meta-analysis of previous studies. Supporting economic data and sources for these initial estimates, and as a resource for subsequent stages of the CMP, is provided in Attachment D.

The preliminary damage/loss results are summarised in Table 32 and represent a typical 1 % AEP event as a potential cost to ecosystem services and built-assets. A 'lower' and 'higher' range of estimates have been displayed over two time periods, present-day (PD sea level) and 2100 (PD + 0.9 m sea level). The estimates indicate that natural and residential (urban) assets as well as agricultural land uses are all currently at risk, with the risk substantially increasing by 2100. These estimates provide a sense of the business case for the CMP development. With potential damage costs to the shire of up to $80M by 2100, the case for investing in a CMP and actions to mitigate inundation risk alone is a strong one.

Table 32. Preliminary damage / loss estimates for a 1 % AEP event.

Land use type	PD damage/loss – lower estimate	PD damage/loss – higher estimate	2100 damage/loss – lower estimate	2100 damage/loss – higher estimate
Wetlands	$72,813	$495,072	$148,266	$1,008,097
Forests	$140,083	$952,463	$235,626	$1,602,082
Mangroves / Saltmarsh / Seagrass	$818,681	$2,120,035	$875,356	$2,267,837
Residential (urban)	$27,249,800	$37,188,200	$54,229,800	$74,008,200
Agriculture	$860,576	$1,122,238	$2,097,818	$2,717,408

Tourism – a case study of Urunga

Publicly available economic datasets specific to key tourism attractions are limited. Tourism Research Australia provides insights into the importance of the sector to the local and state economy. Based on a recent four-year average (2015 – 2018) approximately 229,000 people visit Bellingen per annum (this includes international, domestic overnight and domestic day visitors) with a (weighted) average spend by visitors of $255 per trip (see Table 33). Domestic travellers staying the night contribute the greatest amount to total expenditure, approximately $45.6 million. Using weighted averages, the gross spend per year by tourists in Bellingen is approximately $58.4 million.

Table 33. Key tourism metrics for the Bellingen Shire

Metric	International	Domestic overnight	Domestic day	Totals (approx)*
Visitors ('000)	6	100	122	229
Average stay (nights)	7	4	n/a	5
Average spend per trip ($)	259	456	90	255
Total ($ million)*	**1.6**	**45.6**	**11.0**	**58.4**

Source: Tourism Research Australia (2018)

** Totals have been rounded and therefore minor errors exist within the tabulated data*

Data availability indicating the main reason for tourist visitation was not of sufficient quality to be used to estimate total expenditure per 'reason for visitation'. However, to provide some context, of the 100,000 domestic overnight visitors to Bellingen, 59 % of those visitors stated that 'holiday' was the primary reason for visitation (TRA, 2018).

Holidays that include a visit (or visits) to the beach are a crucial component of tourism for domestic and international tourists within Australia (particularly Queensland). A study undertaken by Hajkowicz et. al. (2013) found that 53 % of international tourists consider Australia's beaches to be the country's most appealing attraction (followed by Australian wildlife at 46 % and the Great Barrier Reef at 44 %). Further, a study undertaken by Tourism Research Australia (2013) found that Australians rank Australia's beach destinations as better than those in Bali, Fiji and Thailand, and a greater proportion of Australians are more likely to take a

beach holiday in Australia than go overseas. As such, from this information we can infer that the existence and health of Australian beaches drive a considerable amount of Australia's tourism activity.

Anecdotally, if the region is temporarily affected by a hazard (e.g. a significant storm) then we would likely see tourists that have already travelled to Bellingen partake in a non-coastal activity (e.g. shopping). In many cases this would result in a substitution of expenditure in the region – not lost expenditure. However, a potentially profound issue is the risk that tourists who are considering travelling to the region perceive that the region has been damaged by the coastal hazards and choose not to visit Bellingen altogether. This would result in a loss to the region's economy.

A full economic analysis is scheduled for a later stage of the CMP process. However, possible losses to tourism due to coastal hazards can be initially understood by using a hypothetical (and simplified) case study.[5] As indicated in the strategic context to the CMP, the low relief of the estuary exposes agricultural and urban areas (including Urunga, Mylestom and Bellingen) to the risk of tidal inundation due to sea level rise and increasing storm tides. By focusing on Urunga, we can begin to understand the magnitude of risk to tourism against the backdrop of a changing climate.

Urunga has a population of 3,000 people (ABS 2016).[6] Tourism data recording the number of visitors to Urunga is not readily available; however, a desktop search indicated that there are approximately eight local accommodation options of various types.[7] In total it is estimated that there is overnight accommodation for 320 guests, which is approximately 11 % of the township's permanent population. Hypothetically, if a major weather event substantially damaged the beach at Urunga prior to the period between Christmas and New Year, it is probable that significant losses to tourism would be incurred. Visitors would likely choose to go elsewhere for their holidays. If we assume that domestic overnight travellers and international travellers change their plans, and don't visit Urunga over this period, the losses could range between $85,000 to $250,000.[8;9] The upper estimated loss in turnover of $250,000 translates into a direct loss of value-added to the Bellingen economy of approximately $120,000.[10] This subsequent reduction in economic activity could result in job losses equivalent to two full-time equivalents.

6.3 Determining the preferred management options

A full CBA will be completed in Stages 2 and 3 of the CMP development process, to indicate the viability of management options and rank them based on their economic efficiency.

CBA is a comprehensive approach that identifies and values as many relevant benefit streams (e.g. flood protection, recreation) and costs (e.g. construction costs, land foregone) as possible. Both market and non-market values (e.g. public amenity) are considered. Importantly, per NSW Government (2017), CBA is required to be undertaken for any new or altered capital, recurrent or regulatory action for any policy, program, project, proposal or initiative. Therefore, the CBA output is a vital input if Council seeks State co-investment in any of the coastal management measures.

For this CBA, the benefits will be the estimated reductions in base case damage and loss that can be attributed to the performance of the management options (refer to Figure 44). The costs are the estimates of the lifecycle costs of each option. There are two key decision rules in CBA that guide whether an option is economically viable. The first is the benefit cost ratio (BCR), which is expressed as the benefits (in dollars) divided by the costs. This suggests that an option is appropriate if the BCR is greater than one – the higher the ratio the better the option. The other rule is a net present value (NPV) assessment, which is calculated by

[5] The purpose of this hypothetical analysis is to provide a preliminary indication of magnitude and extent of possible loss of tourism expenditure (in a simplified hypothetical study) only. These values should not be referenced for any purpose outside of this scoping study.
[6] ABS Census 2016 data. Accessed at < https://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/SSC14061> on 11/11/2019
[7] This was determined through a Google search undertaken on 5/11/2019.
[8] Including a sensitivity of plus/minus 50%.
[9] Noting that this is a highly conservative estimate given that this case study does not include any adjustment for an increase in accommodation pricing over the summer holiday period nor any expenditure by domestic day visitors.
[10] This was estimated using the Economic Impact Analysis Tool produced by Flinders University. Accessed via AURIN at: http://eiat.aurin.org.au/#/eiat/home

subtracting the benefits from the costs (in present day dollars). If the NPV is greater than zero then the option is viable.

Benefits are closely linked to the values and characteristics of the community, land use, assets in the exposure zones, catchments and receiving environment. A number of different types of economic valuation methodologies will be used to undertake the CBA. This will likely include a mix of market valuation (e.g. gross margins for products), non-market valuation approaches (e.g. revealed preference – travel cost method) and benefit-transfer (see Table 31 for an indicative list). The approach to developing a CBA must be participatory to ensure that key benefits and costs are scoped for inclusion in the analysis. Council and community are best placed to uncover intangible benefits and costs that are unique to Bellingen Shire.

The quality of data for coastal analysis can be variable. Therefore, sensitivity analysis must be undertaken to provide confidence in modelled outcomes. Sensitivity analysis highlights how results are likely to change under alternative assumptions/inputs or within certain tolerances. Best-practise approach to sensitivity analysis requires the use of Monte-Carlo simulations, which calculates a range of possible results for any specified variable. This process enables the analyst to locate which input/s is driving the outcome of the model and then determining if further work is required to improve confidence in that input/s.

The results from the CBA can be used to rank each adaptation option based on its economic efficiency. This information can then be provided to decision-makers as a key input to prioritise the best outcome for each township in Bellingen Shire.

6.4 Financing mechanisms

The total estimated cost for the proposed studies is in likely to be in the order of $200,000 - $400,000 (refer Section 7.1). The Bellingen Shire Council is envisaged to incur the primary administrative burden as the driver of the CMP process. A more detailed estimate for the total cost of the CMP can be determined by the BSC through allocation of labour against each action listed in the forward program (Table 34).

Funding has been made available to support local government in the management of coastal issues such as hazard mapping. This funding is accessible through the Coastal and Estuary grants program. Five streams of funding exist, one for planning and studies, and four for implementing works identified in certified coastal zone or estuary management plans. The planning stream will fund:

- Development of CMPs (including individual stages) or the transition of a CZMP to a CMP, consistent with the NSW Coastal Management Manual
- Studies to understand coastal processes and map coastal hazards/coastal vulnerability area
- Studies to understand threats to the objectives of coastal management areas within the NSW coastal zone
- Investigations and designs for infrastructure works recommended in a certified CZMP or CMP
- Cost-benefit analyses and distributional analysis of who pays.

Each of the recommended actions listing in this scoping study fall within the funding requirements for the planning stream. The reference material for applications can be found at the OEH website (OEH 2019d).

7 CMP Stages 2 to 5

This section clarifies the proposed forward work program for Stages 2 – 5 of the Bellingen CMP development, and links to existing programs.

7.1 Forward work program

Bellingen Shire Council is the primary agency responsible for the development of the Bellingen Shire CMP. Fast tracking is not considered for the Bellingen Shire CMP due to the degree of risk and uncertainty identified. The management issues are complex and interrelated and will require completion of the recommendations through Stages 2 and 3 in order to inform an effective CMP.

The proposed forward program is outlined in Table 34.

Table 34. The forward program for the remaining stages of the CMP process for the Bellingen Shire catchment

		Estimated cost		Estimated date of completion
STAGE 1 - *Determine the scope of the CMP*				
	Draft completion			Oct-19
	Review and feedback			Nov-19
	Final report and grant acquisition			Dec-19
STAGE 2 - *Determine risk, vulnerabilities and opportunities*			**$ 70,000**	
Confirm Stage 2 scope and objectives (project team meeting) & update project plan			$ 5,000	Dec-19
Refine understanding and fill knowledge gaps - Stage 2 studies			$ 40,000	Nov-20
1. Catchment runoff / water quality	Develop and implement a Water Quality Monitoring Strategy (WQMS) that builds on the Riverwatch Program to also include event monitoring, targeting priority locations / known "hot spots" or takes a "Catchment to Coast" approach. Includes components to identify the source of bacteriological, nutrient and turbidity loads, as well as reporting framework, sequencing and funding mechanisms.	$ 40,000		
Update understanding of threats to coastal values and management opportunities			$ 2,500	Nov-20
Update risk assessment			$ 7,500	Dec-20
Identify timing and priorities for responses/actions, thresholds and lead times			$ 5,000	Dec-20
Preparation for planning proposal to amend coastal management areas			$ 5,000	Dec-20
Stage 2 Communication and engagement as per Community and Stakeholder Engagement Plan			$ 5,000	Dec-20
STAGE 3 - *Identify and evaluate options*			**$ 52,500**	
Confirm Stage 3 scope and objectives (project team meeting) & update project plan			$ 2,500	Jan-21
Identify and collate management options across all priority issues			$ 10,000	Mar-21
ARG meeting & confirm and refine all management options			$ 5,000	Mar-21
Evaluate and prioritise management options across all priorities issues - efficacy, economic cost-benefit, plan for implementation			$ 25,000	Apr-21
Identify pathway and timing of actions			$ 5,000	Apr-21
Stage 3 Communication and engagement as per Community and Stakeholder Engagement Plan			$ 5,000	Apr-21
STAGE 4 - *Prepare, exhibit, certify and adopt CMP*			**$ 27,500**	
Confirm Stage 4 scope and objectives (project team meeting) & update project plan			$ 2,500	May-21
Preparation of draft CMP			$ 15,000	Jun-21
ARG meeting to discuss draft CMP			$ 5,000	Jun-21
Exhibition of the draft CMP and the Planning Proposal				Jun-21
Review and adoption of the draft CMP				Jul-21
Submission of the draft CMP to the Minister for certification				Aug-21
Publishing of the Certified CMP in the Gazette				Sep-21
Stage 4 Communication and engagement as per Community and Stakeholder Engagement Plan			$ 5,000	Sep-21
Total Stage 2 - 4			**$ 150,000**	
STAGE 5				
Implement actions in the published CMP				
Implement an effective monitoring, evaluation and reporting (MER) program				
Monitor indicators, trigger points and thresholds				
Amend, review and update the CMP				
Report to stakeholders and the community of progress and outcomes through the IP&R framework				

7.2 Links to existing programs

Several programs exist which are likely to benefit the Bellingen Shire CMP through the provision of information and support for the delivery of the recommended actions. These are summarised below.

Marine Estate Management Strategy
Key actions that the Marine Estate Management Strategy will deliver in Stage 1 (2018 -2020) can be found at the NSW Marine estate website. Many agencies including NSW Department of Primary Industries (Fisheries and Agriculture) and OEH will be involved. The actions relevant to the development of a coastal management program for Bellingen Shire involve:

- Promoting the community benefits of fishing
- Agricultural nutrient reduction trial
- Riparian and riverbank protection
- Streamline regulatory instruments and develop governance framework

The Marine Estate Management strategy also lists two actions targeted at LGA's which involve the implementation of a targeted marine litter campaign and the development of a Marine Litter Working Group.

NSW Adaptation Research Hub
The NSW Adaptation Research Hub is in the process of producing research material which can further enhance the understanding of the local scale impacts of climate change. Multiple projects are directly relatable to the inundation hazard facing the Bellingen Shire catchment and will inform the approach for studies in Stage 2.

IP&R Framework
The Integrated Planning and Reporting framework is established under Chapter 13 of the Local Government Act 1993. It allows for NSW councils to understand how the multiple plans interact within the larger governance framework to ensure holistic and sustainable planning. The CM Act 2016 requires that CMPs to be given effect within the IP & R framework. This means that the CMP and its identified activities should align with the broader community strategic plan, consider community priorities and ensure that its activities are feasible, financially viable and able to be resourced.

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Attachment A
Community and Stakeholder Engagement Plan

Bellingen Shire Council - Coastal Management Program

Community and Stakeholder Engagement Plan

Bellingen Shire COUNCIL

Document history

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Foreword

Councils role and commitment

Bellingen Shire Council have commenced development of a new Coastal Management Program (CMP).

As part of this process Council are committed to:

- *Engaging with the community and other key stakeholders to develop a shared understanding of the values of the Bellinger-Kalang estuary, catchment and coastline.*
- *Facilitating knowledge sharing about catchment management challenges and opportunities, now and in the future.*
- *Incorporating community and key stakeholder feedback into the development of the CMP.*
- *Keeping the community and key stakeholders informed throughout the CMP process.*

Contents

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Introduction

Bellingen Shire Council Coastal Management Program (CMP) is being developed as part of the NSW Coastal and Estuaries Program which is guided by the Coastal Management Act 2016. It forms part of the Coastal Management Framework. The Framework is based on recent legislative reform introduced by the NSW government to adopt a holistic approach to coastal management. This approach attempts to integrate multiple tiers of government through the development of Coastal Management Programs (CMP).

A CMP has five key stages based on the integrated and coordinated approach to land-use planning in the coastal zone. The process aims to:

- Identify and manage risk to the environmental, social and economic values of the coast
- Evaluate and select management actions to manage the coastal environment
- Integrate the actions into Councils' integrated planning and reporting framework

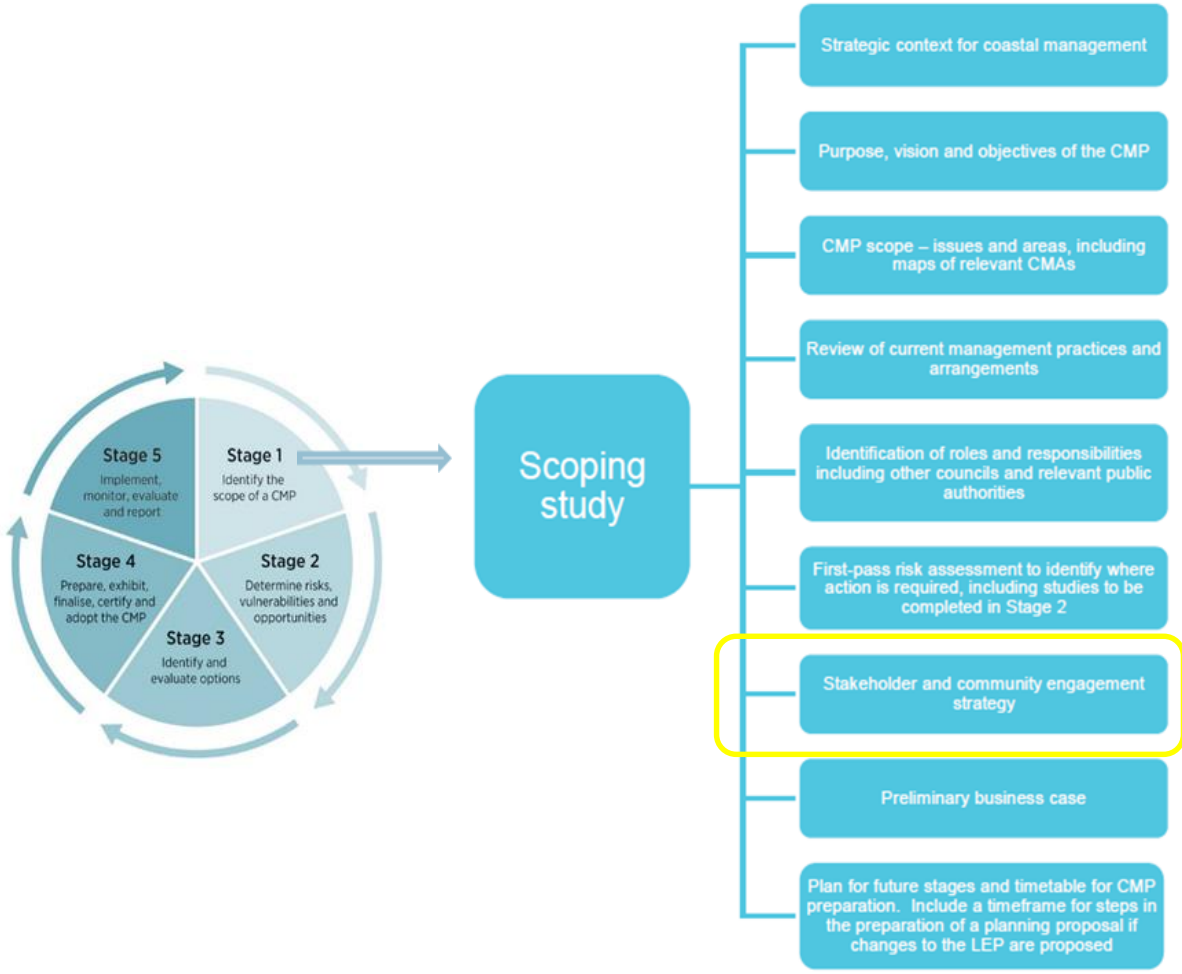


Figure 1. *CMP stages and key components of the scoping study stage (OEH 2018 a)*

This Community and Stakeholder Engagement Plan (also referred to in the document as C&SEP or 'the Plan') has been developed as part of the Stage 1 scoping study for the Bellingen CMP.

Purpose

Purpose

The purpose the Bellingen Shire Council CMP C&SAP is to identify (OEH 2018b):

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

Considerations

Key considerations in the development of the C&SAP have included (OEH 2018b):

- Previous / current coastal planning processes and initiatives
- Demographic structure of the community including length of residence and future projections of population growth
- The complexity of coastal management issues and the level of risk
- Which individuals, organisations and public authorities are relevant and their relative interest and influence in CMP outcomes
- Specific consultation required to align with the preparation of a planning proposal
- The community's values, aspirations, perceptions and attitudes to the coast
- The level of community satisfaction with council's previous consultation and coastal management performance
- Diverse community preferences as to how and when they are engaged in the planning processes
- How to design an equitable, inclusive and legitimate process
- Specific consultation requirements that may apply, for example, Traditional Owners.

How to use this document

This document should be consulted at the beginning of each Stage of the CMP process. The Bellingen Community and Stakeholder Engagement Plan comprises:

- ✓ Context and strategic elements of the C&SEP
- ✓ An Implementation Plan, with actions relevant to each CMP Stage.

As the CMP progresses, it is anticipated that variations to the C&SEP may be required. Variations should ensure a strong link is maintained to the engagement objectives for each Stage.

This Bellingen Shire Council CMP Community & Stakeholder Engagement Plan (C&SEP):

- Introduces the context and the values the Bellingen Shire is aiming to protect through the development of the CMP
- Outlines the significance of effective communication and engagement in the development of the CMP
- Provides an analysis of key stakeholder sectors and groups and the relationship to coastal management in the Shire
- Outlines the generic and specific purpose and objectives for communication and engagement for each stage of the CMP
- Identifies the optimal timing and delivery method of communication and engagement activities
- Identifies key governance and internal communication processes with the project team and Bellingen Shire Council's roles and responsibilities in communication and engaging with stakeholders
- Documents the agreed communication and engagement activities.

These elements of the C&SEP has been developed to be consistent with the relevant guidelines for coastal management in New South Wales (NSW OEH 2018).

Bellingen Shire

The Bellingen Shire is located within the Coffs Harbour region of northern NSW (Figure 2). The Bellinger and Kalang Rivers join at the town of Urunga to form the Bellinger catchment. The catchment covers an area of 1110 km^2. The estuary occupies approximately 160 km^2 within the catchment, including saltmarsh and saline wetlands. There is approximately 13 km of open coastline within Bellingen Shire which extends from Tuckers Rocks to North Valla Beach, and includes Schnapper Beach and Hungry Head Beach. Two smaller estuaries (Dalhousie Creek and Oyster Creek) and two headlands (Wenonah Head and Hungry Head) are also within the Shire's coastal zone. Coastal hazards that pose a risk to the Bellingen coastline include periodic erosion during storms and water inundation in the back beach areas.

The Bellingen Shire is known for its cultural values, and places emphasis on liveability and social cohesion. Originally settled by Europeans in the 1840s for timber logging, the economy has since shifted to the farming of beef cattle, dairy production and cropping, and many residents take an interest in hobby farming. There has also been an increase in tourism with the establishment of State Forests and National Parks, which cover 53 % of the local government area. The local waterways and coastlines are highly valued for their recreational and aesthetic value.

The population of Bellingen Shire was 12,963 as of the 2016 census and is projected to experience a population growth then decline over the next two decades. The largest towns in the Shire are Bellingen and Urunga, with village settlements in Fernmount, Repton, Raleigh and Mylestom. Rural areas in the Shire include Thora, Gleniffer, Kalang, Brierfield and Valery. The Bellingen coastline remains mostly undeveloped, with the exception of recreational facilities.

Bellingen Shire - location

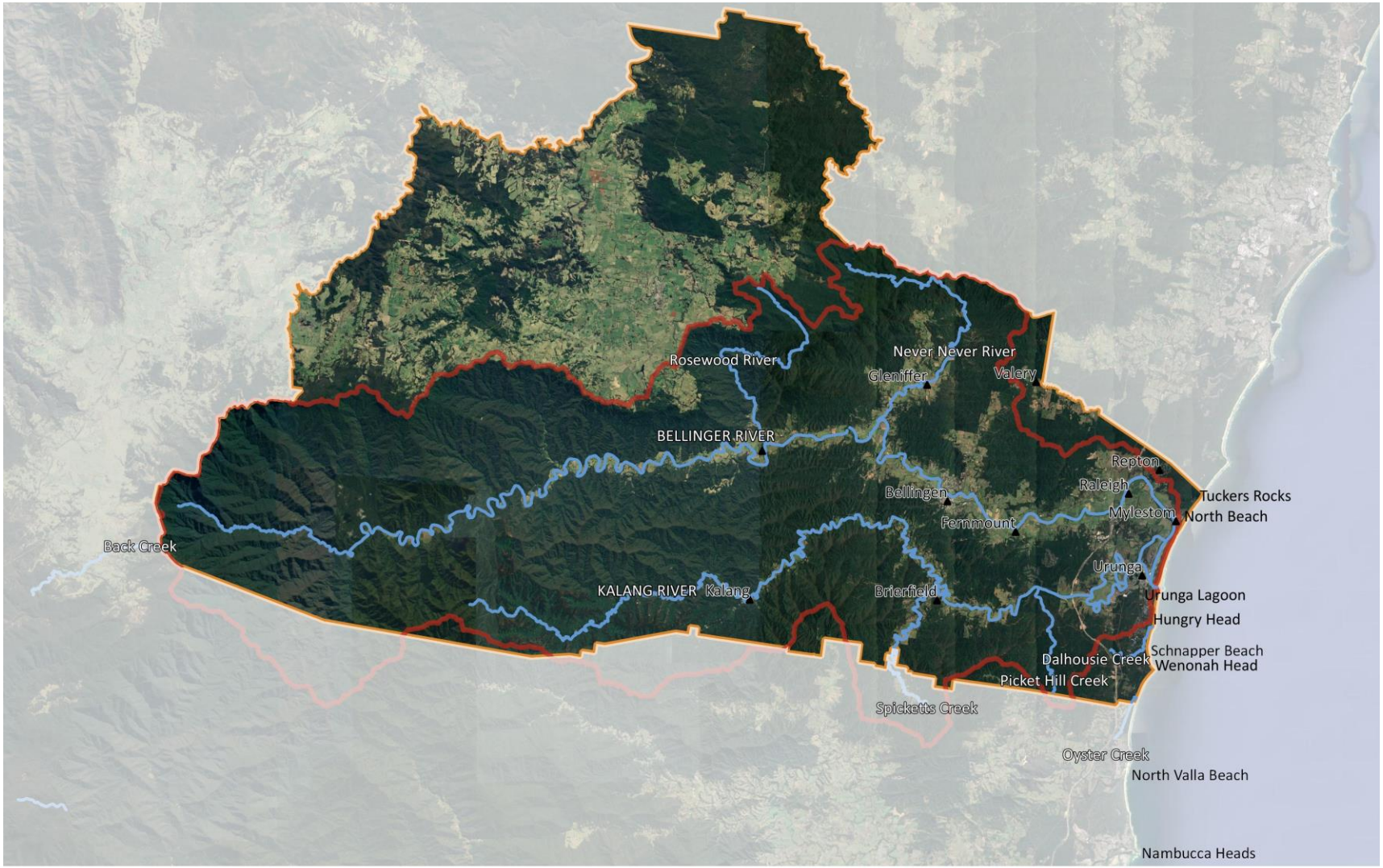


Figure 2: Bellinger catchment and Local Government Area (LGA)

Bellingen Shire – coastal management areas

According to the State Environmental Planning Policy (Coastal Management) 2018, the coastal zone is defined by four coastal management areas:

- Coastal wetlands and littoral rainforest area – defined as areas with particular hydrologic and ecological characteristics
- Coastal vulnerability area – defined as the area subject to any of the seven coastal hazards. The vulnerability area will be identified and mapped by each council based on local conditions
- Coastal environment area – defined as coastal waters, estuaries, coastal lakes and lagoons, and surrounding land including beaches, dunes, headlands and rock platforms
- Coastal use area – defined as land adjacent to the coast where development is or may be carried out

Bellingen's coastal management areas (Figure 3) include coastal wetlands and littoral rainforest, coastal environment and coastal use areas.

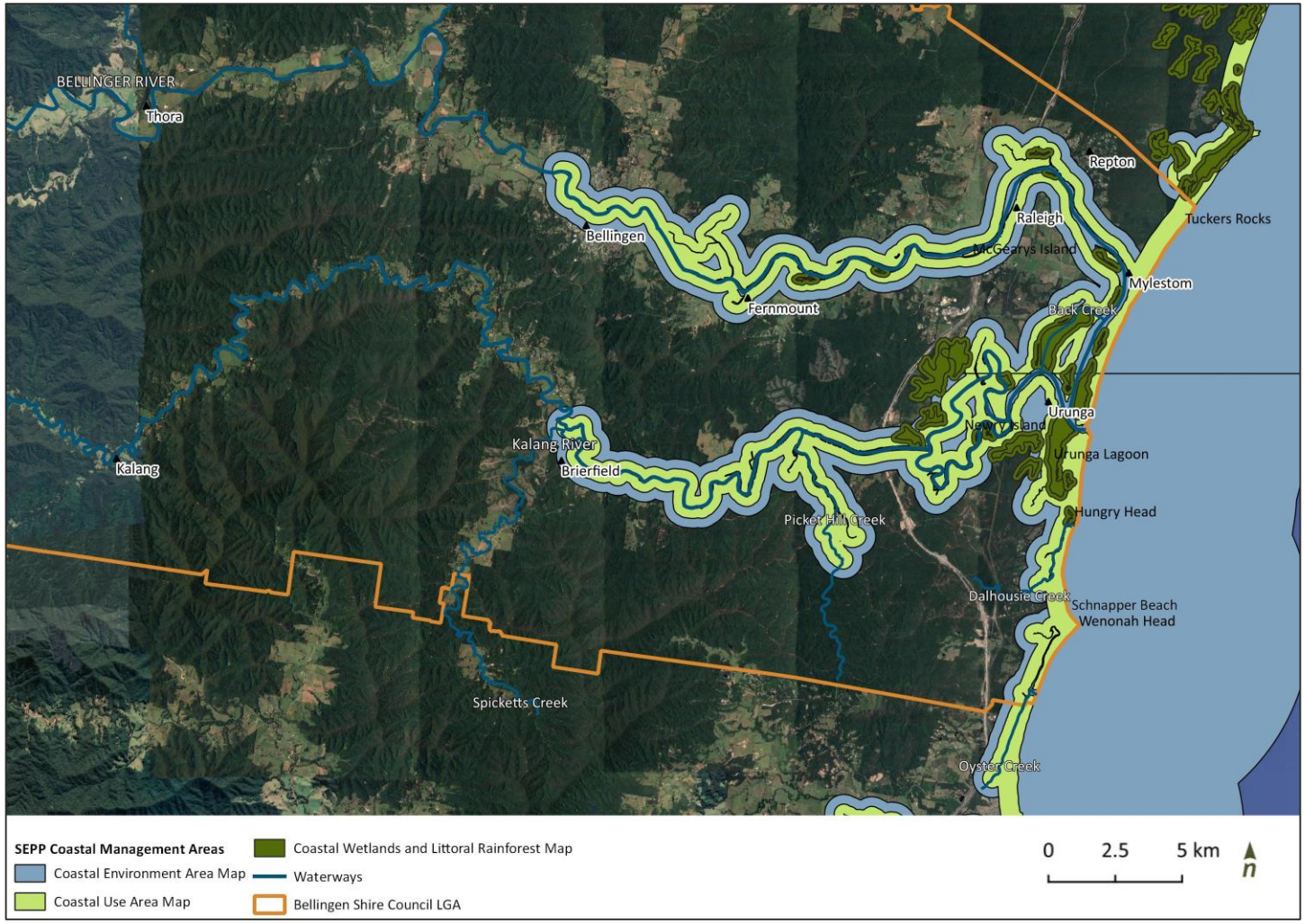


Figure 3: CM SEPP (2018) defined coastal management areas within the Bellingen Shire Council LGA

Demographic profile

Population

The total population of the Bellingen Shire is approximately 12,668 people, and will see a population growth and then decline over the next two decades (see Figure 7) (SAPHaRI 2018). A large proportion of the population is aged 35 years and above.

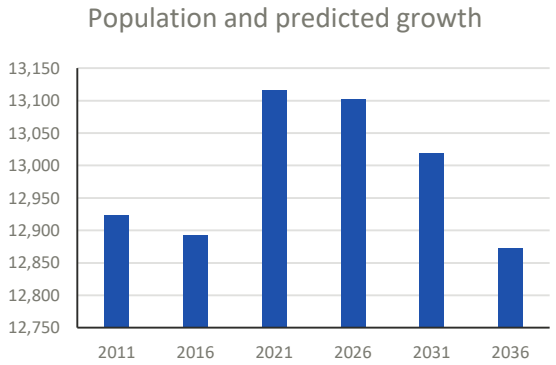


Figure 6: Predicted population growth of the Bellingen Shire (NSW SAPHaRI 2018)

The majority of the population are long term (non-transient) residents. For example:

- Over 5 years, 52.4% of residents did not change their address, and nearly 14% of those who moved remained within the Bellingen Shire
- Approximately 44% of residents own the dwelling they occupy, which is higher than the state average of 35.5%.
- From the most recent National Visitor Survey (2016/17), data suggest Bellingen Shire received over 380,000 domestic visitors
- Local population can double during busy holiday periods

Settlements

The major population centres in the catchment are Bellingen and Urunga, followed by village settlements of Fernmount, Repton, Raleigh and Mylestom; then the rural areas of Thora, Gleniffer, Kalang, Brierfield and Valery.

At the time of the ABS 2016 census, population numbers were:

- Bellingen 3779
- Urunga 3000
- Repton 646
- Raleigh 645
- Fernmount 369
- Mylestom 344
- Thora 332
- Gleniffer 369
- Kalang 266
- Brierfield 333
- Valery 140

It is predicted that majority of the growth in the Coffs Harbour region will be focussed around the existing major regional centres with lesser growth in smaller towns such as Bellingen.

Demographic profile

Employment

Health care, education and training, and retail trade are the leading employment industries (Figure 6).

The most common occupations in the Bellingen Shire include professionals 21.4%, technicians and trades workers 14%, managers 13.9%, labourers 12.6%, and community and personal service workers 12%.

The main industries employing residents of the Bellingen Shire were health care, education and service. Hospitals were the top employers, with aged care residential services, primary and secondary education, and cafes and restaurants. Agriculture is another dominant industry in the shire as 9% of the total population is employed in this industry, which is higher than the state average of 2.2%. However, the industry saw a decline in the employment rate from 10.1% over the five years from 2012/13.

Diversity

The most common ancestries in Bellingen Shire are: English 31.8%, Australian 30.2%, Irish 9.9%, Scottish 8.8% and German 3.5% (ABS 2016). At the time of the census:

- The percentage of Aboriginal and/or Torres Strait Islander people in Bellingen Shire was 3.5%
- The majority of residents were born in Australia. Only 19.5 % of the population were born overseas, in comparison to the state average of 34.5%.

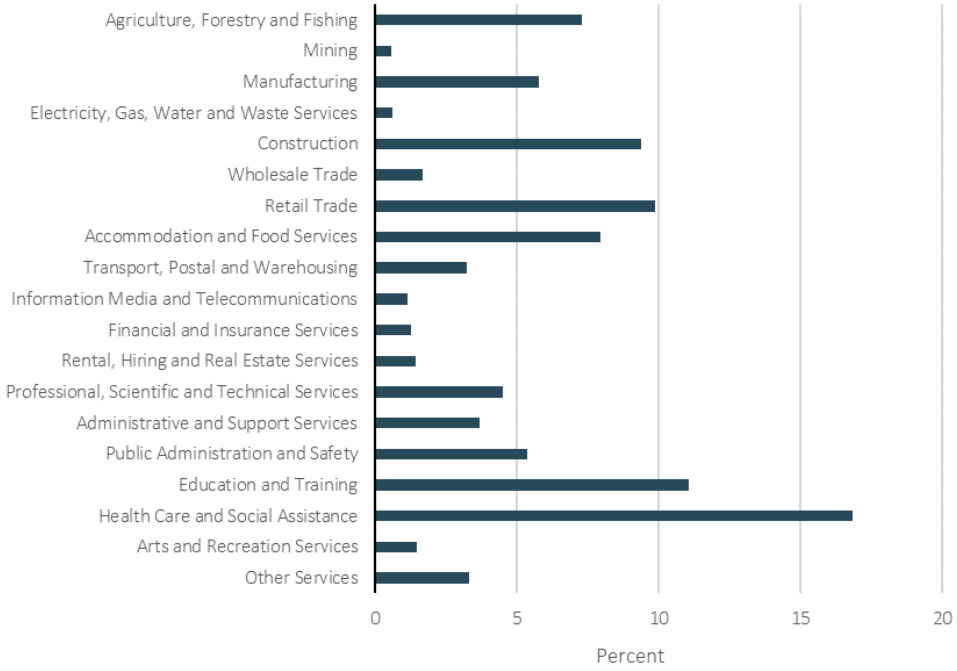


Figure 7: Employment industries of the Bellingen Shire (ABS, 2016)

Coastal communities – Repton

Repton (approx. population 646) is small village settlement in the Bellingen Shire close to the coast. T

he settlement is situated along the Bellinger River. Part of the Bongil Bongil National Park lies within the Bellingen Shire and surrounds the settlement of Repton.

The primary land use practices in Repton are rural residential agriculture, grazing on native vegetation and is taken up by residual native cover.

Aerial image of Repton

Coastal communities – Mylestom

Mylestom (approx. population 344) is a small village settlement in the Bellingen Shire along the Bellinger River and close to the coast.

Mylestom remains the closest settlement to the largely undeveloped shoreline, which is highly valued for recreation and tourism. The settlement of Mylestom is surrounded by land used for recreation and grazing on native vegetation. The minor recreational facilities include picnic areas and barbeques. Recreational pursuits include walking, surfing, swimming, fishing and sightseeing.

South of the Mylestom township is the Mylestom Spit, which is at risk of becoming breached as a result of coastal processes. The estuary foreshore has also been receding landward, which suggests that recovery due to foreshore accretion is not likely to occur.

Aerial image of Mylestom

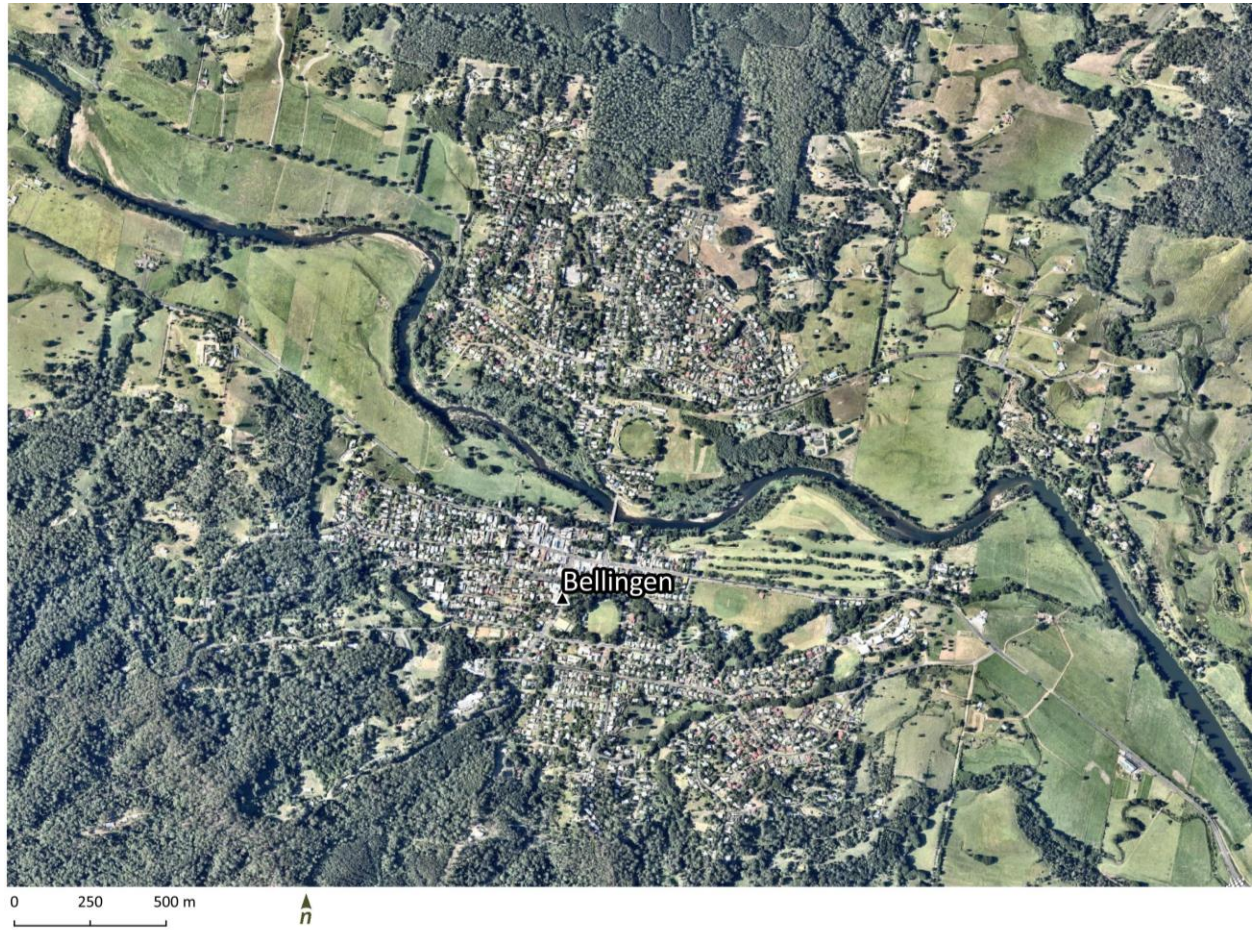
Urban communities – Bellingen

Bellingen (approx. population 3779) is the main population centre in the Bellingen Shire.

Bellingen is located inland, along the Bellinger River and is approximately 15 km from the coast. Despite the distance from the coast, Bellingen is considered to lie within the coastal environment area.

Bellingen is surrounded by areas used for stock grazing on native vegetation, grazing on modified pastures, sown pastures and production forestry, as well as small rural residential areas with agriculture.

Tidal flow is restricted mostly to the Urunga Lagoon, however, Bellingen is likely to become inundated during a more extreme tidal events.



Aerial image of Bellingen town

Urban communities – Urunga

Urunga (approx. population 3000) is the other major population centre in the Bellingen Shire.

Urunga is the closest urban centre to the coast and estuary opening, at the confluence of the Bellinger and Kalang Rivers. Urunga lies 1 km from the coast and within the coastal use area, and also includes residents surrounding the nearby Hungry Head and Dalhousie Creek areas.

Urunga is surrounded by urban residential areas, as well as land used for recreation and grazing on native vegetation.

Tidal flow is restricted mostly to the Urunga Lagoon.

Aerial of the Bellinger River entrance at Urunga

Aerial image of Urunga town

Communities – Raleigh

Raleigh (approx. population 645) is a smaller urban centre within Bellingen Shire. The future population growth for this village is anticipated to be minimal in the future due to the projected impacts on waterways and flood-prone land.

The primary land use in the area surrounding Raleigh is grazing on modified pastures and native vegetation. Along the Bellinger River at Raleigh are mangrove and seagrass communities. These communities are protected under the *Fisheries Management Act 1994* as they are high value ecological assets which are susceptible to sea level rise.

There is land held in the Crown Trust which has been dedicated to recreational use.

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Aerial image of Raleigh

Communities – Fernmount

Fernmount (approx. population 369) is a smaller urban centre within Bellingen Shire, located along the Bellinger River, approximately 10 km from the coast. Fernmount is unlikely to experience significant population growth in the coming years due to the projected impact on waterways and flood prone land.

The land surrounding the Fernmount township is primarily used for grazing on modified pastures, including sown pastures. The residential areas are a mix of urban and farm infrastructure.

There is land held in the Crown Trust which has been dedicated to recreational use.

Aerial image of Fernmount

Key values – Indigenous

The Coffs Harbour region has been the traditional home of the Gumbaynggirr people for thousands of years. The Bellinger Valley was occupied by two of the seven clans of this nation. The clans migrated around between the valley and the plateau, taking advantage of the seasonal availability of different resources.

The Bellinger Valley and coastline was highly regarded for its abundance of resources and the Gumbaynggirr people would share these resources with neighbouring groups, also providing an opportunity for trade.

An image of Aboriginals spearing fish along the Bellinger River taken from a book written by an early European settler (Source: Bellingen Museum 2019)

Bongil Bongil is described by the Gumbaynggirr people as 'a place to stay a long time' due to the abundance of food

Food was abundant in the estuaries, swamps, wetlands, woodlands and rainforests. Seafood was highly valued and was a primary source of food. Midden sites along the dunes demonstrate that the coast was an important place for Aboriginal people, both in terms of a food source and meeting place. There are also remnants of stone fish traps in the tidal areas which were used to catch fish.

Following European settlement in the area, the Indigenous way of life was overwhelmed and the population was frequently displaced by settlers and natural events. A reserve was first established on Urunga Island but was later moved to Yellow Rock after a flood event, and this became the last population of the lower Bellinger tribe.

The coastal area around Wenonah Head between Dalhousie and Oyster Creeks is held as part of the Native Title for the Gumbaynggirr people. A Native Title claim has also been submitted by the Gumbaynggirr people for a parcel of land south of Hungry Head and is awaiting determination.

Key values – European history

Permanent European settlements in the Bellingen Shire began as early as the 1840s, originally establishing the area for timber logging between Raleigh and the coast. Cedar was the first to be logged, followed by other rainforest species when cedar supplies were exhausted. Settlement in the lower valley was formalised by the end of the 1840s when a ship was built to transport the timber. These practices continued until the early 20th century, when most of the land had been cleared.

The Crown Lands Act introduced in 1861 saw extensive clearing of land by owners. The floodplains in the estuary were cleared for maize cultivation, which resulted in a shift away from sub-tropical rainforests by the end of the 1800s. Following a drought period during the early 20th century in the Bellinger Valley, cropping gave way to beef and dairy cattle grazing on native vegetation, and sown pastures.

After the declaration of National Parks, over half of the Bellingen catchment area is now covered by National Parks, State Forests and Nature Reserves. This helps preserve and maintain the natural beauty of the region.

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Key values – Social values

The extensive areas of Natural Park and Nature Reserves within the region highlight the importance to the community of preserving the environment. There is a key road, named Waterfall Way, which establishes a link between the upper reaches of the Bellinger River near Dorrigo and the town of Bellingen. The road highlights the natural beauty of the Bellinger Valley and passes waterfalls and forests.

Along the coast is a number of areas dedicated to Crown Land which have been reserved for recreational use. The estuary and rivers are primarily used for kayaking and canoeing. The beaches, particularly at Urunga and Mylestom, are prized for swimming, fishing and surfing. The National Parks also attract bushwalkers.

Bongil Beach is contained within Bongil Bongil National Park in the northern extent of Bellingen Shire near Repton and extends over 10 km along the coastline. Protected within Bongil Bongil National Park are sand dunes, littoral rainforests and wetlands of significance, as well as sites of Aboriginal significance. It is a popular spot for fishing, swimming and walking.

Jaaningga Nature Reserve is also located within approximately 10 km of the coastline within the Bellingen Shire and was established to preserve the Newry golden wattle. Due to its remoteness, visitor numbers are low, however, it is most commonly used for trail bike riding.

Key values – Ecosystem values

The Bellingen Shire has a diversity of ecosystem values (Figure 8).

Approximately 53% of Bellingen Shire land is classified as a state forest or national park. Majority of this land is maintained on the upper slopes of the catchment area. The isolated sections on the lower floodplains include the wetland and estuarine environments such as Urunga Lagoon.

A key endangered ecological community within the shire is Littoral Rainforest. There are small areas covering a combined area of less than 0.04 km² near Urunga Lagoon and Hungry Head.

Within the Bellinger-Nambucca faunal corridor, grey-headed flying fox are considered to be at risk, with the addition of coastal shorebirds, while the faunal corridor south of Hungry Head, has identified ospreys and blossom bats as the focal species threatened by sea level rise. Koala habitat available within the coastal zone is experiencing continual decline.

Sea level rise projections are also likely to affect species within the seagrass, mangrove and coastal wetland communities. Seagrasses in the region provide food and shelter for many fish and invertebrate species, and have a high conservation value. Due to habitat clearing, large areas of estuarine wetlands, including mangroves, have been lost. The largest saltmarsh community exists at Urunga Lagoon, with smaller patches throughout the estuary.

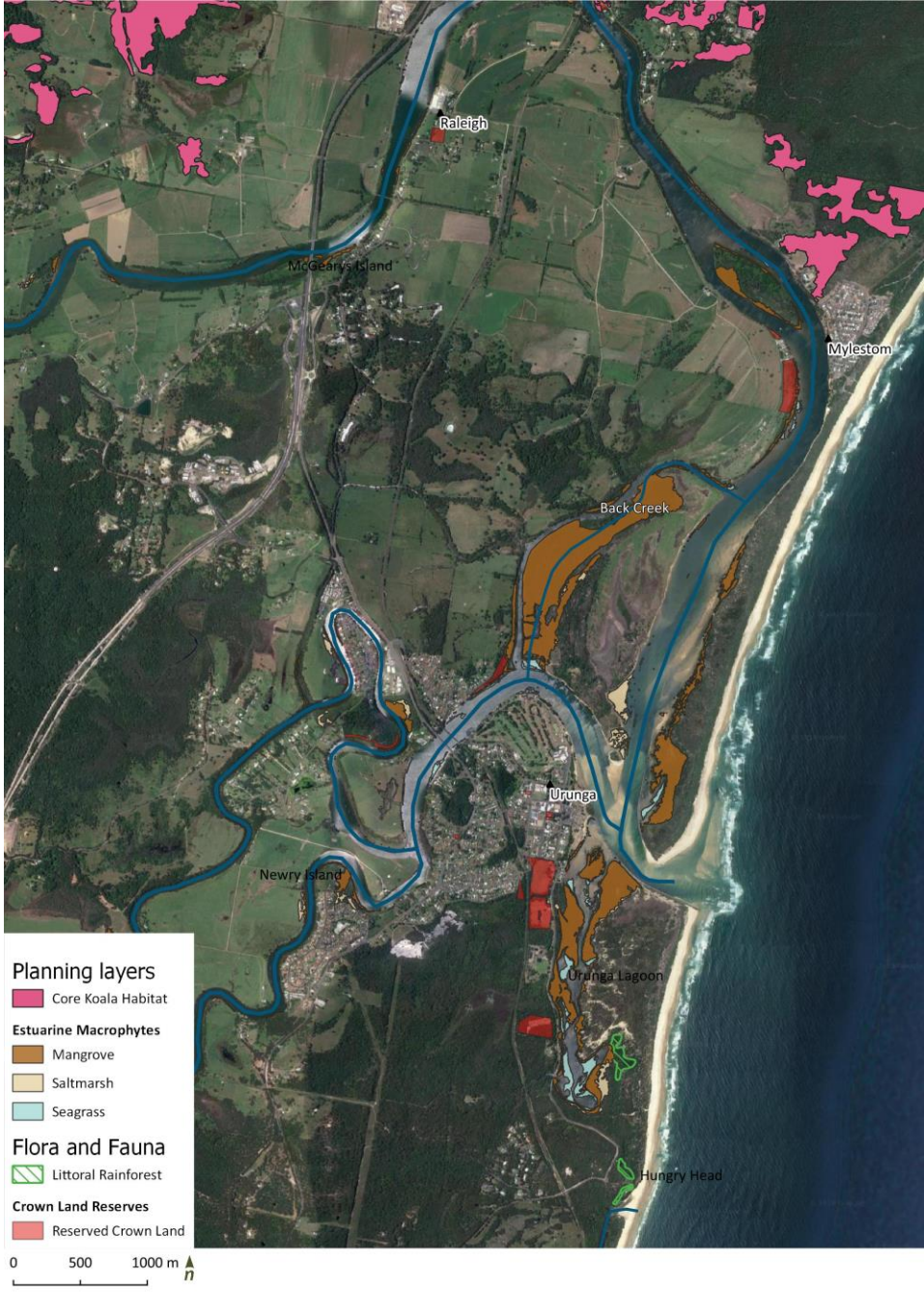

Figure 8: Key ecological values in the Bellingen Shire coastal area

Key values – Hydrological

The Bellingen Shire has a sub-tropical climate with most rainfall occurring during summer, from December to April. The average annual rainfall is 1526 mm, which is typically lower on the coastal floodplains compared to the upper catchment.

Due to land use changes and development in the catchment, the Bellinger and Kalang Rivers have undergone changes in their channel capacity through erosion processes. There have also been clear periods of drought and higher flood activity. From 1948 to 1977, there was a period of high flood activity. Following on from this between 1978 and 2009, a drought-dominated regime persisted.

Over half of the catchment area is contained within National Park, State Forest and Nature Reserves. The remaining land is primarily used for logging of native forests and agriculture, including beef and dairy cattle, fruit, vegetables and nuts.

The main sources of water are bores and an infiltration well. These sources supply the town of Bellingen, as well as Raleigh, Repton, Mylestom and Urunga for residential and farming purposes. Irrigation requirements in this region are low but it is crucial during drier months. Dairy farms and most crops use irrigated water. The main source of irrigated water is farm dams. There are also groundwater storage units in the Bellingen Shire, but very little (0.08%) water is extracted from these resources for irrigation.

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Key values – Socio-economic

Tourism and recreation

The National Parks and largely undeveloped coastline draws residents and tourists to enjoy the natural beauty that Bellingen Shire has to offer. During the 2017/18 period, the Bellingen Shire received over 380,000 visitors with most visiting for a day trip. An average of 5,000 international tourists have visited the Bellingen Shire annually. The region experiences a population fluctuation during peak holiday periods. However, employment in the tourism sector remains low with 1.8% of population employed in Arts and Recreation Services.

The coastal floodplain systems support many different habitats and provide biodiversity, which attracts visitors for a range of tourism industries, such as fishing, bird watching and leisure sports.

The natural assets play a significant role in local tourism and recreation. Through maintaining wildlife abundance, well-vegetated riparian zones it helps to ensure that the waterways and coastlines can support a wide range of functions.

Agriculture

The agriculture, forestry and fishing industries employ approximately 9% of local workers, higher than the state average of 2.2%. The largest proportion of registered businesses (25.4%) are associated with these industries. This emphasises the value that Bellingen Shire residents place on agriculture, which remains a focus in the community.

The largest industries related to cattle, with livestock (45.2%) and dairy (44.6%) constituting the main commodities of agricultural production. Other smaller industries included vegetables, fruit, and cereal crops.

What will successful communication and engagement look like?

Bellingen Shire CMP

Successful communication and engagement for the Bellingen Shire CMP will comprise six outcomes:

- ✓ A shared understanding of:
  - the cultural, social, ecological and economic values provided by the Shire's coastline, estuary and catchments
  - the issues and coastal hazards affecting communities and ecosystems
  - risk and implications for the protection of public and private assets
- ✓ Optimal use of resources (time and financial)
- ✓ Stakeholders have the capacity to contribute meaningfully to the CMP development and long term implementation
- ✓ Planning and management decisions are based on evidence, knowledge, and dialogue
- ✓ Shared accountability and responsibility for managing coastal hazards
- ✓ Maximum acceptance of planning outcomes and decisions (in short and long term).

What will successful communication and engagement look like?

The broad objectives for engagement during the Bellingen Shire CMP process include that:

- ✓ There is open communication with community and stakeholders to ensure there is transparency in all decisions
- ✓ There is broad acceptance of the catchment and coastal processes and the constraints which estuary and catchment management must operate
- ✓ Decisions are evidence based using the best available science and information.

To achieve the intended outcomes and objectives, the process of engagement for the Bellingen Shire CMP will follow the progression of discussion and understanding outlined in Figure 9.

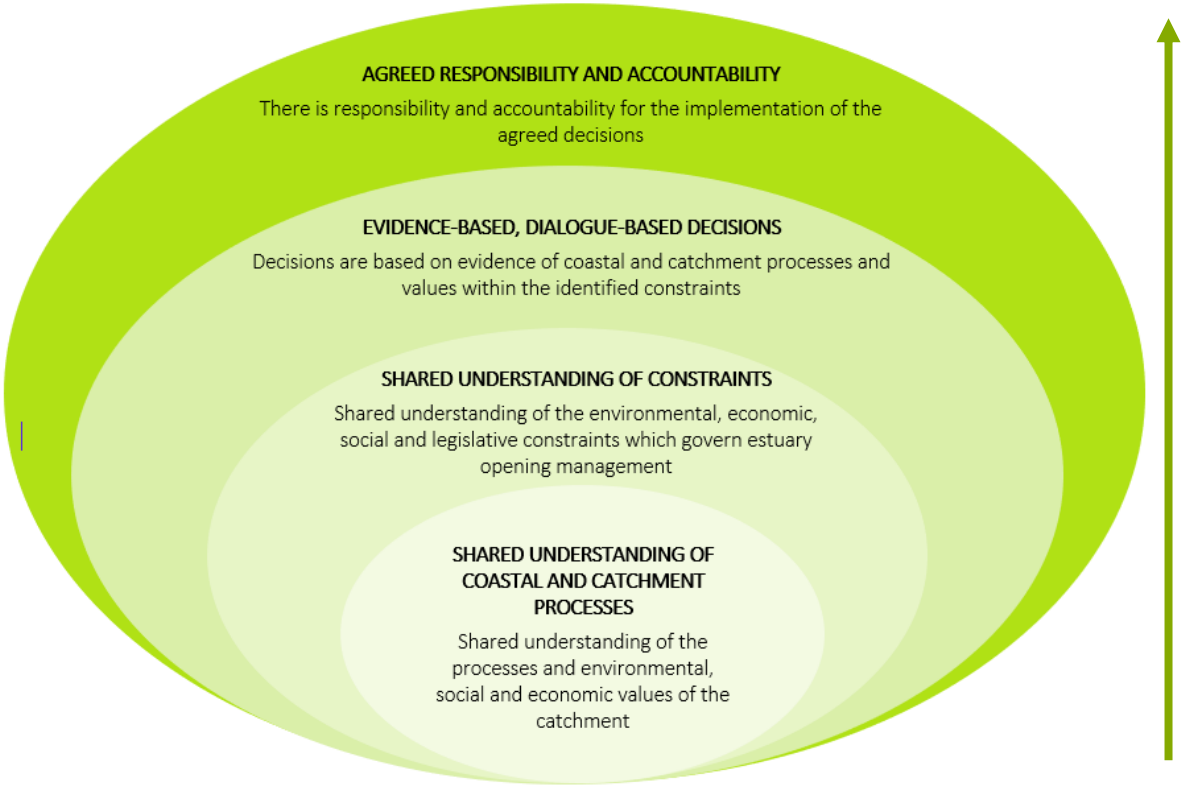

Figure 9: Process of engagement

Principles of effective engagement and communication

Underpinning the delivery of the Bellingen Shire CMP are a number of engagement **principles**.

1. **Appropriateness** – communication and engagement strategies and actions:

- Will be written in an appropriate language for the target audience
- Delivered through appropriate communication platforms, channels and pathways
- Implemented in a timely manner and respects the time of others
- Reflect the appropriate level of participation and associated commitment (Figure 9).

Depending on the stage of the CMP process, public consultation will include elements of inform, consult and involve (Figure 9).

2. **Consult and engage early and often as necessary** - Communication and engagement has already commenced with the development of the Stage 1 scoping study. Communication and engagement should have a clear purpose and occur in a timely manner with each Stage.

3. **Know your audience and be inclusive** – A stakeholder analysis has been developed as part of this Plan (Attachment 1) but should be regularly reviewed to ensure all stakeholders are captured. Opportunities for all stakeholder sectors and audiences should be accommodated for in some form.

4. **Respect, transparency and open communication** – Trust and meaningful relationships are essential to effectively achieve the objectives of the CMP.

INCREASING IMPACT ON THE DECISION

	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
PUBLIC PARTICIPATION GOAL	To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision making in the hands of the public.
PROMISE TO THE PUBLIC	We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and aspirations, and provide feedback on how public input influenced the decision.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will look to you for advice and innovation in formulating solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.

Figure 9: Scale of public participation (Source: IAP[2])

Principles of effective engagement and communicatio

5. **Understand the risks and be prepared** – An initial risk analysis (Attachment 2) has been undertaken as part of the Plan development and has been recommended to be reviewed at regular intervals.
6. **Utilise existing approaches and mechanisms** – early engagement with key stakeholders including BSC has identified many existing channels that will be optimised prior to new approaches being developed.
7. **Share the load –** While the BSC has core responsibility for development of the CMP, there are many roles and opportunities for others to take lead responsibility for specific actions and activities this includes the role of community advocate.
8. **Consistent, simple messages** – The CMP process potentially involves many complex processes and challenging concepts, every effort should be given to ensuring all communication materials reiterate common messages and concepts explained in simple and concise language. Key messages for each Phase of the CMP are identified in this Plan.
9. **Visual and engaging** – An emphasis has been placed on designing communication and engagement activities and tools that are visually appealing, highly engaging, interactive and professional. Every effort should be given to ensuring mapping products and visual tools are accurate, easy to understand, and minimise the potential for misinterpretation (e.g. Attachment 3).
10. **Adaptive and flexible** – A monitoring and evaluation framework has been developed to ensure the Action Plan is regularly reviewed and updated to reflect any changing context, situation, or new information. This review process will also ensure there is a continual learning loop and appropriate reflection of what has worked well and what could be done better.

Bellingen Shire CMP stakeholders

Various stakeholder groups across the Bellingen Shire community will have different interests in the Bellingen CMP process. At a high-level, the following stakeholder groups have been identified. An understanding of these groups informs the methods of engagement and communication recommended for the Bellingen CMP. A comprehensive list of stakeholders can also be found in table later in this section

Infrastructure and public asset owners

This stakeholder group have a key interest in protecting and maintaining public assets and infrastructure such as waterways, roads, sewerage systems, pipes, national parks, recreational assets (public boat ramps).

They are likely to require a high degree of communication and engagement throughout the development of the CMP to identify key assets and potential mitigation strategies.

Example stakeholders include:

Bellingen Shire Council, Department of Industry – Crown Lands, Bellinger Heads State Park Trust, NSW OEH, NSW National Park and Wildlife, NSW Transport Roads and Maritime Service, NSW Department of Primary Industry (Fisheries), Forestry Corp of NSW

Private asset owners

This stakeholder group have an interest in protecting their private assets such as property, business, commercial assets (e.g. crops) and infrastructure (e.g. irrigation infrastructure).

They are likely to require communication and engagement on all aspects of the CMP that will have an impact on their owned assets.

Example stakeholders include:

Property owners, local business owners, farmers

Public asset user groups

This stakeholder group have an interest in protecting public assets that they use. This may include recreational assets (e.g. boat ramps), environmental assets (e.g. wetlands, national parts, beaches), and other public services and amenities.

They are likely to require communication and engagement surrounding public assets of value.

Example stakeholders include:

Urunga and North Beach Surf Life Saving Clubs, Australian Lifeguard Service, Urunga Anglers Club, Urunga Sail Training Club, Bellinger River Sailing Club, community members

Cultural and environmental asset protection special interest groups

This stakeholder group is interested in protecting and enhancing cultural and environmental assets in the Bellingen region.

This may includes environmental values in areas of significance and broadly across the Shire, for example waterway health and water quality, soil erosion and condition, and biodiversity.

Examples include:

North Beach Community Alliance, Bellinger Landcare Inc., OzGreen, Bellingen Bush Regenerators, Bellingen Riverwatch, Friesians and Fish, Newry Island Foreshore Rehabilitation

Bellingen Shire CMP stakeholders

Traditional Owners

Traditional owners are custodians of the land and interested in protecting cultural values, environmental values and private assets.

In the Bellingen Shire this includes Gumbaynggirr traditional owners.

Example stakeholders include:

Local Aboriginal Land Council (Coffs Harbour and Dorrigo)

General interest in the management and protection of the Bellingen Shire coast

These stakeholders refer more broadly to the general population of Bellingen Shire that are interested in the management of the Bellingen coast and waterways and any assets or values that may be vulnerable to coastal hazards.

For those generally interested, regular updates and publicly accessible information may be a suitable level of communication and engagement throughout the CMP.

Other interested parties

Other interested parties includes stakeholders that may not necessarily hold a stake in the CMP, but may be a source of information, or generally interested in the outcomes of the CMP.

Other interested parties can be kept informed.

Examples include:

Universities, other agencies.

Bellingen Shire CMP stakeholder groups

Agency Reference Group
An Agency Reference Group (ARG) has been formed as part of the Stage 1 scoping study to provide guidance on the study and also latter stages of the CMP. The ARG consists of members from:

- **Bellingen Shire Council**
- **NSW Office of Environment and Heritage (OEH)**
- **NSW Parks and Wildlife**
- **NSW Transport, Roads and Maritime Services**
- **Forestry Corporation NSW**
- **Department of Industry – Crown Lands**
- **NSW Department of Primary Industries (Fisheries)**
- **Bellinger Landcare**
- **Coffs Harbour Local Aboriginal Land Council**

Throughout the CMP the ARG will ***Collaborate*** based on the IAP2 public participation framework.

Key stakeholders
There are diverse array of stakeholders with a range of interests in the Bellingen CMP and its coastal management areas and catchments. A list of key stakeholders will be developed with the ARG to engage throughout the CMP process. This stakeholder list may include:

- **Bellingen Heads State Park Trust**
- **Local Aboriginal Land Council**
- **Bellinger Landcare Inc.**
- **OzGreen**
- **Urunga Surf Life Saving Club**
- **Australian Lifeguard Service**
- **Bellingen Bush Regenerator**
- **Urunga Anglers Club**
- **Urunga Sail Training Club**
- **Bellinger River Sailing Club**

Throughout the CMP these key stakeholders will need be ***involved*** based on the IAP2 public participation framework.

Bellingen Shire COUNCIL alluvium NCEconomics

Strategies and activities

There are a number communication and engagement strategies and tools that are proposed to underpin the development of the Bellingen Shire CMP. These are summarised in the following sections, and initial actions are then identified for each Stage.

Branding: *To help build public recognition of the Bellingen Shire CMP and Council's commitment to integrated coastal and catchment management*

- Establish **a customised 'brand' and look** for use in all communication materials. The may include use of Council's logo with a CMP tag line or tailored graphic elements that are identifiable to the Bellingen Shire CMP. This is an optional task, however is useful for building awareness and buy-in for the project and helps with communications materials.

Establish key networks: *To help build capacity and maintain strong networks to support engagement and decision-making*

- Establish an **inter-departmental Council Project Steering Team (PST)** that includes representative of key departments and sections and key consultants
- Establish an **Agency Reference Group (ARG)** comprising representatives of each of the key stakeholder groups (or similar)

Strategies and activities

Knowledge sharing: *To guide stakeholders through technical components of the CMP, building knowledge and understanding, and to receive local information that will assist in creating a strategy that is tailored to the need of the Bellingen coast*

- Deliver **targeted workshops and meetings** for the ARG (as a minimum) to review technical outputs and implications, and guide the CMP work program
- **Community workshops**
- Undertake **personalised briefings and project updates** to key individual organisations and groups on as needs basis
- On-line community **values and knowledge surveys**

Communications: *To help build general awareness and understanding across the community*

- Establish a dedicated **website** or webpage information to ensure consistent communication and activity coordination
- Develop and disseminate regular **progress updates** (e.g. Attachment 3)
- Develop and disseminate project **fact sheets** suitable for a range of technical and non technical audiences on key topics
- Prepare targeted **media releases** in line with the proposed key messages for distribution locally and regionally
- Utilise local **social media** outlets to disseminate key information this includes BSC media as well as those of key stakeholder groups

Create a shared history and vision for the Bellingen coast: *To build a shared understanding of historical events, and identify values sought for the future Bellingen coastal catchment landscape*

- Encourage the community to **submit photos and stories of historical events, and identify values sought for the coastal areas** via the project website, knowledge surveys and face-to-face engagement
- **Develop a timeline** for the Bellingen coast to communicate the shared history and vision for the future

CMP engagement objectives, outcomes and activities by Stage

The initial engagement objectives and outcomes for each Stage of the Bellingen Shire CMP process are outlined in Table 1. This is to be updated as the project progresses.

Table 1. Engagement objectives and outcomes for each Stage of the CMP development

CMP stage	Objectives (Why do we want to engage)	Outcome (What will success look like)	Strategies and key activities (What will be done)
Stage 1 - Identify and scope CMP	• Identify the social, economic and environmental values of the Bellingen coastline. • Identify the key threats to the values within the study area. • Ensure all key stakeholders have a common understanding of the economic, ecological, social and cultural values of the Bellingen coastal areas, and the issues affecting their management • Identify management objectives for the CMP	Shared understanding of the economic, ecological, social and cultural values for Bellingen's coastal areas, and issues affecting their management Identify key objectives for the CMP based on protecting values	• ARG meeting at start of project to help define objectives of CMP • Contact key stakeholders by phone and/or email to discuss their concerns • Develop community brochure outlining CMP process • Community survey to determine values and threats • Stakeholder workshops to discuss drainage/ issues • ARG meeting to discuss recommendations for Stage 3
Stage 2 - Determine risks, vulnerabilities and opportunities	• Communicate the proposed study approaches and any inherent uncertainty • Ensure different perspectives are incorporated in the analysis of consequences and likelihood	Community and stakeholder acceptance of the outcomes of the risk assessment	• Updated community brochure outlining the outcomes of Stage 1 and recommended studies being undertaken in Stage 2 • Contact directly affected landholders about studies which may be occurring on or near their properties • ARG meeting to discuss outcomes of studies and update risk assessment • Feedback from stakeholders on risk assessment

CMP engagement objectives, outcomes and activities by Stage

The initial engagement objectives and outcomes for each Stage of the Bellingen Shire process are outlined in Table 1. This is to be updated as the project progresses.

Table 1. Engagement objectives and outcomes for each Stage of the CMP development

CMP stage	Objectives (Why do we want to engage)	Outcome (What will success look like)	Strategies and key activities (What will be done)
Stage 3 - Identify and evaluate options	• Determine the acceptability of management actions to stakeholders and the community • Engage public authorities about implications for their assets and responsibilities	Community and stakeholder acceptance that the decision process used to select options is evidence based	• ARG meeting to discuss preliminary management options implications for their assets and responsibilities • Workshops with key stakeholders who may be impacted by certain actions • Contact directly affected landholders or residents who occupy land which may be affected by recommended changes to coastal management area maps • Updated community brochure outlining the outcomes of Stage 2 and recommended actions agreed to in Stage 3
Stage 4 - Prepare, exhibit, finalise, certify and adopt the CMP	• Seek feedback on the draft CMP	Feedback on Draft CMP used to inform final CMP	• ARG meeting to discuss preliminary CMP recommendations and implications for their assets and responsibilities • Exhibit draft CMP publicly • Prepare document outlining how feedback on draft CMP was used to finalise CMP

Monitoring and evaluation

Ongoing monitoring and evaluation (M&E) of communication and engagement throughout the life of the CMP is a beneficial process for reviewing how the program is being received by the community and key stakeholders, which stakeholders have been engaged, and reflecting on whether appropriate outcomes have resulted from communication and engagement throughout.

The input provided by stakeholders and the community during the CMP process is important to help shape the technical scope and approach to each subsequent stages of the CMP. Reflecting at the end of each phase is necessary to ensure that the input provided through engagement is appropriately shaping the CMP process.

Additionally, it is possible that the CMP will be delivered by multiple agencies, and documenting the successes and challenges of engagement and communication will be a valuable activity for providing continuity and trust with various stakeholder groups. Having a record of key learnings through the development of the CMP will also be a useful resource during implementation.

Two monitoring and evaluation options for the CMP engagement process are presented below. Option one is considered as the acceptable minimum effort, while option two refers to a more detailed monitoring and evaluation approach.

Option 1: *Periodically review communication and engagement*

Schedule a internal reflection/review with the project team at the end of each CMP Stage to consider input provided through engagement and how this will shape subsequent Stages. Reflecting on key evaluation questions may be useful to inform this review.

Provide regular opportunities to stakeholders (through existing channels of communication) to communicate if they are happy with the level of communication and engagement.

Option 2: *Detailed monitoring and evaluation approach*

This approach would involve an increased effort to collate data to assist with answering Key Evaluation Questions, and reporting on outcomes.

Monitoring and evaluation

Key evaluation questions for engagement M&E

The following key evaluation questions include one question that simply relates to the delivery of activities and outputs, while the other three relate to the achievement of outcomes:

1. Were all engagement activities delivered and received as planned in the Community and Stakeholder Engagement Plan?

2. Did engagement activities, and the subsequent inclusion of stakeholder input into the CMP contribute to Outcome 1?

3. Did communication and engagement activities promote shared accountability and responsibility for management of the Bellingen coast, and the decisions resulting from the CMP?

4. Was communications and engagement delivered in the most efficient way possible, and build community capacity and interest (e.g. relationships and networks) to continue to provide input?

In answering all of these questions, efforts should be made to identify opportunities for improvement either in the continued development of the CMP or during implementation of the CMP.

Evaluation timeframes

For the life of the project, periodic evaluations that seek to answer the key evaluation questions would be suited at:

1. Completion of Stage 1
2. Completion of Stage 2 - 3
3. Completion of Stage 4

Data collection

Data collection that may be used to determine if communication and engagement has been successful can include:

- Numeric data on the delivery of outputs e.g. how many workshops held, stakeholders engaged etc.
- Internal review/reflection at the end of each Stage
- Evaluation surveys (following workshops and other engagement activities)
- Seeking feedback from stakeholders and broader Bellingen community

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Attachment

Summary of stakeholders

1

Attachment 1 – Summary of stakeholders

Stakeholder group	Representative/Contact	Interest in engagement	Relevance to project/comments	Primary engagement approach (IPA2)	Contact to date
Bellingen Shire Council	• Alex Waldron	*Preserve local values, maintain healthy waterways and prevent contamination of rivers and creeks*	Manager, sustainable environment and waste		
	• Craig Salmon	*Maintain healthy waterways*	Manager, Water and sewage		
	• John Fyfe	*Maintain existing infrastructure*	Manager, Maintenance	• *Consult* • *Involve* • *Collaborate*	
	• Luke Perry	*Ensure CMP requirements are met for future planning and development in the region*	Team leader, Planning		
	• David Maunder	*Provide scope of assets within coastal environment area*	Asset Engineer/ Acting manager		
	• Nikkela Williams	*Ensure that sewage is properly managed and waterways are not contaminated*	OSMS Project Officer		
	• Lynn Delgado	*Sustainable use and management of coastal zone*	Sustainability Officer		
NSW Office of Environment and Heritage	• John Schmidt	*Ensure estuary and coastal zones are managed according to CMP process and to align with community values*	Senior Coast and Estuary Officer	• *Consult* • *Involve* • *Collaborate*	
NSW Department of Industry – Crown Lands	• Peter Baumann	*Maintaining natural resources in the estuary*	NRM Project Officer	• *Consult* • *Involve*	
	• Catherine Knight	*Maintain and preserve coastal departments on Crown Lands*	Coastal unit	• *Collaborate*	
NSW National Parks and Wildlife	• Sophia Meehan	*Determine rehabilitation efforts required as part of CMP process*	Manager, Landforms and Rehabilitation	• *Consult* • *Involve*	
	• Josh Chivers	*Maintenance and preservation of National Parks and Wildlife in the coastal zone*	Senior Project Officer, Coastal Landscapes	• *Collaborate*	
NSW Department of Primary Industries (Fisheries)	• Patrick Dwyer	*Maintain healthy waterways to meet community values*	Senior Fisheries Manager	• *Consult* • *Involve* • *Collaborate*	
NSW Local Land Services	• Justine Graham	*Determine how natural assets will be affected under scenarios set out under the CMP and how they can be managed*	Team Leader Operations Natural Assets	• *Consult* • *Involve* • *Collaborate*	

Attachment 1 – Summary of stakeholders

Stakeholder group	Representative/Contact	Interest in engagement	Relevance to project/comments	Primary engagement approach (IPA2)	Contact to date
NSW Transport, Roads and Maritime Services	• Anna Sedlak	*Determine whether transport, roads and maritime services will be affected by coastal processes*	Boating Officer, Transport RMS	• *Inform* • *Consult* • *Collaborate*	
Bellinger Heads State Park Trust	• Michelle McFayden • Derek Van Leest	*Ensure that the value of the Bellinger Heads State Park is maintained*	Council representative/Deputy General Manager Representative from NSW Department of Industry – Crown Lands, Group Leader	• *Inform* • *Consult*	
Forestry Corp	• Peter Walsh	*Manage the health of the waterways, minimising sediment runoff, maintaining riparian vegetation*	Soil and water specialist in hardwood forest division	• *Inform* • *Consult*	
Local Aboriginal Land Council	• Lachlan Skinner (Coffs Harbour) • Robin Heath (Dorrigo)	*Preservation of the Indigenous land values*		• *Consult* • *Involve* • *Collaborate*	
Bellinger Landcare Inc.	• Sandy Eager • Chris Ormond	*Ensure contact and access to landholders*	Coordinator Chairperson	• *Inform* • *Consult*	
OzGreen	• Anton Judovalkis • Amy Denshire	*Coordinate with the Bellingen Riverwatch project and engage with the citizen science program*	CEO Bellingen Riverwatch Coordinator	• *Inform* • *Consult* • *Involve*	
Urunga Surf Life Saving Club	• Michael Dougherty	*Engage with those using the coastal zone*	President	• *Inform* • *Consult*	
Australian Lifeguard Service	• Scott McCartney	*Engage with coastal zone stakeholders to understand their values and concerns*		• *Inform* • *Consult*	
Bellingen Bush Regenerator	• Kim Cheeney	*Local vegetation knowledge*	Lead bush regenerator	• *Inform*	
Urunga Anglers Club		*Coastal zone community stakeholder*		• *Inform* • *Consult*	
Urunga Sail Training Club		*Coastal zone community stakeholder*		• *Inform* • *Consult*	
Bellinger River Sailing Club		*Coastal zone community stakeholder*		• *Inform* • *Consult*	

Attachment

Communication and engagement risk management

2

Communication and engagement risk management

Risk	Likelihood (before – after)	Implications	Mitigation strategy
Consultation fatigue or consultation indifference	Medium – Low	Value of input from stakeholders reduced. Disconnection and disinterest from community, not aware of what's going on and how it might affect them.	Consultation will be planned to target specific stakeholders with key messages that are relevant to them. Let stakeholders know when the consultation process hits major milestones. Demonstrate that stakeholder contributions have been heard and understood. Implement Strategies to Re-engage stakeholders e.g. provide a good reason to come back. How will the consultation affect the outcomes? How will the issue under discussion directly affect them?
Failure to address misinformation or rumours promptly and clearly	Medium - Low	Unwarranted or disproportionate community concern. Loss of buy-in for the CMP. Misinformation may take attention away from real issues requiring consideration and discussion.	Consistent messages throughout all communication materials, and all stages of the CMP development. Identify a key spokesperson that will rapidly address any escalating concerns.
Failure to involve relevant stakeholders or represent local interests	Medium - low	Biased feedback that is not representative of the whole community. Rejection of the CMP by stakeholders that feel their interests and values have not been captured.	Work with council and systematically identify all relevant stakeholders and their likely communication needs. Allocate sufficient resources and time to implement the Community and Stakeholder Engagement Plan in full. Utilise networks such the ARG to develop efficient engagement methods.
Certain stakeholder groups feel that they are not being adequately engaged in the process or not getting their fair share of access to information	Medium – Low	Rejection of the CMP by stakeholders that feel the CMP was unfairly developed to benefit others.	Establishment of publicly accessible information sources (such as the website) and open lines of communication allows for all stakeholders to access information. Communication and engagement does not actively exclude any particular stakeholder groups. Reaffirm that the council is interested in the views of all stakeholders, not just those directly affected.
An extreme event occurs during the development of the CMP	High - Medium	Greater sense of urgency, and those effected may demand action now.	Bellingen Shire confirms its role, commitment and aims of the project through its communication. Frame the event in a way that highlights the importance of developing a CMP to mitigate and prepare for future events.
Insufficient time allowed to effectively engage with the community about potential risks and impacts, and to properly consider stakeholder needs	High – low	Reduced input from stakeholders. CMP developed without full consideration of stakeholder interest and values.	Allocate sufficient resources and time to implement the Community and Stakeholder Engagement Plan in full. Utilise networks such the ARG to develop efficient engagement methods.
Inconsistent or contradictory messaging	Medium – Low	Creates confusion and distrust. Resolving confusion may take attention away from issues requiring consideration and discussion.	Consistent messages throughout all communication materials, and all phases of the CMP development. Brief project team members, and council project working group prior to community engagement to agree on messaging.
Assumption that property values will be adversely affected if mapped in coastal hazard areas	Medium - Low	Insurance premiums become unaffordable, or at worst, properties become uninsurable. New investment in the Shire hampered	Ensure adequate information is provided to ensure that the public understand the context in which technical studies and mapping has been developed. Ensure all spokespersons can respond appropriately to questions and issues raised by the public.

Attachment

Example communications materials – Scoping Study Stage

3

BELLINGEN COASTAL MANAGEMENT PROGRAM

SCOPING STUDY

GET INVOLVED!

We are interested in hearing from the community about their views on the Bellingen Shire open coastline and Bellinger and Kalang estuaries and catchments. Your knowledge and feedback can help shape the future management of the coastline and estuaries.

We would like you to spend 5-10 mins and take part in a survey. Please visit Bellingen Shire Council homepage for details of the survey - **create.bellingen.nsw.gov.au**

If you would like to discuss the Bellingen Shire Coastal Management Program scoping study further please contact **Misko Ivezich** on **0401 048 241** or **misko.ivezich@alluvium.com.au** for more information.

Bellingen Shire COUNCIL

alluvium

PURPOSE

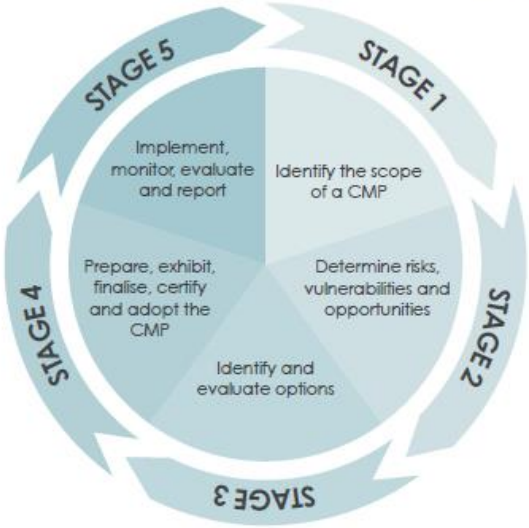
The Bellingen Coastal Management Program (CMP) Scoping Study (Stage 1) aims to work with the community to understand the issues and values across the coastline and within the estuaries and catchment of the Bellinger and Kalang Rivers . This understanding will help target additional investigations and studies in later stages of the Bellingen Shire CMP process.

BELLINGEN SHIRE COASTAL MANAGEMENT

The Bellingen Shire is located within the Coffs Harbour region of northern NSW. The Bellinger and Kalang Rivers join at the town of Urunga. The total catchment of these rivers covers an area of 1110 km². The estuary occupies approximately 160 km² within the catchment, including saltmarsh and saline wetlands. There is approximately 10 km of coastline in Bellingen Shire. Two smaller estuaries, Dalhousie Creek and Oyster Creek, are also within the Shire's coastal zone. Coastal hazards that pose a risk to the Bellingen coastline include periodic erosion during storms and water inundation in the back beach areas.

The Bellingen Shire is known for its cultural values, and places emphasis on liveability and social cohesion. Originally settled by Europeans in the 1840s for timber logging, the economy has since shifted to the farming of beef cattle, dairy production and cropping, and many residents taking an interest in hobby farming. There has also been an increase in tourism with the establishment of State Forests and National Parks, which cover 53 % of the local government area. The local waterways and coastlines are highly valued for their recreational and aesthetic value.

Bellingen Shire Council is working with the NSW Government to develop a long term plan to manage the Shire's coastline and estuaries. The recently released Coastal Management Manual sets out mandatory requirements and essential elements for a Coastal Management Program. Council is talking to key stakeholders as part of this processes but would also like to hear from the broader community.



Attachment B
Bellingen CMP Community Survey

Survey Report

30 January 2017 - 23 September 2019

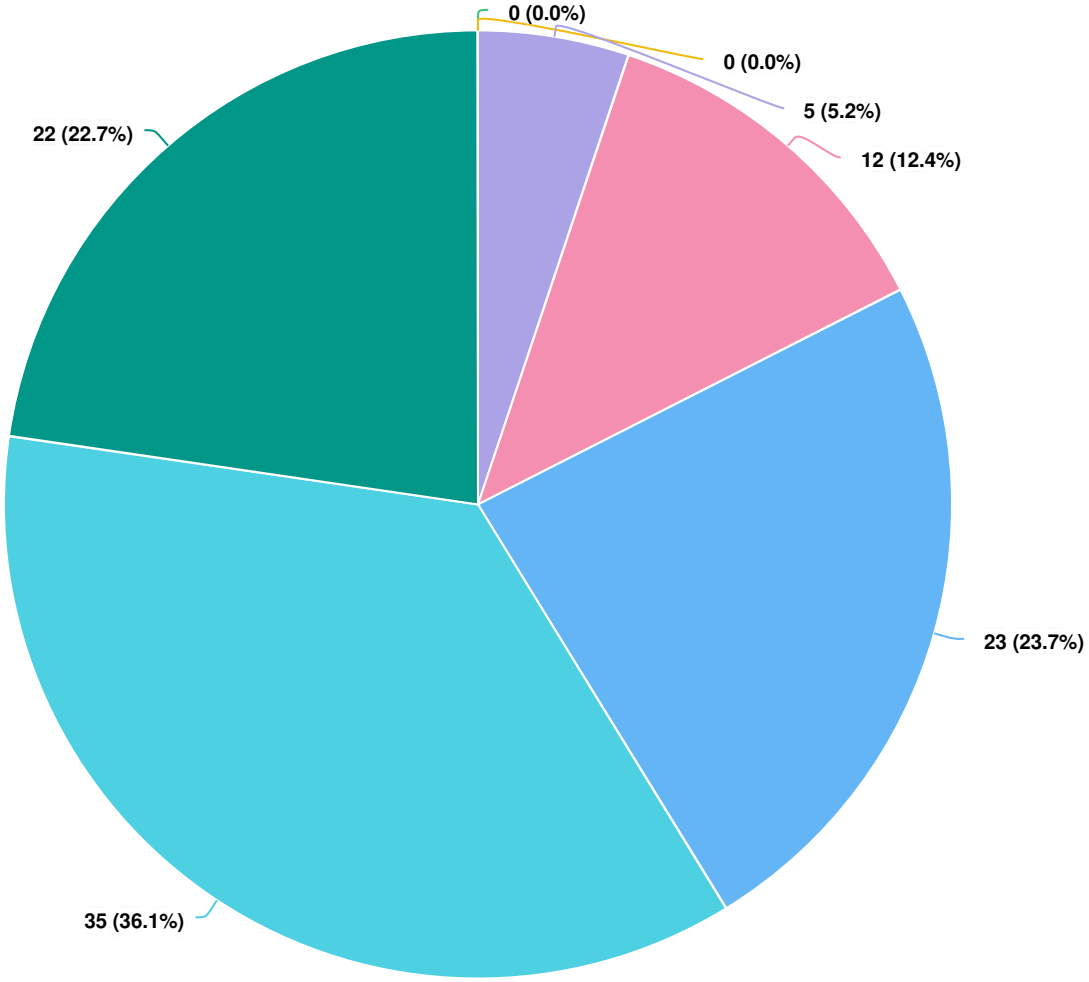
Survey: Your coastal values and experiences

PROJECT: Bellingen Coastal Management Program

Create

engagement hq
by Bang the Table

Q1 What is your age?

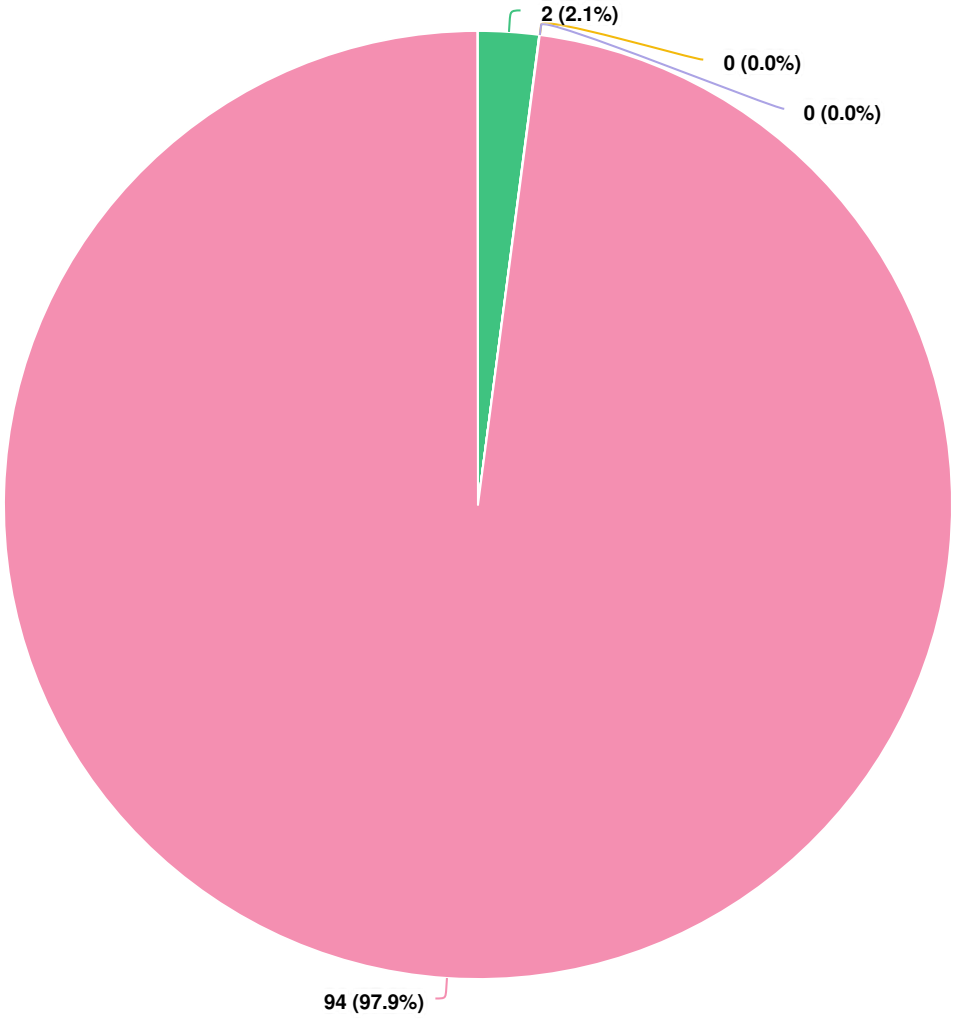


Question options

Under 18 | 18 to 25 | 26 to 35 | 36 to 45 | 46 to 55 | 56 to 65 | 65 or older

Optional question (97 responses, 0 skipped)

Q2 Do you identify as:

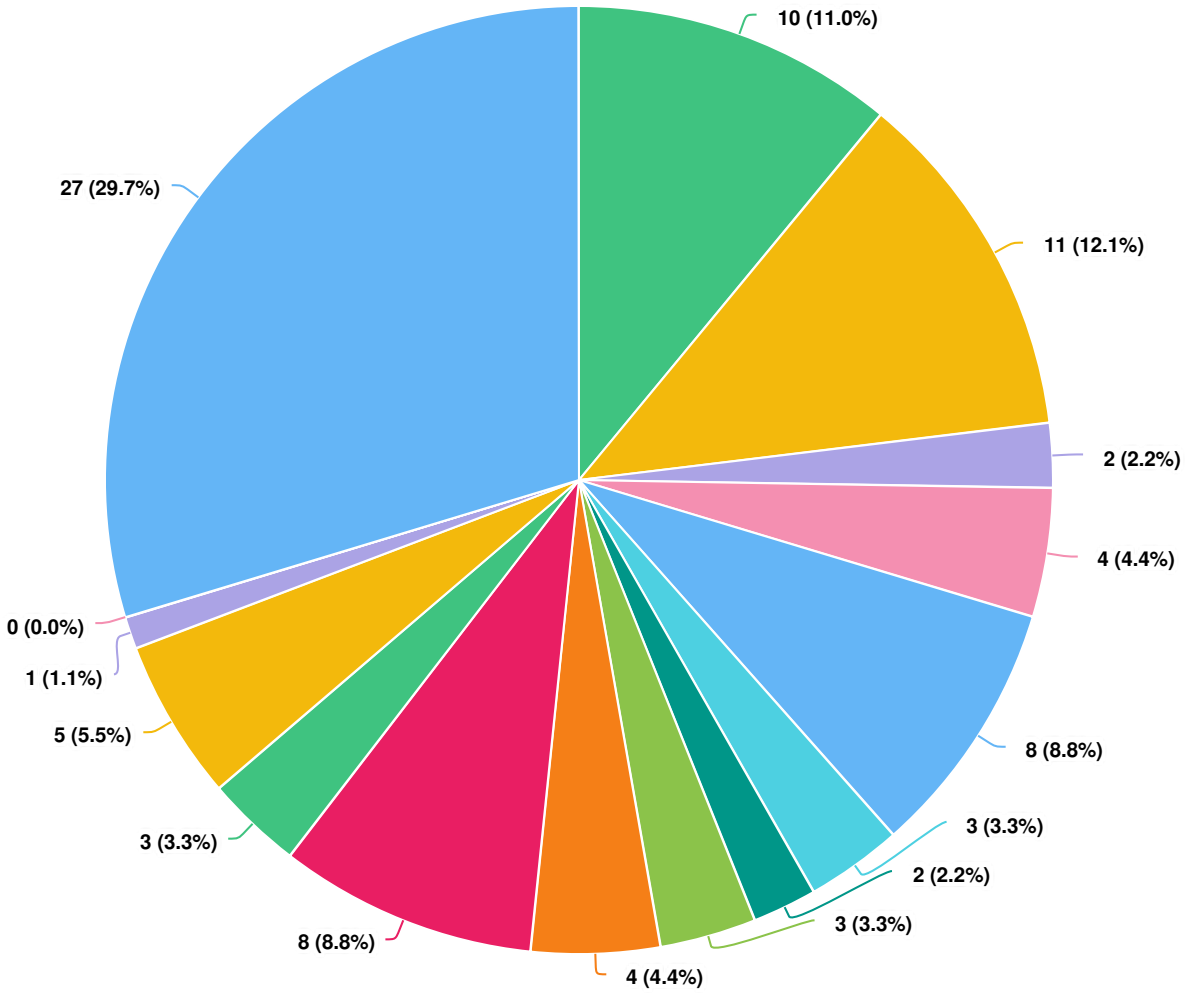


Question options

- Aboriginal
- Torres Straight Islander
- Both Aboriginal and Torres Straight Islander
- Neither Aboriginal or Torres Straight Islander

Optional question (96 responses, 1 skipped)

Q3 Which of the following best describes your occupation?



Question options

- Healthcare and Social Assistance
- Education and Training
- Retail Trade
- Construction
- Accommodation and Food Services
- Agriculture
- Forestry and Fishing
- Manufacturing
- Public Safety and Administration
- Professional, scientific and technical services
- Environmental Consulting
- Arts, Media and Communication
- Financial and Insurance Services
- Mining
- Retired

Optional question (91 responses, 6 skipped)

Q4 Where in the Bellingen Shire do you live? Please list your location.

Anonymous 6/17/2019 03:56 PM	Urunga township
Anonymous 6/17/2019 11:48 PM	Hungry Head
Anonymous 6/18/2019 11:59 AM	Urunga
Anonymous 6/18/2019 05:25 PM	North Bellingen
Anonymous 6/18/2019 05:49 PM	Mylestom
Anonymous 6/18/2019 07:39 PM	MylestomReptonRaleighBellinger RiverNorth Beach
Anonymous 6/18/2019 08:33 PM	Outside of shire but a regular visitor/user
Anonymous 6/18/2019 10:15 PM	Bellingen
Anonymous 6/19/2019 10:02 AM	Dorrigo
Anonymous 6/19/2019 11:12 AM	Fernmount
Anonymous 6/19/2019 02:37 PM	Kalang
Anonymous 6/19/2019 03:39 PM	mylestom
Anonymous 6/19/2019 06:21 PM	Urunga
Anonymous 6/20/2019 09:44 AM	Mylestom
Anonymous 6/20/2019 07:17 PM	Bellingen
Anonymous 6/20/2019 07:37 PM	Bellingen
Anonymous	Gleniffer

6/21/2019 08:34 AM	
Anonymous 6/21/2019 09:21 AM	BELLINGEN
Anonymous 6/21/2019 08:03 PM	north bellingen
Anonymous 6/24/2019 09:23 AM	Repton
Anonymous 6/24/2019 11:02 AM	Boggy Creek
Anonymous 6/24/2019 06:22 PM	Urunga
Anonymous 6/25/2019 08:22 AM	Urunga
Anonymous 6/26/2019 12:59 PM	Urunga
Anonymous 6/26/2019 03:05 PM	Valery
Anonymous 6/26/2019 03:40 PM	Bellingen
Anonymous 6/26/2019 07:27 PM	Kalang
Anonymous 6/26/2019 08:08 PM	Urunga
Anonymous 6/30/2019 02:43 PM	Gleniffer
Anonymous 6/30/2019 04:47 PM	Hungry Head
Anonymous 7/07/2019 10:50 AM	Urunga
Anonymous 7/07/2019 11:27 AM	Urunga
Anonymous 7/07/2019 11:27 AM	Bellingen
Anonymous 7/07/2019 11:40 AM	Urunga

Anonymous 7/07/2019 01:23 PM	Newry Island
Anonymous 7/07/2019 01:48 PM	Urunga
Anonymous 7/07/2019 01:55 PM	Urunga
Anonymous 7/07/2019 03:07 PM	RALEIGH
Anonymous 7/07/2019 03:16 PM	Urunga
Anonymous 7/07/2019 05:29 PM	Urunga
Anonymous 7/07/2019 06:00 PM	Urunga
Anonymous 7/07/2019 09:19 PM	Short Cut Road
Anonymous 7/08/2019 03:05 PM	Riverside Drive Urunga
Anonymous 7/08/2019 04:40 PM	Gleniffer
Anonymous 7/08/2019 04:50 PM	Thora
Anonymous 7/08/2019 04:52 PM	Fernmount
Anonymous 7/08/2019 07:50 PM	Bellingen
Anonymous 7/09/2019 12:32 PM	Urunga
Anonymous 7/09/2019 12:37 PM	urunga
Anonymous 7/09/2019 12:46 PM	Newry Island, Urunga
Anonymous 7/09/2019 01:25 PM	Newry Island Urunga
Anonymous 7/09/2019 02:02 PM	On the upper Kalang

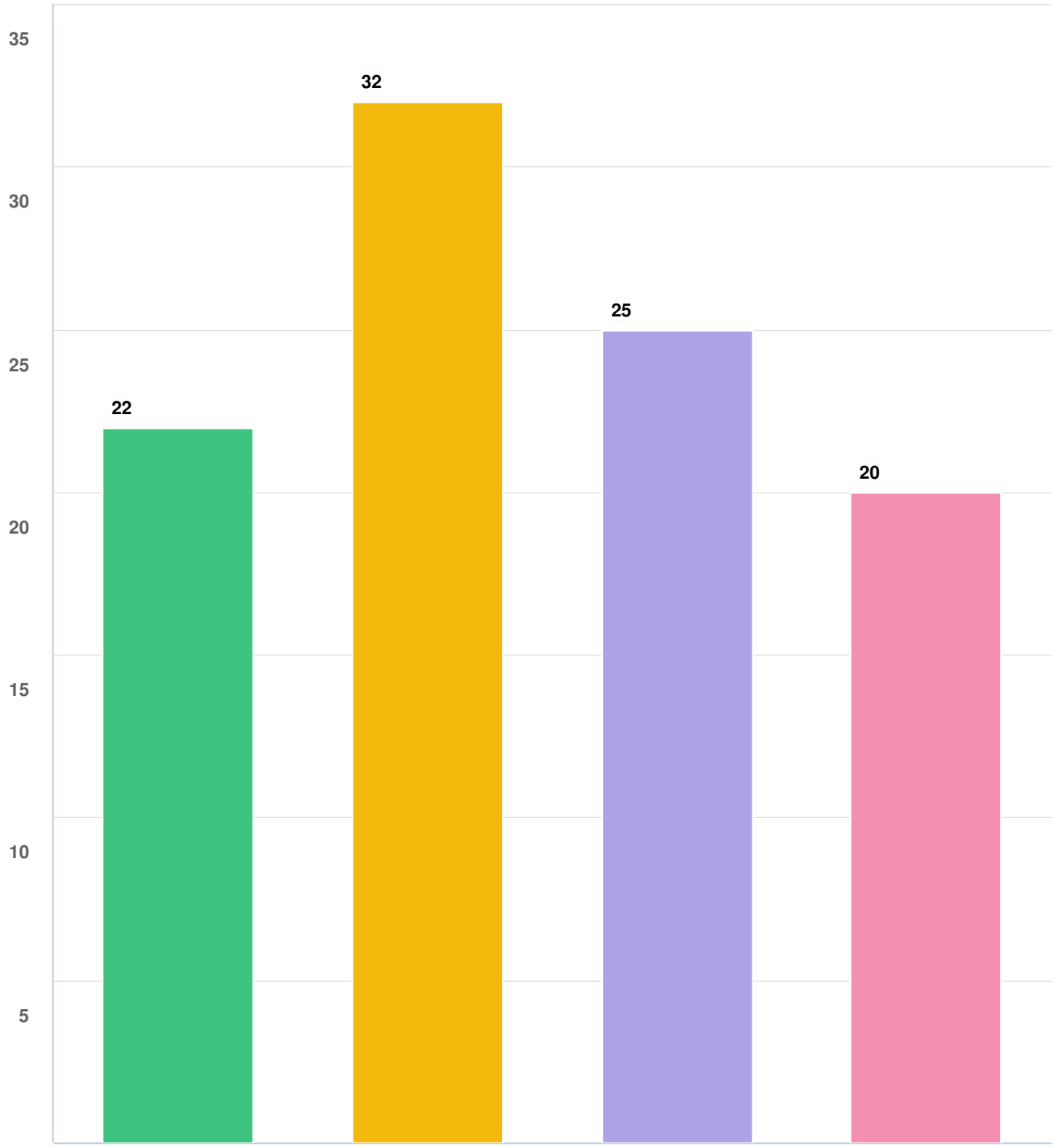
Anonymous 7/09/2019 02:17 PM	Urunga
Anonymous 7/09/2019 02:19 PM	Urunga
Anonymous 7/09/2019 03:11 PM	Raleigh
Anonymous 7/09/2019 05:12 PM	Repton
Anonymous 7/09/2019 05:24 PM	Brierfield
Anonymous 7/09/2019 05:30 PM	Urunga
Anonymous 7/09/2019 05:52 PM	Urunga
Anonymous 7/09/2019 06:04 PM	I used to own a farm near Urunga
Anonymous 7/09/2019 06:46 PM	Repton
Anonymous 7/09/2019 07:56 PM	Urunga
Anonymous 7/09/2019 09:44 PM	Fernmount
Anonymous 7/09/2019 10:02 PM	Urunga
Anonymous 7/09/2019 10:04 PM	Urunga
Anonymous 7/09/2019 10:18 PM	Urunga
Anonymous 7/09/2019 11:21 PM	Urunga in the Kalang river
Anonymous 7/09/2019 11:56 PM	Urunga
Anonymous 7/10/2019 03:07 AM	raleigh
Anonymous 7/10/2019 09:03 AM	Newry Island

Anonymous 7/10/2019 11:00 AM	I work in Bellingen but live at Valla.
Anonymous 7/10/2019 11:16 AM	Bellingen
Anonymous 7/10/2019 12:35 PM	MYLESTOM
Anonymous 7/10/2019 12:39 PM	Raleigh
Anonymous 7/10/2019 01:01 PM	Bellingen
Anonymous 7/10/2019 01:32 PM	Urunga
Anonymous 7/10/2019 02:40 PM	Repton
Anonymous 7/10/2019 06:48 PM	Urunga
Anonymous 7/10/2019 07:37 PM	Coastal
Anonymous 7/11/2019 06:56 AM	URUNGA
Anonymous 7/12/2019 06:21 PM	Urunga
Anonymous 7/13/2019 03:29 PM	Dorrigo
Anonymous 7/18/2019 10:17 AM	Urunga
Anonymous 7/18/2019 01:15 PM	Bellingen
Anonymous 7/20/2019 01:40 PM	Repton
Anonymous 7/20/2019 01:54 PM	Repton
Anonymous 7/20/2019 03:43 PM	Urunga
Anonymous	Urunga

7/21/2019 04:29 PM	
Anonymous 7/28/2019 10:48 PM	Bellingen
Anonymous 8/01/2019 05:10 PM	Raleigh
Anonymous 8/01/2019 06:08 PM	Urunga
Anonymous 8/03/2019 12:39 PM	Urunga
Anonymous 8/05/2019 11:46 AM	Dorrigo
Anonymous 8/13/2019 07:15 PM	Bellingen
Anonymous 9/04/2019 08:05 AM	Urunga
Anonymous 9/04/2019 08:57 AM	Urunga
Anonymous 9/18/2019 02:14 PM	Mylestom

Optional question (97 responses, 0 skipped)

Q5 What is your proximity to the coast/ estuary?

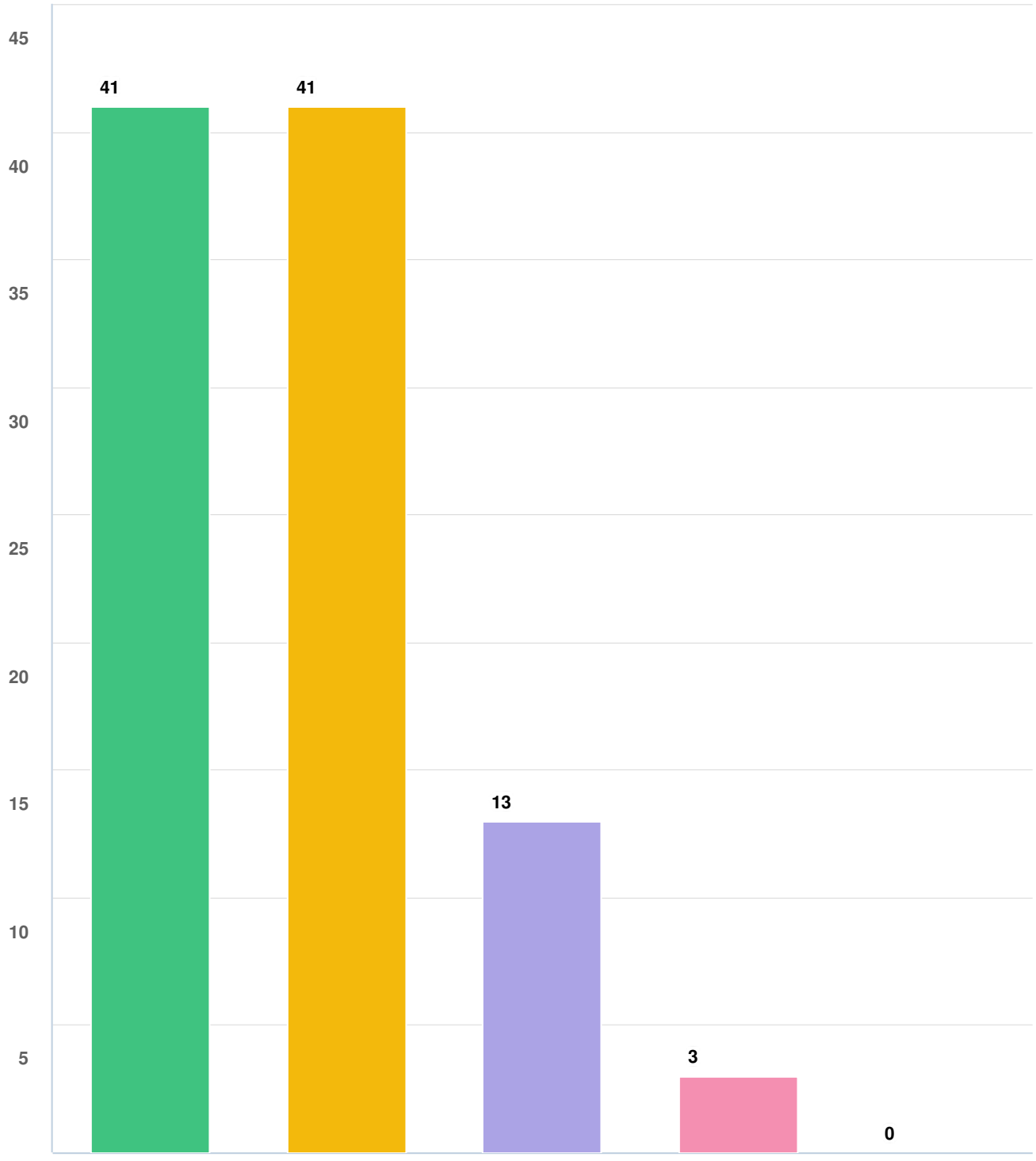


Question options

- Beach or waterfront
- Within 1km of the coast/ estuaries
- Between 1 and 10km of the coast/ estuaries
- Greater than 10km of the coast/ estuaries

Optional question (97 responses, 0 skipped)

Q6 How often do you visit the coastal areas?



Optional question (97 responses, 0 skipped)

Q7 Are you a member of any groups? (e.g. environmental groups, community groups, fishing or recreation groups, etc). Please specify.

Anonymous 6/17/2019 03:56 PM	Urunga CWA, Urunga Uniting Church, Urunga Museum
Anonymous 6/17/2019 11:48 PM	Employee of Landcare Australia
Anonymous 6/18/2019 11:59 AM	Nil
Anonymous 6/18/2019 05:25 PM	No
Anonymous 6/18/2019 05:49 PM	None
Anonymous 6/18/2019 07:39 PM	North Beach Community Alliance, Putt Bennett Fishing Festival, RSL, Legacy
Anonymous 6/18/2019 10:15 PM	No
Anonymous 6/19/2019 10:02 AM	Bellingen Environment Centre
Anonymous 6/19/2019 11:12 AM	Dragonboat Club , environmental.
Anonymous 6/19/2019 03:39 PM	no
Anonymous 6/19/2019 06:21 PM	Titivators Dragon Boat Club Urunga
Anonymous 6/20/2019 09:44 AM	No
Anonymous 6/20/2019 07:17 PM	No
Anonymous 6/20/2019 07:37 PM	Landcare
Anonymous 6/21/2019 08:34 AM	Coffs Coast Climate Action Group
Anonymous 6/24/2019 09:23 AM	Landcare Myelstom, BVNB SLSC, Repton P&C

Anonymous 6/24/2019 11:02 AM	Bellinger landcare, Australian Plants Society
Anonymous 6/24/2019 06:22 PM	No
Anonymous 6/26/2019 12:59 PM	no
Anonymous 6/26/2019 03:40 PM	CEL
Anonymous 6/26/2019 07:27 PM	BEC. CEL.
Anonymous 6/30/2019 02:43 PM	Bellingen environment centre, Bellingen seed savers, horse riding groups
Anonymous 6/30/2019 04:47 PM	Landcare
Anonymous 7/07/2019 10:50 AM	UMCC, Titivator Dragon boats
Anonymous 7/07/2019 11:27 AM	No
Anonymous 7/07/2019 11:27 AM	Northbank Community Garden. Bellingen Landcare
Anonymous 7/07/2019 11:40 AM	No
Anonymous 7/07/2019 01:23 PM	Urunga Tidal Facility Action Group
Anonymous 7/07/2019 01:48 PM	Urunga community groups
Anonymous 7/07/2019 01:55 PM	No
Anonymous 7/07/2019 03:16 PM	0
Anonymous 7/07/2019 05:29 PM	Book club
Anonymous 7/07/2019 06:00 PM	No
Anonymous 7/07/2019 09:19 PM	None

Anonymous 7/08/2019 03:05 PM	Titivators dragonboat club
Anonymous 7/09/2019 12:32 PM	No
Anonymous 7/09/2019 12:46 PM	Kayaking group of men and women
Anonymous 7/09/2019 01:25 PM	Urunga SLS
Anonymous 7/09/2019 02:02 PM	Bellingen District Greens
Anonymous 7/09/2019 02:17 PM	Art space Urunga, I have paddles with the titivators on occasion
Anonymous 7/09/2019 02:19 PM	No
Anonymous 7/09/2019 03:11 PM	Urunga tidal swimming facility action groupUrunga
Anonymous 7/09/2019 05:30 PM	No
Anonymous 7/09/2019 06:04 PM	No
Anonymous 7/09/2019 07:56 PM	No
Anonymous 7/09/2019 09:44 PM	Bellingen Riverwatch
Anonymous 7/09/2019 10:04 PM	Nil
Anonymous 7/09/2019 10:18 PM	No
Anonymous 7/09/2019 11:21 PM	No
Anonymous 7/09/2019 11:56 PM	No
Anonymous 7/10/2019 11:00 AM	Birdlife Australia, Landcare, National Parks & Wildlife, Keywee Bushwalking & other
Anonymous 7/10/2019 11:16 AM	Landcare

Anonymous 7/10/2019 12:35 PM	Mylestom Landcare
Anonymous 7/10/2019 12:39 PM	Walking group
Anonymous 7/10/2019 01:01 PM	Bellinger Lancare
Anonymous 7/10/2019 01:32 PM	no
Anonymous 7/10/2019 02:40 PM	Riverwatch, Gunganbuwala, RAR, AJP,
Anonymous 7/10/2019 06:48 PM	Urunga Chamber
Anonymous 7/10/2019 07:37 PM	No
Anonymous 7/11/2019 06:56 AM	Urunga SLSC
Anonymous 7/12/2019 06:21 PM	Chamber of Commerce
Anonymous 7/13/2019 03:29 PM	Coffs Coast dragon Boat Club
Anonymous 7/18/2019 10:17 AM	Paddling group
Anonymous 7/18/2019 01:15 PM	Bellingen Golf Club
Anonymous 7/20/2019 01:40 PM	Titivators dragon boat club
Anonymous 7/20/2019 01:54 PM	Urunga Titivators Dragonboat Club
Anonymous 7/20/2019 03:43 PM	Titivators Dragon Boat Club
Anonymous 7/21/2019 04:29 PM	Titivators Dragon Boat Club
Anonymous 7/28/2019 10:48 PM	Landcare
Anonymous	Several community groups as well as recreational clubs

8/01/2019 05:10 PM	
Anonymous 8/03/2019 12:39 PM	Urunga SLSC
Anonymous 8/05/2019 11:46 AM	Aboriginal Land Council Dorrigo
Anonymous 8/13/2019 07:15 PM	Nil
Anonymous 9/04/2019 08:57 AM	No
Anonymous 9/18/2019 02:14 PM	Coffs Coast Dragon Boat Club

Optional question (75 responses, 22 skipped)

Q8 Which beach, foreshore or coastal area do you visit most often?

Anonymous 6/17/2019 03:56 PM	urunga lido
Anonymous 6/17/2019 11:48 PM	The Lido at Urunga
Anonymous 6/18/2019 11:59 AM	Kelang River
Anonymous 6/18/2019 05:25 PM	The estuary, river mouth and beaches from bundagin to oyster creek
Anonymous 6/18/2019 05:49 PM	Nth Beach
Anonymous 6/18/2019 07:39 PM	Mylestom, Bongil Bongil, Bellinger River, North Beach
Anonymous 6/18/2019 08:33 PM	Bellinger & Kalang Rivers
Anonymous 6/18/2019 10:15 PM	Hungry head
Anonymous 6/19/2019 10:02 AM	Urunga
Anonymous 6/19/2019 11:12 AM	Urunga rivers and coast
Anonymous 6/19/2019 02:37 PM	Urunga
Anonymous 6/19/2019 03:39 PM	mylestom
Anonymous 6/19/2019 06:21 PM	I live on the Kalang River where I kayak. I also walk at Hungry Head and swim there twice a week.
Anonymous 6/20/2019 09:44 AM	Mylestom and Bellinger River
Anonymous 6/20/2019 07:17 PM	Urunga Lido
Anonymous 6/20/2019 07:37 PM	Hungry head, wenonah
Anonymous	Urunga Boardwalk

6/21/2019 08:34 AM	
Anonymous 6/21/2019 09:21 AM	Urunga
Anonymous 6/21/2019 08:03 PM	Urunga, third headland, mylestom
Anonymous 6/24/2019 09:23 AM	North Beach
Anonymous 6/24/2019 11:02 AM	Bellinger/Kalang estuary, Hungry Head, North Beach, Sand Mines
Anonymous 6/24/2019 06:22 PM	The rivers at urunga
Anonymous 6/25/2019 08:22 AM	Urunga beach and estuary
Anonymous 6/26/2019 12:59 PM	North Beach, South Beach, Hungry Head, Valla Beach, Kalang/Bellinger rivers
Anonymous 6/26/2019 03:05 PM	Tuckers Rock & Urunga Boardwalk
Anonymous 6/26/2019 03:40 PM	Valla and urunga
Anonymous 6/26/2019 07:27 PM	Hungry head
Anonymous 6/26/2019 08:08 PM	Kalang River near golf club, Urunga boardwalk and Hungry Head beach in equal amounts.
Anonymous 6/30/2019 02:43 PM	Urunga, hungry head, myrlstom, sawtell
Anonymous 6/30/2019 04:47 PM	Hungry Head and Third Headland and river via Atherton Drive
Anonymous 7/07/2019 10:50 AM	Urunga
Anonymous 7/07/2019 11:27 AM	Urunga lido, hungry head, third hradland
Anonymous 7/07/2019 11:27 AM	Bellinger River, and Urunga
Anonymous 7/07/2019 11:40 AM	Jetty

Anonymous 7/07/2019 01:23 PM	Urunga Boardwalk
Anonymous 7/07/2019 01:48 PM	Urunga lido
Anonymous 7/07/2019 01:55 PM	Lido to beach
Anonymous 7/07/2019 03:07 PM	Mylestom
Anonymous 7/07/2019 03:16 PM	Hungry Head
Anonymous 7/07/2019 05:29 PM	Urunga lido,
Anonymous 7/07/2019 06:00 PM	Hungry head
Anonymous 7/07/2019 09:19 PM	Board Walk Area
Anonymous 7/08/2019 03:05 PM	Kalang River
Anonymous 7/08/2019 04:40 PM	Hungry Head, Urunga
Anonymous 7/08/2019 04:50 PM	Urunga
Anonymous 7/08/2019 04:52 PM	Urunga, Mylestom, Hungry Head
Anonymous 7/08/2019 07:50 PM	Urunga, sawtell, 3rd headland(winona)
Anonymous 7/09/2019 12:32 PM	Urunga river and wetlands
Anonymous 7/09/2019 12:37 PM	urunga lido
Anonymous 7/09/2019 12:46 PM	Mainly tidal water rivers
Anonymous 7/09/2019 01:25 PM	Kalang river and hungry head
Anonymous 7/09/2019 02:02 PM	Hungry Head

Anonymous 7/09/2019 02:17 PM	Urunga river - atherton drive and Hungry head
Anonymous 7/09/2019 02:19 PM	Urunga boardwalk and Hungry Head beach
Anonymous 7/09/2019 03:11 PM	Urunga foreshore and Kalang river
Anonymous 7/09/2019 05:12 PM	Tuckers
Anonymous 7/09/2019 05:24 PM	Hungry Head
Anonymous 7/09/2019 05:30 PM	Hungry heads
Anonymous 7/09/2019 05:52 PM	Urunga Boardwalk
Anonymous 7/09/2019 06:04 PM	Urunga
Anonymous 7/09/2019 06:46 PM	Urunga, Tuckers Rock
Anonymous 7/09/2019 07:56 PM	Urunga
Anonymous 7/09/2019 09:44 PM	Urunga
Anonymous 7/09/2019 10:02 PM	Urunga, Third Headland , Kalang River
Anonymous 7/09/2019 10:04 PM	Hungry Head
Anonymous 7/09/2019 10:18 PM	Urunga ledo
Anonymous 7/09/2019 11:21 PM	Urunga
Anonymous 7/09/2019 11:56 PM	Lido
Anonymous 7/10/2019 03:07 AM	Urunga Broardwalk
Anonymous 7/10/2019 09:03 AM	Urunga boardwalk

Anonymous 7/10/2019 11:00 AM	Valla Beach, Urunga Wetlands, Hungry Head & Bongil Bongil
Anonymous 7/10/2019 11:16 AM	Urunga
Anonymous 7/10/2019 12:35 PM	Alma Doepel Reserve & North Beach
Anonymous 7/10/2019 12:39 PM	Hungary heads
Anonymous 7/10/2019 01:01 PM	Urunga
Anonymous 7/10/2019 01:32 PM	Kalang River
Anonymous 7/10/2019 02:40 PM	Tucker's Rocks
Anonymous 7/10/2019 06:48 PM	Hungry Head, Urunga Boardwalk
Anonymous 7/10/2019 07:37 PM	Urunga
Anonymous 7/11/2019 06:56 AM	Hungry Head beach and Kalang River
Anonymous 7/12/2019 06:21 PM	Urunga lagoon, boardwalk and ocean
Anonymous 7/13/2019 03:29 PM	North Beach/Mylestom
Anonymous 7/18/2019 10:17 AM	Kalang, Hungry Head
Anonymous 7/18/2019 01:15 PM	Bellinger river
Anonymous 7/20/2019 01:40 PM	Kalang River . Tucker’s Rock beach
Anonymous 7/20/2019 01:54 PM	Kalang River, Bellinger River, Tuckers Rock Beach, North Beach (Mylestom)
Anonymous 7/20/2019 03:43 PM	All of the above daily
Anonymous	All of the above

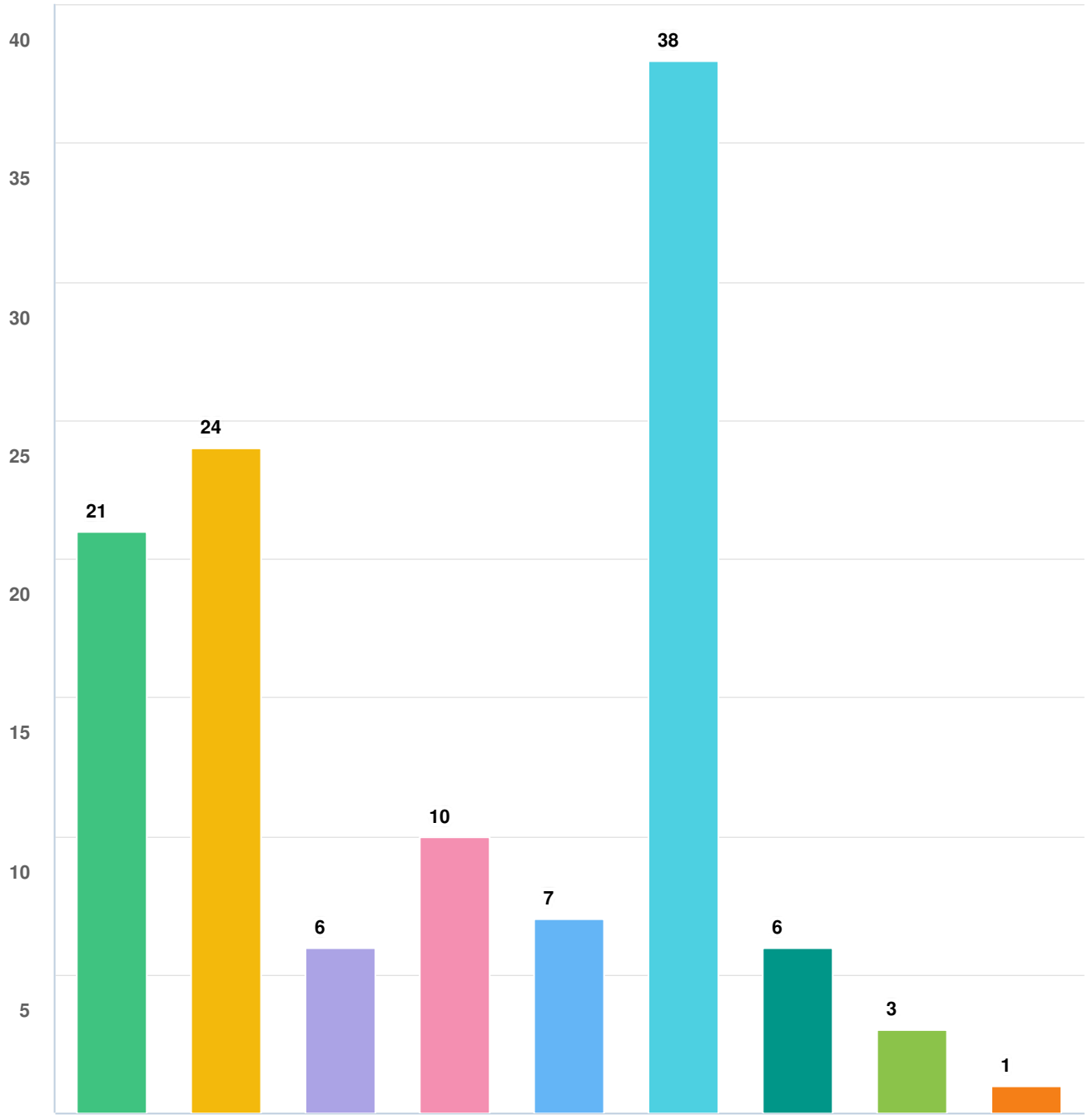
7/21/2019 04:29 PM	
Anonymous 7/28/2019 10:48 PM	Hungry Head
Anonymous 8/01/2019 05:10 PM	Urunga Lagoon and boardwalk or Mylestom lookout and beach
Anonymous 8/01/2019 06:08 PM	Boardwalk
Anonymous 8/03/2019 12:39 PM	Hungry Head Beach
Anonymous 8/05/2019 11:46 AM	Nanbuccha and Valla
Anonymous 8/13/2019 07:15 PM	Hungry Head, Atherton Drive
Anonymous 9/04/2019 08:05 AM	Kalang River urunga, Sea Lido, Hungry Head beach
Anonymous 9/04/2019 08:57 AM	Urunga river mouth mainly
Anonymous 9/18/2019 02:14 PM	Bellinger River Mylestom, Kalang Urunga, North Beach Mylestom

Optional question (97 responses, 0 skipped)

Q9 Within the Bellingen Shire coastal catchments - the Bellinger River and Kalang River catchments, how important are each of the following values to you?

Optional question (97 responses, 0 skipped)

Q10 Which value is most important to you? Please select one.

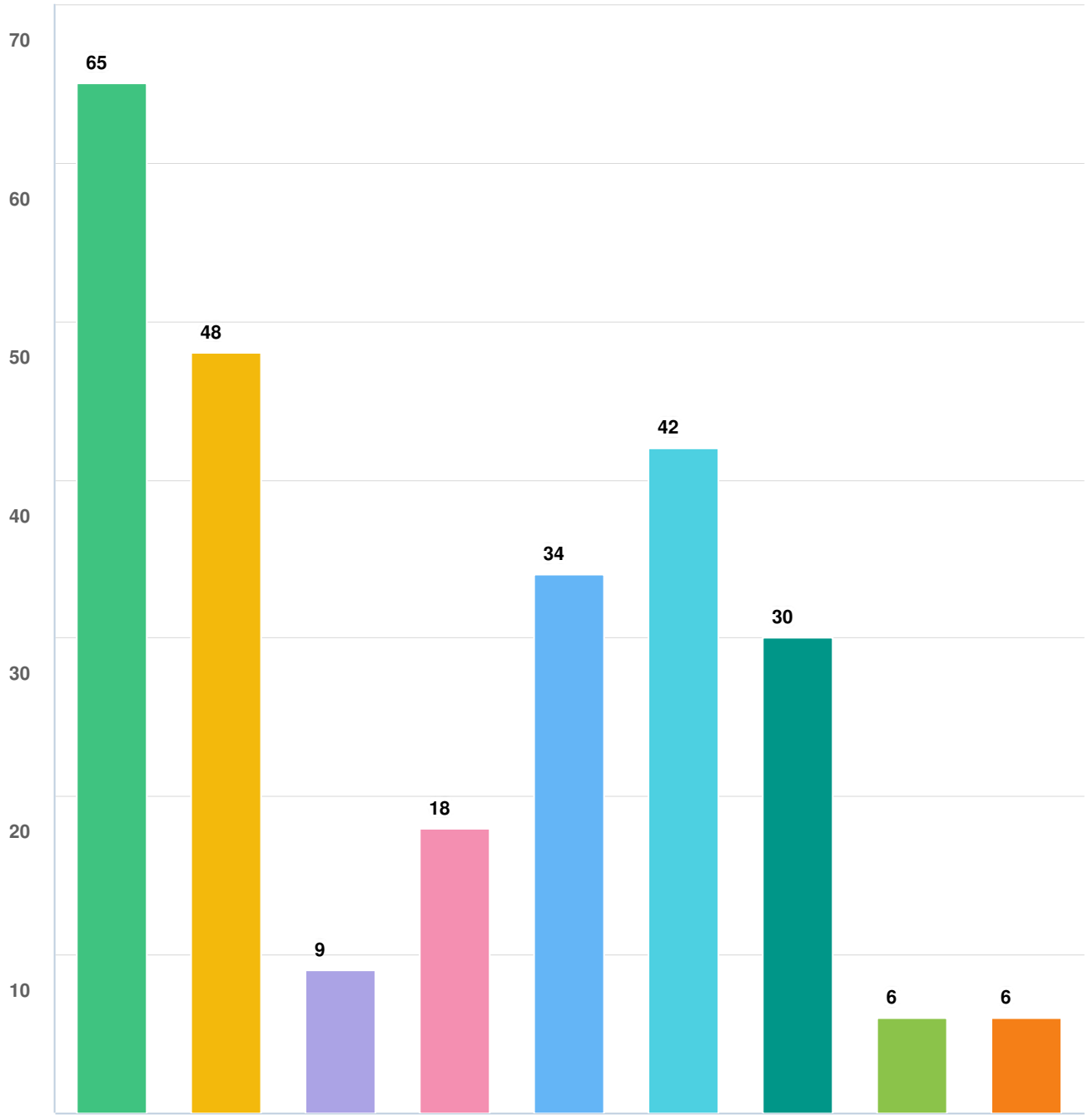


Question options

- Work or education opportunities
- Commercial or business opportunities (agriculture, tourism, etc.)
- Recreational assets (parks, amenities, etc.)
- Natural ecosystems and wildlife
- Access to the beaches
- Exercise (walking, cycling, etc.)
- Traditional Owner values
- Recreational opportunities (boating, surfing, fishing, swimming, life saving etc).
- Unique landscape features and natural beauty

Optional question (96 responses, 1 skipped)

Q11 What do you think attracts people to living in and visiting our region?

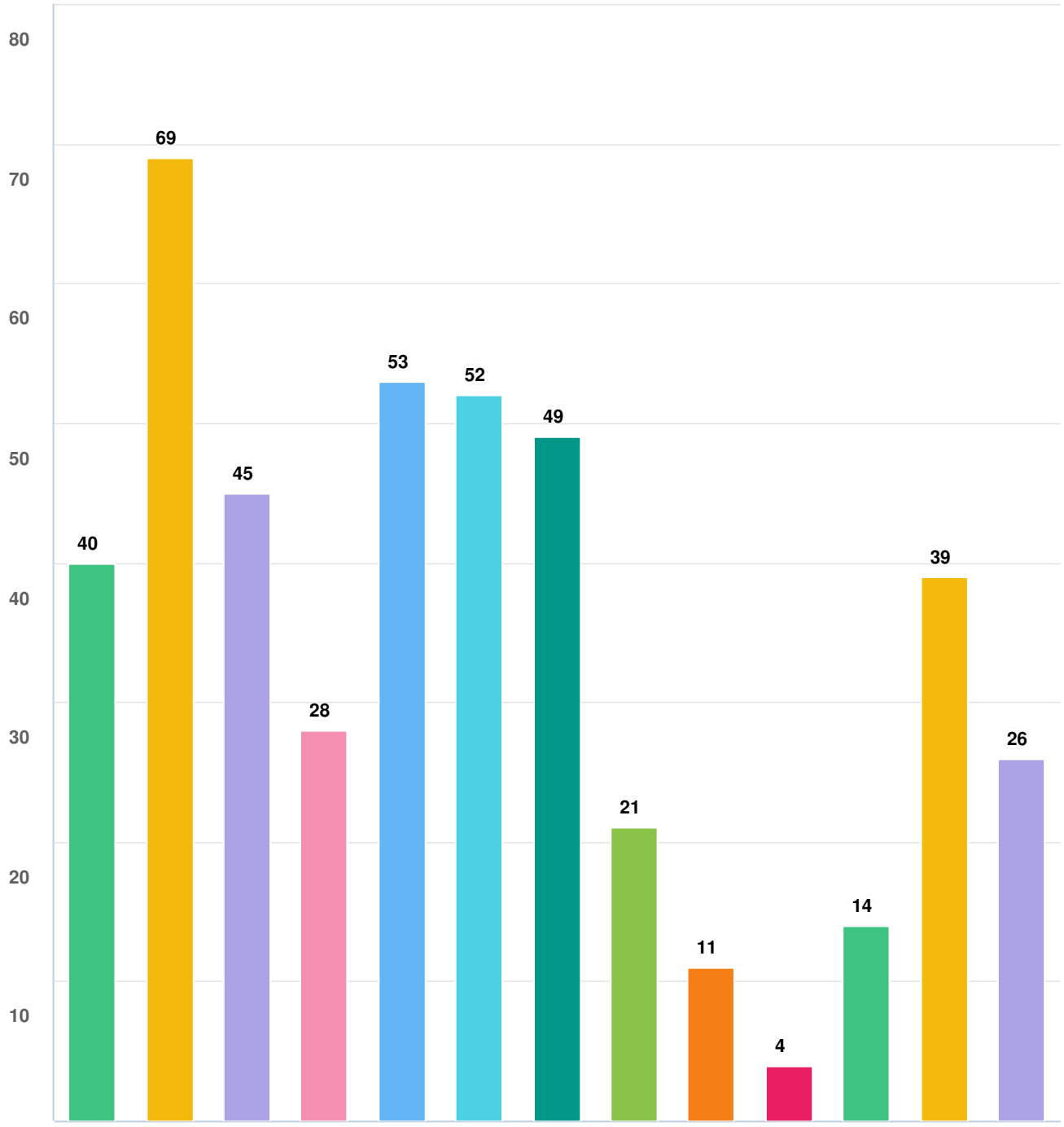


Question options

- Work or education opportunities
- Commercial or business opportunities
- Recreational assets (parks, amenities, etc.)
- Natural ecosystems and wildlife
- Access to the beaches
- Exercise (jogging, walking, cycling, etc.)
- Traditional Owner values
- Recreational opportunities (boating, surfing, fishing, swimming, etc.)
- Unique landscape features and natural beauty

Optional question (96 responses, 1 skipped)

Q12 What do you consider to be the top 5 threats to the coast and estuaries?



Question options

Wasterwater management · Urbanisation · Stormwater dishcharge · Recreational fishing · Recreational boating · Poor drainage · Pollution (rubbish) · Pests (animals and weeds) · Loss of vegetation along waterways · Beach erosion · Climate change · Riverbank erosion · Agriculture

Optional question (97 responses, 0 skipped)

Q13 Could you give a short explanation of why you feel they are a threat?

Anonymous 6/17/2019 03:56 PM	Boating using high speed and sharp turns causes waves which belt the banks causing erosing. Urbanisation takes the natural watercourse and natural flood plains away causing damage from flood water. Also increased population brings ridding of natural growth holding ground naturally. Population - well people can't help rubbish pollution!!! Agriculture using pest/weed killer that drain into watercourse
Anonymous 6/17/2019 11:48 PM	Agriculture leads to pesticide runoff, as well as stock access to river systems creating erosion of banks and increase of waste/faeces. Loss of vegetation = increased erosion and less natural filtration of runoff. Stormwater carries huge amounts of pollution and rubbish, inc chemicals from gardens, oil and other leaks from cars, etc, and it's unfiltered. Pollution (rubbish) is swallowed by birds and fish, this includes discarded fishing lines/ghost nets etc.
Anonymous 6/18/2019 11:59 AM	Bank erosion along Kalang river is reducing the access to waterways, following rainfall events and also the increasing boating use the water is muddy indicating runoff and bank erosion is a major cause of the decline in water quality
Anonymous 6/18/2019 05:25 PM	It is what I see
Anonymous 6/18/2019 05:49 PM	Climate change and over development
Anonymous 6/18/2019 07:39 PM	Wild dogs and Feral cats to native species. Pollution camping on Foreshores and discharging grey waste into river. Poor drainage with drainage pipes below high tide mark limiting discharge of water and flooding homes. Massive uptake of Sand dredging at Norco which limits the recharge rate of the Spit at Mylestom. Invasive weeds like Bitou and Lantana which have not been sprayed properly in over a decade. Sewerage works are finally in planning stage.
Anonymousv 6/18/2019 08:33 PM	Being on the rivers regularly I see the way certain riverbanks are changing from erosion, largely caused by loss and/or removal of natural vegetation. Pollution is also a threat but definitely isnt the highest threat. Agriculture is also not the highest but there has been some serious incidents of agricultural pollution in the rivers in the past
Anonymous 6/18/2019 10:15 PM	The climate emergency effects everything. Agriculture needs to be more regulated in terms of the effect it has on the environment. Forests maintain rivers and the clear felling now practiced is the wrong way to sustain the waters. The stream and river banks need to maintain natural vegetation. Too many people will always stress the environment.
Anonymous 6/19/2019 10:02 AM	Because I have personally seen the damage over time
Anonymous 6/19/2019 11:12 AM	Lack of erosion control has resulted in significant loss of river shoreline and wilting up of river entrances.

Anonymous 6/19/2019 03:39 PM	destruction of natural hydrology
Anonymous 6/19/2019 06:21 PM	These are all threats as they impact on our environment in which we choose to live. they can stop tidal flows they can impact our ability to get our dragon boats into the water. There is nothing in here about the movement of sand into our recreational areas it will be one of the biggest threats to managing our water ways.
Anonymous 6/20/2019 09:44 AM	It is hard to select just five. We as humans are the main threat to our natural environment.
Anonymous 6/20/2019 07:17 PM	Watched it develope for 25 years now
Anonymous 6/20/2019 07:37 PM	The second greatest threat to biodiversity after land clearing is invasive species. Historic clearing of riparian vegetation contributes significantly to erosion and has led reduced structural complexity of rivers. Changing agricultural practises (e.g increased production horticulture) is resulting in changing threats to aquatic systems across the shire.
Anonymous 6/21/2019 08:34 AM	Climate change will impact everything. Intensive agriculture is poisoning waterways with chemical use. Domestic animals and pests impact waterways and destroy natural ecosystems. Best practice waste water management will limit its impact on natural ecosystems.
Anonymous 6/21/2019 08:03 PM	logging might lead to erosion on steep banks
Anonymous 6/24/2019 09:23 AM	5 generations of living on and with the Bellinger river, give me a fairly good understanding of its ebb and flow over the years.
Anonymous 6/24/2019 11:02 AM	Climate change with associated sea level rise is undoubtedly biggest threat, causing erosion and loss of waterfront vegetation. Not to mention direct human impacts.
Anonymous 6/24/2019 06:22 PM	We have lived here for 20 years and we can see the change in the foreshore along the rivers. The Lido used to be a nice deep spot to swim, look at it now.
Anonymous 6/26/2019 12:59 PM	The rivers in the area have changed over time. There's so much recreational fishing in the area/boats etc it's had a massive impact. The natural flow of the river I think has also had an impact - too much sand - at the mouth of the river, it's no longer as deep as what it used to be due to the sand build up - less fish coming in/out from the ocean. The sand needs to be dredged. It's also a shame that the estuary where the boardwalk is at Urunga has not had a fishing banned placed on it. It should be a nursery of sorts/safe haven for the smaller fish to breed and thrive. I've lost count of how many times I walk along there and see people fishing and keeping the small fish that they catch. It's really disappointing and worrying.
Anonymous 6/26/2019 03:05 PM	Agriculture (intensive) and De-Forestation (Loss of vegetation) are, in my opinion, the greatest threat to the health of our coast and estuaries. The chemicals that leach into the waterways from intensive conventional agriculture significantly damages the ecosystems within the waterways. The

	research on this is only just starting to comeback, but it is significant. There needs to be better regulation and management of intensive agriculture to ensure the ecosystems and the beautiful environment of our shire is not compromised in favour of the profits of a few landholders. Also clear-felling of habitat along the river systems directly impact erosion and sedimentation into our estuaries and coast. There is much research about this too. In all this Shire is a gift to those who live here and visit, we need to preserve the pristine environs and encourage eco-tourism as a primary commercial driver of this area.
Anonymous 6/26/2019 03:40 PM	Reduce the health of the ecosystems. Noise of motors reduce the quality of life for all.
Anonymous 6/26/2019 08:08 PM	The river mouth is heavily silted, the worst I have seen in 29 years living here. I have seen cows on the island walking on the extended spit and be only 50 metres from the boardwalk. Urunga flooded badly in 2009 when the river mouth was nowhere near as heavily silted as today. Should another major flood event occur, the water will be unable to get away and I fear this time many more homes, (including mine,) will be severely impacted by flooding. The river needs dredging to allow water to get away. Erosion of all kinds and rising tides due to climate change will alter the natural water course and has the potential to cause extreme damage to homes and infrastructure in low lying areas.
Anonymous 6/30/2019 02:43 PM	I miss the number one threat. Logging of state forests. In economical, not rational, damages environment, tourism, downriver ecosystems, river health, forests ability to protect us from bush fire. Just does not make environmental or economical sense.
Anonymous 6/30/2019 04:47 PM	Some agricultural practices contribute to river bank erosion e.g. cattle, and water quality. Developments increase hard surfaces and run off, and impact protective vegetation. With increasing development comes recreational beach users soing an increase in beach driving, jet skiing and boating.
Anonymous 7/07/2019 10:50 AM	We have local farms with no river fencing and over farming on local islands which is creating foul smells and eroding the river banks which in turn pollute the river and muddy it making it unattractive and a threat to local oyster farming.
Anonymous 7/07/2019 11:27 AM	All these result in pollution and and the distruction of natural environments , wild life habitats
Anonymous 7/07/2019 11:27 AM	We see the effects. Urban Sprawl bring weeds, domestic animals are a threat. Run off from that too
Anonymous 7/07/2019 01:23 PM	The increase in water levels, especially during storm events will have a significant impact on Newry Island, my home and the homes of my surrounding neighbours. The river banks are being eroded in areas on the island and this adds to the instability of the foundations.
Anonymous 7/07/2019 01:55 PM	We need not have an impact on every ecosystem. I find 4wds on beaches a serious threat too. Places do not need to be that accessible to all.
Anonymous 7/07/2019 09:19 PM	Loss of vegetation along river banks results in bank erosion. Domesticated cats allowed to roam wild prey on native wildlife. Pollution and stormwater go

	hand in hand regarding health of the beaches and estuaries.
Anonymous 7/08/2019 03:05 PM	Mismanagement of resources and neglect of problem areas
Anonymous 7/08/2019 04:52 PM	These things all have a negative effect on natural waterways and surrounding habitats. If they remain unchecked, irreparable damage will be done to the coast and estuaries.
Anonymous 7/08/2019 07:50 PM	These affect some of the most fragile parts of estuaries, such as endangered wildlife habitats. And also the natural cycle of these areas.
Anonymous 7/09/2019 12:32 PM	Even though I see the erosion being worked on there should be more done. I don't like the treated water going into the river system, it should go to the wetlands and filter back
Anonymous 7/09/2019 12:46 PM	The river mouth needs to be dredged to reduce flooding in times of heavy rainfall. Even the kids in primary school know that you have to clean out the drain to get the water to run away. It would also increase the tidal exchange to improve the river health. It would help oyster farmers, fishermen and boat users too. The longer term future for Urunga area is reliant on tourists using the river. It is very silted up and the moment, sailing boats virtually can't use the river, and motor boats have difficulty too. This dredging can be done at no cost to the council too.
Anonymous 7/09/2019 02:02 PM	Climate change is putting all our natural systems under pressure and all these issues weaken the ability for our rivers and estuaries resilience.
Anonymous 7/09/2019 02:17 PM	Waste water washes into our estuary when there is a lot of rain - natural overflow. This concerns me as the animals could be affected as could our beautiful natural environment.
Anonymous 7/09/2019 03:11 PM	Degredation of natural enviroment
Anonymous 7/09/2019 05:12 PM	Agriculture has caused environmenta damage through erosion chemical use and the runoff into river systems and logging and cause irreparable damage to our fauna and flora. Boating on the rivers causes river bank erosion and cars driving along the beach from North Beach Myleston up to Bundagen headland is damaging the beach and is dangerous fire walkers and ppl trying to relax when sitting on the beach . It is madness that in a NP we have cars zooming along the beach destroying the ambience and whole integrity of the NP ...
Anonymous 7/09/2019 05:24 PM	Sea levels are rising
Anonymous 7/09/2019 06:04 PM	The Bellinger and Kalang Rivers are subject to unnecessary levels of phospates, nitrates and orher chemicals when clearing in or around the riparian area occurs (eg clear felling)
Anonymous 7/09/2019 06:46 PM	Concerned about overuse of fertilizers and herbicides upstream. Plus visitors and weekenders with speedboats and 4wds etc not giving any consideration to nature, riverbanks, dunes and tracks. No rangers locally mean lots of cars in national parks, dangerous dogs in public areas, free campers leaving refuse.

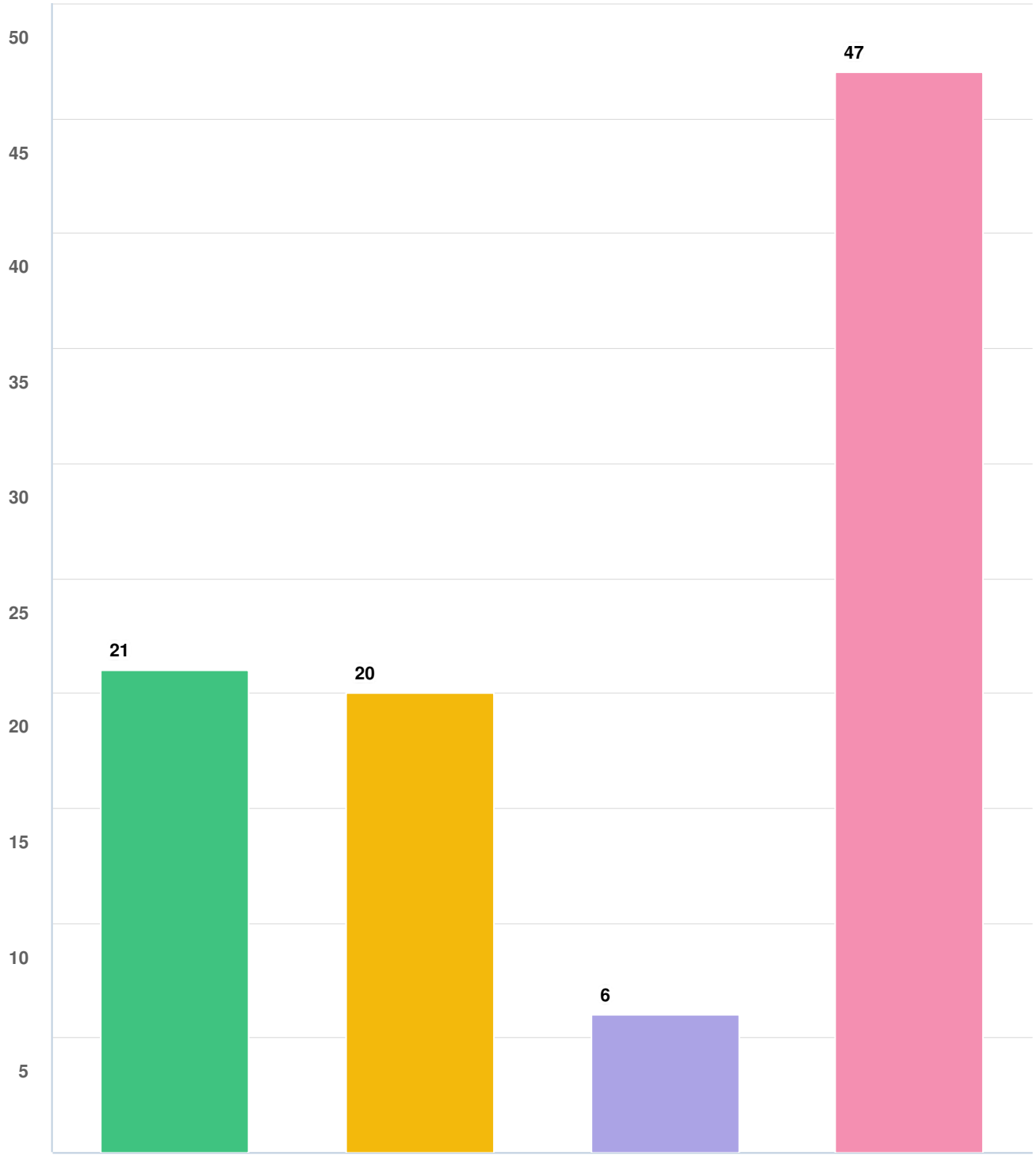
Anonymous 7/09/2019 07:56 PM	The river valley including the headwaters and estuaries are vulnerable ecosystems
Anonymous 7/09/2019 09:44 PM	Because they are all major factors that lead to our river health being threatened and that threatens all life.
Anonymous 7/09/2019 10:18 PM	Climate change affects all of the above. Pollution kills wildlife and takes away from natural beauty as do pests. Erosion takes away from natural beauty
Anonymous 7/09/2019 11:21 PM	Because natural Environmental factors have not been well cared for
Anonymous 7/10/2019 11:00 AM	The health of our estuaries and foreshores are impacted by human activities. These ecosystems are fragile and an increase in agriculture causes an increase in nutrients which leaches into our waterways leading to algal blooms and pollution. The amount of plastic ending up in our oceans and beaches. allowing vehicles and dogs on our beaches has seen all the nesting shorebirds disappear from our beaches in the last 6 years. We need to do away with septic systems in our towns along the coast to reduce sewerage ending up in our precious ocean.
Anonymous 7/10/2019 12:35 PM	In the area of Mylestom a neglect of weed control is having an increased impact especially within crown land and on properties adjoining crown land.
Anonymous 7/10/2019 01:32 PM	All of these compromise natural ecosystems and biodiversity
Anonymous 7/10/2019 02:40 PM	Urbanisation relentlessly removes habitat, urban waste & runoff ends up in pristine bush & waterways. Agriculture also deforests the land, the runoff polluted waterways. Clearing of riverbanks removes habitat & destabilizes the land resulting in erosion. Feral animals are a massive problem nationally for all our vulnerable species. Cats alone kills multiple millions of Australian native wildlife annually. Along with deforestation for urban development & industry, ferral pests & exotic plants pose the greatest threats to this country
Anonymous 7/10/2019 06:48 PM	All come under human activity. We need to respect and treat our waterways as the delicate ecosystems they are not playgrounds and resources.
Anonymous 7/11/2019 06:56 AM	The effects of erosion can be seen along the river and coastline from the 30 years I have been frequenting these areas.
Anonymous 7/12/2019 06:21 PM	There is not enough active response to these issues - but plenty of talk...
Anonymous 7/13/2019 03:29 PM	Without climate change beach erosion is possibly not an issue, however with it coastal communities stand to be obliterated. Riverbank erosion seems to be exacerbated by loss of vegetation. However it is quite obvious that "wake boats" cause significantly more erosion to river banks than do other water craft. They been banned in other caistal waterways and should be banned ASAP from ours. They are an unneccessary and unjustifiable risk to waterways.
Anonymous	Near Urunga a farm is discharging cow poo into the water, cattle are on the

7/18/2019 10:17 AM	river banks causing erosion
Anonymous 7/18/2019 01:15 PM	The weed problem along the river frontage at the Bellingen Golf Club is out of control & need assistance to bring it back to manageable level
Anonymous 7/20/2019 01:40 PM	Agriculture due to waste management and overuse of chemicals in the expanding blueberry industry. Erosion due to poor boat handling ,ie large wake.
Anonymous 7/20/2019 01:54 PM	The unique natural beauty, will be lost if riverbank erodes much more and the pollution from folk not respecting the place, not all folk, some.
Anonymous 7/20/2019 03:43 PM	The pollution from farms cattle situated on river edge with run off from the cattle with little care as to the impact on the river system not to mention the smell that radiates from them. Our river systems are the blood line of our community and need to be respected and preserved.
Anonymous 7/21/2019 04:29 PM	As more land is developed mismanagement of land use if not managed properly will allow erosion and pollution of our waterways.
Anonymous 8/01/2019 05:10 PM	Erosion does just that. Feral animals such as dogs, cats and fox are out of control and kill our wildlife on a daily basis. Pollution threatens our water quality and the natural environment.
Anonymous 8/01/2019 06:08 PM	Dogs should be banned to protect endangered wildlife
Anonymous 8/03/2019 12:39 PM	Eroded and dangerous access to beaches and recreation areas is a threat to public safety.
Anonymous 8/05/2019 11:46 AM	Plosion 0f the environment and water quality
Anonymous 8/13/2019 07:15 PM	Vegetation Loss in the riparian zone I see is the most major threat. Grazing by stock (Agriculture) to the water's edge damages banks, grazes out regrowth and eventually leads to grass edged waterways which are inadequate to deal with flood forces, boat wash (Recreational Boating), and wind-wave action. Sea level rise (Climate Change) will only put more pressure on these low lying landscapes. Once the banks begin to retreat (riverbank erosion), only hard engineering treatments can stall it, at great cost. Best example is the Urunga Island which has goats and cows grazing not only through mangrove & salt marsh (fish habitat) but on the banks, and remarkably on the foreshore as well. Not a single deep rooted plant has survived this grazing pressure leaving only shallow grass - and it is experiencing 1 meter erosion retreat per year, especially at the northern tip on the eastern arm. This is lost habitat, lost land, lost sediment into the river system and lost money for someone when it comes to fixing it.
Anonymous 9/04/2019 08:05 AM	These threats have direct impacts on water quality within the estuaries.
Anonymous 9/04/2019 08:57 AM	The rivers are too silted up due to the breakwalls built many years ago. This restricts the water flows causing increased bank erosion. Extensive dredging needs to be done from the mouth to a good way up the rivers to aid tidal flow

	and increase fish stocks
Anonymous 9/18/2019 02:14 PM	A lot of fertilisers running into the water with top soil etc not good for fish life. Riverbank erosion causes more trees to disappear along the river edge. Pollution with plastics and run off from urbanisation is bad for the river and life in the rivers. Wastewater management from farms and sewer systems and industry along the waterways is needed to keep water clean and fish healthy - eco system well.

Optional question (70 responses, 27 skipped)

Q14 **Have you been affected by coastal erosion, storm tide inundation and/ or flooding in the past? This could include impact to your property, business, local beach, etc.**



Optional question (94 responses, 3 skipped)

Q15 Do you have any details of your past experience with coastal erosion, storm tide inundation and / or flooding in our region? This could include significant events or changes to the coast you've observed over time.

Anonymous 6/17/2019 03:56 PM	Have observed using photos of sand moving from the morgo st. area further into the river and lido. Hungry Head has closed over from sand dunes shrinking and less water coming down Dalhousie Ck from less rainfall filling creeks. Atherton Drv has had more erosion as ground dry and incoming wave damage.
Anonymous 6/18/2019 11:59 AM	No flooding events in our time living here but many trees have been lost along the bank due to erosion
Anonymous 6/18/2019 05:25 PM	The sand always returns.
Anonymous 6/18/2019 05:49 PM	Flooding of Bellinger river at times
Anonymous 6/18/2019 07:39 PM	Multi floods and inundation at Mylestom of residences over a long period. Insufficient and poorly designed roadworks and drainage which causes flooding to residences. Erosion as the sand required to keep the Mylestom spit is removed from the system at Norco by dredges. Dredging is required of Rivermouth to ensure proper flows during floods.
Anonymous 6/18/2019 10:15 PM	No
Anonymous 6/19/2019 10:02 AM	General degredation
Anonymous 6/19/2019 11:12 AM	Bellingen Sailing Clubhouse has seen erosion of foreshore.
Anonymous 6/19/2019 03:39 PM	May 1974...the effects on the nsw coastline are well documented
Anonymous 6/19/2019 06:21 PM	Mine is more to do with passing boat waves along the kalang river. I have also noticed over the past 5 years that the rivers mouth is sanding up and at low tide you struggle to paddle a kayak along the northern edga of the river.
Anonymous 6/20/2019 09:44 AM	Over the past years we have seen beach and riverbank erosion. There have been significant flood events also in the past.
Anonymous 6/21/2019 09:21 AM	East coast low, Bellinger river flood in town
Anonymous 6/21/2019 08:03 PM	floods from 2009 onwards in Bellingen
Anonymous	The silting up of the river mouth seems to have an effect on the health of our

6/24/2019 09:23 AM	river. Inappropriate river bank plantings causing bank erosion (wrong trees) Damage by some wake boats and some Gov vessels causing severe bank erosion. Yes I grew up on/in the river at Raleigh and now I live on the river in a popular ski-ing and fishing location at Repton.
Anonymous 6/24/2019 11:02 AM	Bank erosion along brackish sections of both rivers during flooding and as a result of boat wash. Bank erosion due to flooding and vehicle pressure adjacent to Urunga golf course. Significant loss of beachfront vegetation at south Valla over the past 30 years.
Anonymous 6/24/2019 06:22 PM	The Lido silting up. Also the huge sandbag that has encroached over the rock wall at the point of Urunga Island.
Anonymous 6/26/2019 12:59 PM	No.
Anonymous 6/26/2019 03:05 PM	As a resident of the area for 5 years, I have seen a decrease in significant flooding over this time. Also in the last 2 years I have observed that the beaches are being changed more regularly by big surf events, but I don't have a longer time frame to assess whether this is more significant than normal.
Anonymous 6/26/2019 08:08 PM	In 2009, the Kalang river flooded to knee depth in Bellingen Keys estate and properties were evacuated. I acknowledge this was an extreme event and Emergency services did their best but struggled to cope. (Not knowing where the evacuation site was, (Golf club, not the Honey Bee), unfamiliar with the area, evacuation bus stranded in the middle of the street etc. Property owners who were not flooded are also being subject to signifcant increases in home insurance costs. Value of properties dropped and are harder to sell. All efforts must be made to reduce the possibility of flooding again, by maintaining river banks and dredging the river mouth to maximise the volume of water that can escape.
Anonymous 6/30/2019 02:43 PM	Massive erosion to river beds in my property. Trees down, banks swept away. River beds need more protection, life stock needs to be kept out of the river, river banks must have buffers if native vegetation. Herbicides and fertilizers must be contained.
Anonymous 6/30/2019 04:47 PM	I've observed changes over 10 years. The creek shifts and reforms and has little impact on the overall dune structure of the beach. People may be inconvenienced for short periods of time in the scheme of things. Plantings have been washed away and have little impact on the tidal changes that are inevitable.
Anonymous 7/07/2019 10:50 AM	I am aware of the flood 10 years ago but didnt live here then. it was a 1/100 flood and i consider this a low threat
Anonymous 7/07/2019 11:27 AM	Damages to property, isolation, erosion.
Anonymous 7/07/2019 01:23 PM	2009 flood event destroyed much of my property and belongings. It caused my children and I ongoing PTSD in times of severe weather events.
Anonymous 7/07/2019 03:16 PM	2009 flood sand bars Inlet At hungry head

Anonymous 7/07/2019 09:19 PM	Significant quantities of dead trees and vegetation coming down river being deposited on beaches. Silting up of the river the Urunga lagoon. Development of a main tidal flow channel along the finger boardwalk which us undermining the boardwalk piers, this has come about by removal of rock sections of the breakwall at the top of the wall, as the tides rises large flows of water enter the lagoon thru' these gaps. I believe this also results a build up of silt around the Sea Lido areas.
Anonymous 7/08/2019 04:50 PM	Most in Bellingen are set up for floods. Council are on the ball and very proactive in managing the fallout.
Anonymous 7/08/2019 04:52 PM	Erosion to the beach and dunes at Mylestom after significantly high tides.
Anonymous 7/09/2019 02:02 PM	Less floods due to a changing climate.
Anonymous 7/09/2019 02:17 PM	The house I live in had flood waters go through it from overflow down the hill. Since buying this house we have fixed the drainage and havn't had a problem yet.
Anonymous 7/09/2019 03:11 PM	Major flooding of Urunga in 2009 (?) which left deep layers of silt/mud on the golf course and in the Lido swimming area for many months
Anonymous 7/09/2019 05:52 PM	Flooding 2009 caused by poor drainage
Anonymous 7/09/2019 07:56 PM	No personal experience of flooding
Anonymous 7/09/2019 09:44 PM	Iv noticed how much vegetation we have lost along the rivers and how much sediment is now choaking our waterways.
Anonymous 7/09/2019 10:18 PM	Na
Anonymous 7/09/2019 11:21 PM	New to area so cannot validly comment
Anonymous 7/10/2019 09:03 AM	2009 flooding at Urunga and Newry Island
Anonymous 7/10/2019 11:00 AM	December 2008, May 2009, August 2017 saw our coast line significantly changed due to storms. flooding and high tides. Areas along the coast suffered significant erosion - loss of beaches, dunes, land and vegetation.
Anonymous 7/10/2019 12:39 PM	Yes I worked a property on the lower reaches of the Bellinger river and witnessed a large piece of land fall into the river , this was prior to the dredging operations.
Anonymous 7/10/2019 01:32 PM	Issues include: how Dalhousie Creek affects public access to the beach and lifesaving services How riverbank erosion along the Kalang is compromising Atherton Drive in Urunga How sediment/sand inundation is affecting the Kalang River mouth

Anonymous 7/10/2019 02:40 PM	Not in this region. But yes- when I was living on the south coast of NSW
Anonymous 7/10/2019 06:48 PM	The Hungry Beach has changed considerably with the current surf observation deck under threat in big tides.
Anonymous 7/11/2019 06:56 AM	urunga SLSC has been affected by storm tide inundation many times, particularly as Dalhousie Creek has changed its direction to the sea over the last 10-15 years.
Anonymous 7/12/2019 06:21 PM	2009 inundation of the Urunga village was catastrophic for those affected directly. A plan of action was developed and shelved. The inadequate major-event drainage has still not been addressed and, because there was a decision to not proceed with the consultant's recommendation, another such event WILL result in a class action.
Anonymous 7/13/2019 03:29 PM	My work place in Bellingen has been "threatened" by the larger floods (e.g.2009) in the past, though the building remained above flood levels.
Anonymous 7/18/2019 10:17 AM	Unmanaged river bank eroding
Anonymous 7/18/2019 01:15 PM	Flood waters have penetrated Golf Club facilities on more than 3 occasions in the past 15 years
Anonymous 7/20/2019 01:40 PM	Large build up of sand in rivers over last 2-3 years.
Anonymous 7/20/2019 01:54 PM	With the riverside erosion there are concerns the clubhouse is going to fall into the river and the easy access to launching water vessels into river plus easier for swimming with the beaches however these are getting washed away
Anonymous 7/20/2019 03:43 PM	In my area a lot of the river erosion comes from the continuing wash of boats ignoring the waterway speed signs.
Anonymous 7/21/2019 04:29 PM	Erosion of riverbank where we live is an ongoing problem from incorrect boat usage (speed limits not adhered too) allowing bank to erode away.
Anonymous 8/01/2019 05:10 PM	I live 35 metres above water level, no flooding here.
Anonymous 8/03/2019 12:39 PM	In times of medium to high rainfall there is no access to Hungry Head Beach for Urunga SLSC and the Public. If people cannot get access to a patrolled beach it will means they will swim in areas that are not safe and places lives at risk.
Anonymous 8/05/2019 11:46 AM	Flooding in Bellingen and Dorrigo
Anonymous 8/13/2019 07:15 PM	I hold no property that is vulnerable to these processes, but see it daily in my environmental consulting profession.
Anonymous 9/04/2019 08:57 AM	Many flood events, they have been happening forever

Optional question (56 responses, 41 skipped)

Q16 What changes (positive or negative) have you seen in the catchment, estuaries and coastline over time?

Anonymous 6/17/2019 11:48 PM	New to the area
Anonymous 6/18/2019 11:59 AM	Not been a resident long enough to comment
Anonymous 6/18/2019 05:25 PM	More sand in the estuary
Anonymous 6/18/2019 05:49 PM	River bank restoration
Anonymous 6/18/2019 07:39 PM	Widening and shallowing of the Bellinger River. I have observed this for over 60years. River mouth becoming shallow and dangerous to all users. Proper training walls required and need repairing. Negative is the Fishballs that were installed in incorrect positions and were not to the original design or location. Poison of Coral trees and not underplanted or removed and left to be fixed afterwards, very bad Environmental planning. Mylestom Pool was made out of wrong timbers and was constructed on the wrong angles. Erosion of the Concrete structures at Mylestom which replaced sandy beach and ended up causing damage/erosion where once we had Sandy beaches.
Anonymous 6/18/2019 08:33 PM	The siltation at the mouth of the rivers is the worst currently that I can ever remember seeing. Many people say it just needs a major flood, however there have been several significant floods in the last few years and the siltation has only worsened.
Anonymous 6/18/2019 10:15 PM	N/a
Anonymous 6/19/2019 11:12 AM	Food some sandbags have been installed. Estuary around Newry Island need dredging for boat access.
Anonymous 6/19/2019 03:39 PM	destruction of marine habitat (seagrass beds) destruction of fish stocks by commercial over fishing destruction of riverbanks siltation of the lower reaches of the river
Anonymous 6/20/2019 09:44 AM	Bellinger River has received attention with bush regeneration and the placement of the large concrete blocks to help with riverside preservation. The visiting boating community need education and or policing in keeping with speed limits.
Anonymous 6/20/2019 07:17 PM	Lido gets narrower. Less grass. Pkayground was moved. Where previously was quite a wider grassy area it's now sand
Anonymous 6/20/2019 07:37 PM	Over my lifetime the bellinger and kelang rivers have changed significantly. Positive changes have been that in many areas there has actually been an increase in structural complexity, narrowing of channels and re-establishment of some riparian and in-stream ecosystems. Negative changes have been the

	increase in impacts from invasive species, increased low flows due to reductions in rainfall.
Anonymous 6/21/2019 08:03 PM	negative: logging in Kalang headwaters positive: bush regeneration on riverbanks in north Bellingen
Anonymous 6/24/2019 09:23 AM	Encroachment of river banks by invasive species. Lack of adequate open space for recreation on river banks. Lack of basic maintenance of existing facilities. All leading to less recreational use of our waterways.
Anonymous 6/24/2019 11:02 AM	Recent rock revetments on lower Kalang near sailing club were necessary even though they restrict access (need to allow access for launching canoes when planning inevitably more walling). Tree planting along lower Bellinger a great success.
Anonymous 6/24/2019 06:22 PM	See above
Anonymous 6/25/2019 08:22 AM	Weeds, impacts of dogs and people on estuary. amount of cars on beach has increased especially at northern end of Urunga beach and driving up near dunes.
Anonymous 6/26/2019 12:59 PM	Not many positive changes. More people, more boats, more sand, less fish.
Anonymous 6/26/2019 03:05 PM	I live on the border of Pine Creek. Since the establishment of a large Blueberry farm upstream from me, I have observed a significant decline in the flow and quality of the creek. Also the Bellingen River turtle extinction event, which was (hopefully) wonderfully averted by the efforts of the local community and scientists.
Anonymous 6/26/2019 08:08 PM	Increased erosion along the island on Back Creek, with RMS signs being washed away. Inability to access Hungry Head beach by lifesavers due to watercourse changing. Sanddune at the Southern edge of the creek at Hungry Head (adjacent to the surfclub) has been severely eroded around 2003 (and made a good project on coastal erosion for my child.) It is still eroded today. Oyster farmers severly impacted by polluted water. possibly from river pollution up stream. This must be prevented.
Anonymous 6/30/2019 02:43 PM	Some revegeration, but we need more!
Anonymous 6/30/2019 04:47 PM	The coastline continues to be dynamic with no ill effects. The river, however, has been impacted by erosion adjacent to structures, and by visitors and locals camping close to the edges and driving boats and jet skis in increasing numbers.
Anonymous 7/07/2019 10:50 AM	I have seen local farmer on an island nearby change the usuage to intensive and causing river fouling during rain and general unpleasant usage of an area with high visibility
Anonymous 7/07/2019 11:27 AM	Too much weed invasion. Property owners doing Regen
Anonymous 7/07/2019 01:23 PM	Lido filled with silt and restricting the flow of water to the lagoon

Anonymous 7/07/2019 03:16 PM	Nil
Anonymous 7/07/2019 09:19 PM	Refer comments above.
Anonymous 7/08/2019 03:05 PM	Sand build up near rivermouth making access difficult; frothy, greasy surface on the water near Yellow Rock creek; some construction of rock embankments
Anonymous 7/08/2019 04:52 PM	Continued erosion of riverbanks between the river mouths and Bellingen/Kalang, from cattle having unchecked access to the river. This also results in significant water pollution from faeces. Rubbish and human faeces left behind by campers along the riverside at Urunga, and also in the Promised land.
Anonymous 7/08/2019 07:50 PM	The cleanup of the creek at urunga estuary and lagoon, seem really positive. Peoples rubbish, damage and lack of respect for these areas leaves an impact that can be seen everytime i visit the coast.
Anonymous 7/09/2019 12:32 PM	The wetlands improvements
Anonymous 7/09/2019 12:46 PM	Sand is washing out from behind the training walls at the mouth of the river and silting the river.
Anonymous 7/09/2019 02:02 PM	More weeds and less flooding events that our rivers rely on to flush them.
Anonymous 7/09/2019 02:17 PM	So many pelicans have returned - this shows me how healthy the area is.
Anonymous 7/09/2019 03:11 PM	The Urunga Lido was silting up making which was once deep water very shallow Alsoo the Urunga Lagoon has become very shallow and impossible to navigate at low tide.
Anonymous 7/09/2019 05:12 PM	Silting up of the Bellinger river, pollution affecting the oyster growing on the Bellinger river ...
Anonymous 7/09/2019 06:04 PM	Negative -silting up of the Kalang
Anonymous 7/09/2019 06:46 PM	Because no rangers are policing areas, there are consistently free campers where there shouldn't be, people with dangerous loose dogs on beaches and paths. It's getting worse every month and making it very unpleasant for locals and tourists alike.
Anonymous 7/09/2019 07:56 PM	Management of the river entry to the ocean
Anonymous 7/09/2019 09:44 PM	Bellingen river watch and the Bellingen environmental center.
Anonymous 7/09/2019 10:18 PM	Na

Anonymous 7/09/2019 11:21 PM	As above
Anonymous 7/10/2019 09:03 AM	Sand shoals in Kalang making boating difficult. Erosion of sand on beaches and in rivers.
Anonymous 7/10/2019 11:00 AM	Negatives: * Loss of Shorebirds and wildlife due to dogs and vehicles on beaches * Erosion of dunes and beaches due to an increase in storm events * Increase of rubbish and plastic on beaches, in estuaries and ocean. * Oyster industry under threat due to sewage in catchment Positives: * Cleaning up of Urunga Wetlands * Putting in a boardwalk at Urunga to protect the fragile mangroves * Landcare volunteers dealing with weeds and carrying regeneration works * Connecting Newry Island to BSC Sewer Infrastructure
Anonymous 7/10/2019 12:35 PM	The removal of weed and endemic plantings within the Alma Doepel Reserve from local volunteers. In the negative it would have to be the lack of response from departmental agencies on all levels.
Anonymous 7/10/2019 12:39 PM	Too many decisions being made by newcomers who do not take the time to research local history before becoming expert on all things environmental
Anonymous 7/10/2019 01:32 PM	Fish habitats and numbers seem to be more plentiful in the Kalang The oyster industry has been able to operate with reduced pollution since surrounding septic systems have been taken off line. The Bellinger and Kalang rivers are relatively free of rubbish
Anonymous 7/10/2019 02:40 PM	The south coast of the 60's & 70's was largely pristine. And abundant with wildlife, the ocean, lakes & rivers abundant with species. Now the lakes, rivers &creeks are barren.
Anonymous 7/10/2019 06:48 PM	River property owners removing trees and being involved in activities not suited to clean waterfront areas.
Anonymous 7/11/2019 06:56 AM	There is more sand in the river between the Sailing club and river mouth at Urunga. Hungry Head to the river mouth has lost a lot of sand and dunes. The mouth of Dalhousie Creek has changed, running north in front of the surf club.
Anonymous 7/12/2019 06:21 PM	Erosion of the Kalang River foreshore has worsened dramatically. Recent works are totally inadequate, and WILL be destroyed by the next flood, meaning money wasted. Judicious use of hanbars would have been a sensible, albeit a little more expensive, option to sandbags (GOOD GRIEF...).
Anonymous 7/13/2019 03:29 PM	Unsure.
Anonymous 7/18/2019 10:17 AM	Great improvements to river banks in some areas, also improvements at Atherton Drive.
Anonymous 7/18/2019 01:15 PM	Weeds let grow by council, we are not permittred to do any spraying within 100 meters of the waters edge & the weeds (morning glory) have taken over & killing native vegetation along the river bamk exposing us to flod risk in the future
Anonymous	Some erosion control measures have been implemented,but we need more.

7/20/2019 01:40 PM	
Anonymous 7/20/2019 01:54 PM	The mouth of where the 2 rivers meet - Bellinger & Kalang, the sand bank is getting worse, is it possible to be dredged?
Anonymous 7/20/2019 03:43 PM	Recently river pollution, erosion and sand build up in the river entrances.
Anonymous 7/21/2019 04:29 PM	Several feet of riverbank have eroded away due to wash from boat usage.
Anonymous 8/01/2019 05:10 PM	Erosion of the riverbank along Mylestom retaining wall.
Anonymous 8/01/2019 06:08 PM	Overfishing of breeding estuaries and release of sewer into lido lagoon
Anonymous 8/03/2019 12:39 PM	Dalhousie Creek at Hungry Head has not had a management plan in place for many years that allows safe access onto the beach from the Surf Life Saving Club.
Anonymous 8/05/2019 11:46 AM	Loss of sediment fertiliser in water ways
Anonymous 8/13/2019 07:15 PM	A thin veneer of mature vegetation flanks most of our estuaries which are doing their best to armour the banks but with time, the trees lean then fall in as they slowly get undermined from flood flows & boat wash. (good example is south of Newry Island, Urunga on the Giinagay Way side - will eventually lose those big trees and the road will need protection and rock will be brought in - habitat value marginal).
Anonymous 9/04/2019 08:05 AM	
Anonymous 9/04/2019 08:57 AM	Too much silt accumulating near the river mouth restricting tidal flows up the river. This is due to the break wall construction
Anonymous 9/18/2019 02:14 PM	At Urunga there is only a very small channel for boating. If this was to close up, I don't know if the fish can get in and out of the river system from the sea.

Optional question (66 responses, 31 skipped)

Q17 What positive initiatives have you seen within the catchment, estuaries and open coastline in recent years?

Anonymous 6/18/2019 11:59 AM	Bank stabilisation along Kalang River adjacent to rural lands on Newry Island
Anonymous 6/18/2019 05:25 PM	The bank stabilization in the upper estuary
Anonymous 6/18/2019 05:49 PM	River bank restoration
Anonymous 6/18/2019 07:39 PM	Sewerage planned, Atherton Drive plans, some Riverbank restoration
Anonymous 6/18/2019 08:33 PM	The very recent works to remediate the erosion effects at the sailing club on atherton drive, works to reduce bank erosion in other areas such as newry island banks, and tree stumps placed on the northern bank upstream of the old highway bridge on the Kalang.
Anonymous 6/18/2019 10:15 PM	N/a
Anonymous 6/19/2019 10:02 AM	Dune care, Landcare & restricting access to people & vehicles.
Anonymous 6/19/2019 11:12 AM	Not enough.
Anonymous 6/19/2019 03:39 PM	none
Anonymous 6/19/2019 06:21 PM	None
Anonymous 6/20/2019 09:44 AM	See above
Anonymous 6/20/2019 07:17 PM	Stabilisation
Anonymous 6/20/2019 07:37 PM	Riverbank restoration, erosion control works, invasive species control, wetland restoration, creation of rock fillets & mangrove traps.
Anonymous 6/21/2019 08:34 AM	Rehabilitation of the antimony site in Urunga.
Anonymous 6/21/2019 08:03 PM	planting in erosion zonens
Anonymous	Rocks for Fish Fillets Programme

6/24/2019 09:23 AM	
Anonymous 6/24/2019 11:02 AM	Landcare works around Urunga lagoon and along riverbanks and dune systems (weeding and tree planting) Info boards along Urunga Boardwalk. Establishment of Uncle Tom Kelly memorial along H Head footpath.
Anonymous 6/24/2019 06:22 PM	The extension of the blade walk. Good one Belli Council. (It needs some TLB though)
Anonymous 6/25/2019 08:22 AM	Weed control, fox baiting
Anonymous 6/26/2019 12:59 PM	?
Anonymous 6/26/2019 03:05 PM	The restoration of the old Antimony mine in Urunga was a significant achievement.
Anonymous6/26/2019 08:08 PM	Council has attempted bank stabilisation along Atherton Drive. Urunga Lido drained (but not to a significant depth or area.) Urunga boardwalk extended twice.
Anonymous 6/30/2019 04:47 PM	Targeting the weeds from the boardwalk south to Hungry Head has been an excellent project. Landcare work planting lomandra along the Morgo Street reserve edge has been successful in preventing new paths which lead to erosion. There is a mass of weed (ipomea) across from the golf club, however, which is pulling down trees and destroying what Beach Stone Curlew habitat is left. The bank stabilisation works look interesting.
Anonymous 7/07/2019 10:50 AM	Some farms on Newry Island have fenced off and repaired the riverfront. Its brilliant and should be done on all farms facing the river
Anonymous 7/07/2019 11:27 AM	Lido dredging and bank reinforcements
Anonymous 7/07/2019 11:27 AM	Landcare and bush regen
Anonymous 7/07/2019 01:23 PM	Mylestom tidal pool, Urunga Boardwalk
Anonymous 7/07/2019 01:48 PM	The development of the lido
Anonymous 7/07/2019 03:16 PM	Hopefully the Lido
Anonymous 7/07/2019 05:29 PM	Renew the Lido
Anonymous 7/07/2019 09:19 PM	Some resortation of river banks on the southern bank downstream of the rail bridge.
Anonymous 7/08/2019 03:05 PM	Are near sailing club is receiving some attention; boardwalk areas

Anonymous 7/08/2019 04:52 PM	Very little, unfortunately.
Anonymous 7/09/2019 12:46 PM	Very little. The landcare people have done some planting along the Urunga boardwalk recently, and some work was done along Atherton Drive.
Anonymous 7/09/2019 02:17 PM	I love how the council are fixing up Atherton drive it should help with the erosion problem and give good access to the water for all of us.
Anonymous 7/09/2019 02:19 PM	Wetlands bridge at Urunga
Anonymous 7/09/2019 03:11 PM	The recent dredging of a small area of the Urunga Lido and initial planning for beautification of the foreshore of the Kalang River foreshore adjacent to Atherton Drive Urunga
Anonymous 7/09/2019 05:12 PM	Nil ...it is only getting worse. Now the Forestry are ramping up the clear feeling of the forests adjacent to the Kalang river it will only get worse .The Forestry Commission needs to get out of the forests.
Anonymous 7/09/2019 06:04 PM	The boardwalks along the lagoon and estuary in Urunga are wonderful
Anonymous 7/09/2019 06:46 PM	Honestly can't think of anything, apart from wetlands project in Urunga. Boardwalk keeps falling apart despite expensive works. Lido project and dredging a complete joke which Reflections takes complete credit for.
Anonymous 7/09/2019 07:56 PM	See above
Anonymous 7/09/2019 10:18 PM	Na
Anonymous 7/09/2019 11:21 PM	Love the boardwalks
Anonymous 7/10/2019 09:03 AM	Rocks put along Kalang riverbank. Retaining wall Urunga lagoon.
Anonymous 7/10/2019 11:00 AM	See above
Anonymous 7/10/2019 12:35 PM	Mylestom Landcare and its work within the Alma Doepel Reserve. Bush Regeneration along the Bellinger River on Mylestom Drive.
Anonymous 7/10/2019 12:39 PM	Attempts to eradicate coastal weeds
Anonymous 7/10/2019 01:32 PM	Riverbank restoration at the east of Newry Island Riverbank restoration recently along Atherton Drive Recovery of Urunga Wetlands Atherton Drive Masterplan Development of Urunga Tidal Pool Development of North Beach Surf Club and supporting infrastructure
Anonymous 7/10/2019 02:40 PM	Many years ago state government bought out numerous fishing licences on the south coast believing fish & crustacean stocksThe species would recover.

	populations have never recovered due to years of overfishing. Some of the native forests are now gated & only accessible to walkers which is positive
Anonymous 7/10/2019 06:48 PM	Removal of septic sewage. Some responsible landowners planting natives to protect river bank stability
Anonymous 7/11/2019 06:56 AM	Current riverbank restoration at Urunga sailing club.
Anonymous 7/12/2019 06:21 PM	At least there is some activity - someone is trying. If only some really strategic thought had gone into the activities.
Anonymous 7/13/2019 03:29 PM	None.
Anonymous 7/18/2019 10:17 AM	Bank and erosion management
Anonymous 7/18/2019 01:15 PM	The golf club received a government grant in 2011 & we have delivered in kind more than $13,000 in labor chemicals. We need assistance from council to clean up their property so we can maintain ours
Anonymous 7/20/2019 01:40 PM	Erosion control
Anonymous 7/20/2019 01:54 PM	The more activity of folk using the space as it is currently.
Anonymous 7/20/2019 03:43 PM	Boardwalk Urunga , Urunga Wetlands
Anonymous 7/21/2019 04:29 PM	Urunga wetlands Urunga boardwalk and to come the new lido area at Urunga
Anonymous 8/01/2019 05:10 PM	Erosion control along Atherton Drive, Urunga. Erosion trials along the Bellingen between the old Pacific Highway and Mylestom.
Anonymous 8/01/2019 06:08 PM	Wetlands boardwalk
Anonymous 8/13/2019 07:15 PM	Use of timber logs and rootballs in conjunction with the uncomprimising rock revetment treatements on eroding estuary banks.
Anonymous 9/04/2019 08:05 AM	Positive experience with regards to recreational fishing following the exclusion of professional fishing from Kalang and Bellinger Rivers.
Anonymous 9/04/2019 08:57 AM	Banning of licensed fishermen
Anonymous 9/18/2019 02:14 PM	None.

Optional question (65 responses, 32 skipped)

Q18 What changes would you like to see in the future?

Anonymous 6/17/2019 03:56 PM	I would like to see more policing of waterways on recreational boats to help stop damaging waves. More rainfall. In the meantime, all drains widened in the area, pipes laid that will take storms. River dredged. Breakwater at surf end brought back so not limiting water to wash sand out
Anonymous 6/17/2019 11:48 PM	Improved storm water management, filters, outlets, etc.
Anonymous 6/18/2019 11:59 AM	A program of bank stabilisation works, in conjunction with residents, with shared funding options , acceptable design/construction standards set and provided by council, and long term goals for the maintenance of the river system
Anonymous 6/18/2019 05:25 PM	No dogs on the beach
Anonymous 6/18/2019 05:49 PM	Continued restoration of river and coastline
Anonymous 6/18/2019 07:39 PM	Proper Community Consultation and not just a selected few who curry favour with the relevant departments.
Anonymous 6/18/2019 08:33 PM	Investigation to cause and potential remedies of the siltation at the mouth of the estuary. Improvements to both Mylestom boat ramps as both have severe flaws that cause regular problems for users, and are unsafe at best.
Anonymous 6/18/2019 10:15 PM	A way to limit the impact of high tourist season in the catchment - pollution of the river for example. Provision of bags for dog poo at hungry head and education about dealing with it. Protection for shorebird nesting sites somehow. A forward looking plan that recognises the importance of not just protecting but improving the environment. Provision and recognition of the legal rights of non human persons eg the river. Highest standards of environmental regulation of human activity. We can be the model for the rest of Australia!
Anonymous 6/19/2019 10:02 AM	More restrictions to access on agricultural and recreation land and protection from all kinds of development.
Anonymous 6/19/2019 11:12 AM	Erosion control measures on river banks.
Anonymous 6/19/2019 03:39 PM	a northern training wall built at the mouth of the Bellinger River
Anonymous 6/19/2019 06:21 PM	Some action taken, I believe an option to have the river mouth dredged was available but not taken up. Urunga is the seaside resort for the Bellingen Shire and there are great opportunities at Urunga for development that can increase the number of people in the Shire (rate payers). Sand dredging, indoor basketball arena, properly fix the Lido area not just dig sand out.
Anonymous	Providing a boardwalk along the river from the village of Mylestom to Repton

6/20/2019 09:44 AM	school
Anonymous 6/20/2019 07:17 PM	No sure
Anonymous 6/20/2019 07:37 PM	Increase in funding opportunities for rehabilitation and resilience building of aquatic and marine systems, further building on past rehabilitation efforts. Greater (and more accurate) community understanding of aquatic and marine ecosystem health.
Anonymous 6/21/2019 08:34 AM	Prevention of further damage by human recreational and farming activities. Rehabilitation of natural landscapes and ecosystems.
Anonymous 6/21/2019 09:21 AM	Boat ramp to ocean waters, crossing the bar is very dangerous
Anonymous 6/21/2019 08:03 PM	better management and review of drainage systems in place. lack of maintenance is obvious in many places.
Anonymous 6/24/2019 09:23 AM	More recreational wharf and jetty facilities. Greater attention to weed and invasive species removal near water ways and beaches
Anonymous 6/24/2019 11:02 AM	Continued support for landcare. Address vehicle impact issues along lower Kalang. (In progress) Ban vehicle access from beach between Hungry Head and river mouth. Encourage council to continue its emissions reduction policy as an example to all levels of govt.
Anonymous 6/24/2019 06:22 PM	Better and safer boat ramps. Small platforms along the river so kids can safely fish in the river.
Anonymous 6/26/2019 12:59 PM	I've listed my concerns above - changes addressing these issues would be good.
Anonymous 6/26/2019 03:05 PM	I would like to see a focus on the restoration and improvements of our waterways in this Shire. All the way from the the headwaters of the rivers to the coast. Water is the most significant element in this Shire, we need to care for and maintain a healthy system for all inhabitants and visitors. Two ways to do this is change current logging practices and regulate intensive agriculture.
Anonymous 6/26/2019 03:40 PM	Free camping areas. Not too much infrastructure to keep the natural areas as pristine and untainted by humans as much as possible.
Anonymous6/26/2019 08:08 PM	Protect river banks especially in developed areas. Monitor and dredge the sand build up at the river mouth to encourage safe boating and greater escape of water.
Anonymous 6/30/2019 02:43 PM	Preserve our headwaters, no logging, more revegetation.
Anonymous6/30/2019 04:47 PM	I would like to see people park a bit away from the edge of the river (even though I like parking there). I would like to see camping monitored so that there is less litter ending up in both the ocean and river (collected lots of plastic at Third today). Driving in the designated areas on the beach should be enforced. Signage has been removed and there is nothing stopping

	people driving the entire length of the beach.
Anonymous 7/07/2019 10:50 AM	More river bank repairing
Anonymous 7/07/2019 11:27 AM	In urunga you have a lot of elderly residents with dogs, i believe they need a safe fenced park for their dogs to be exercised, where the dogs stay clean, dry and without excess sand in theitr coats, its easy for the younger generation to take their dogs to the beach areas and then give them a bath once home, but for the elderly this is a task not easily met.
Anonymous 7/07/2019 11:27 AM	More of this
Anonymous 7/07/2019 01:23 PM	Relocation of sand in the Lido, widening of the beginning section of the boardwalk. Speed restrictions around the Kalang to minimise damage to the riverbanks
Anonymous 7/07/2019 01:48 PM	A area of access for people with wheelchairs to be able to swim in the lido
Anonymous 7/07/2019 03:16 PM	Concern about sand bar
Anonymous 7/07/2019 05:29 PM	More disable friendly boat ramps, picnic and bbq facilities along the river banks, ugly old boat sheds to be upgraded or removed
Anonymous 7/07/2019 09:19 PM	Completion of restoration/beautification of the river banks initiated by the Lands Department of State Government.
Anonymous 7/08/2019 03:05 PM	Safe swimming area in the Lido vicinity; amenity blocks; monitoring of overnight campers (rubbish/toileting); sandbags dredged
Anonymous 7/08/2019 04:50 PM	More focus on tourism. If we keep our attention on facilities as well as events that attract tourist to our area, many businesses will benefit. Many locals will find employment in the area as well.
Anonymous 7/08/2019 04:52 PM	Riverbanks being effectively fenced within dairy properties to prevent access to the rivers by cattle. More effective signage confirming no camping along the rivers at the Promised Land, Mylestom and Urunga, and also increased patrols and fines being issued to those who ignore the signs.
Anonymous 7/08/2019 07:50 PM	Better education about our impact both positive and negative. I hope this would lead to more respect and care for our coastline and estuaries.
Anonymous 7/09/2019 12:32 PM	Atherton Drive provided with the funding to create beautiful walk, cycle ways, new boatramps and parks
Anonymous 7/09/2019 12:46 PM	Dredge to river mouth, and remove the sand, and/or put it back behind the training walls.
Anonymous 7/09/2019 02:02 PM	More focus and funding on a whole of the catchment approach on river management.
Anonymous 7/09/2019 02:17 PM	Not really related I would love to see some artworks along the waterways inspired by the great place we live in.

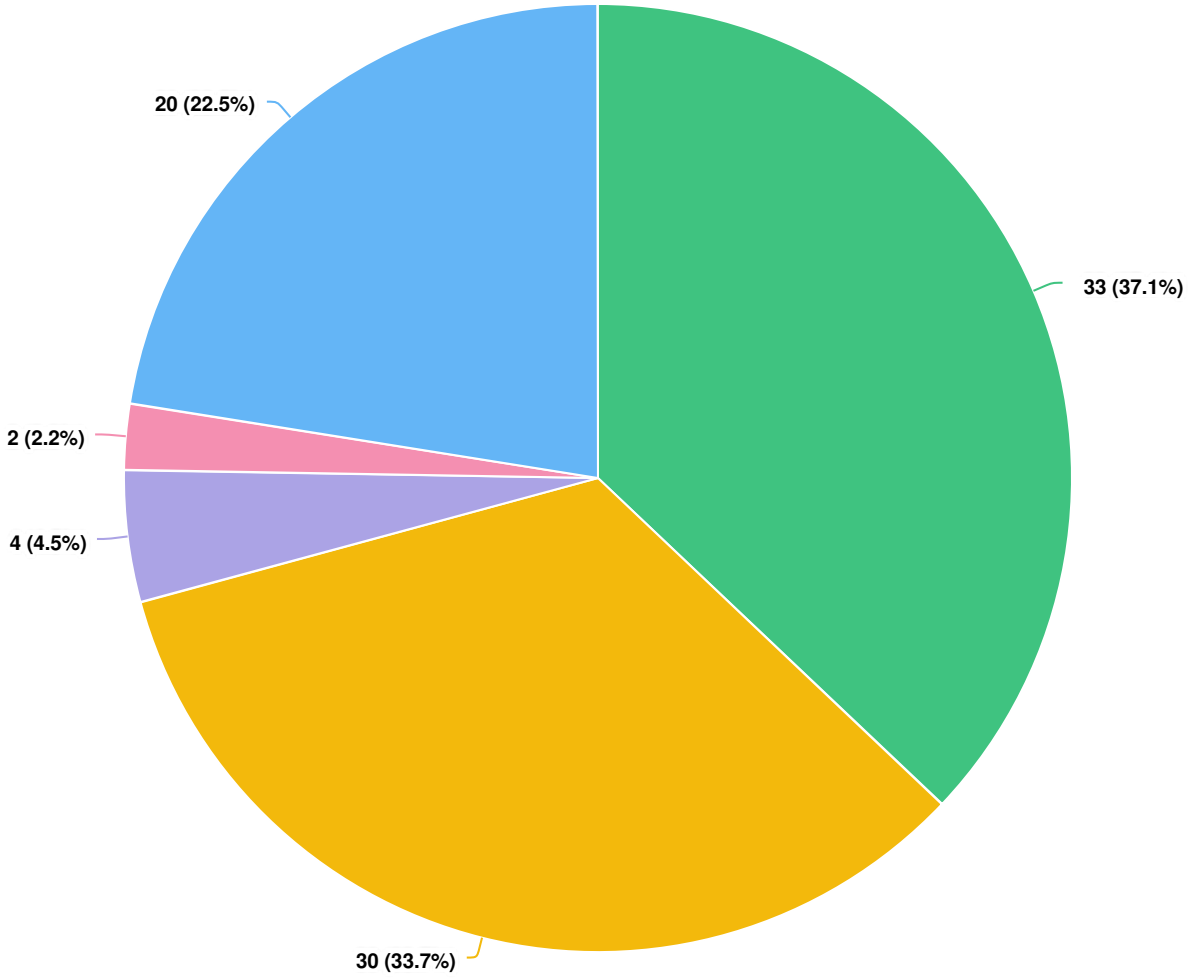
Anonymous 7/09/2019 02:19 PM	No large sandbag in the urunga Latin at badwalk. Restore what t was like when lido was there... minimal sand back then. Looks like a desert now.
Anonymous 7/09/2019 03:11 PM	More dredging of the Urunga Lido to enable larger area suitable for water recreation, Ie swimming,canoeing. Also remediation of the Urunga Lagoon.
Anonymous 7/09/2019 05:12 PM	The Forestry Commission stop logging .Koala habitat preserved and maintained in govt land .Agricultural land needs riparian zones. More marine sanctuaries.
Anonymous 7/09/2019 06:04 PM	The cessation of logging near rivers.
Anonymous 7/09/2019 06:46 PM	Ranger presence making people uphold the laws - camping, dogs, 4wds on beaches, jetskis on Bellinger at dangerous speeds.
Anonymous 7/09/2019 07:56 PM	Management of the river system from headwater to entry to ocean
Anonymous 7/09/2019 09:44 PM	More replanting of our river banks
Anonymous 7/09/2019 11:21 PM	Appropriate vegetation planting and pollution management of waterways
Anonymous 7/09/2019 11:56 PM	Update the Lido
Anonymous 7/10/2019 09:03 AM	More preventative measures against erosion.
Anonymous 7/10/2019 11:00 AM	That 50% of our beaches are vehicle and dog free. That towns along the coast are connected to sewer infrastructure within 5 years. More native vegetation planting along our foreshores. Reduce urbanisation and development along our foreshores. Have more areas along our coast where fishing and tourism (whale watching) practices are not allowed. BETTER SIGNAGE along all of our beaches - do away with leash or off leash or set times for dogs on beaches. Birdlife Australia has carried out extensive surveys and found the only signs a dog owner will abide by are "Dogs Allowed", or "No Dogs Allowed" signs. Support "No Plastic" initiatives in our shire with education, signage and set targets to reduce plastic. Inspect agriculture, forestry & animal farming businesses yearly like council's do for Septic and Food Business' to insure best practice is being carried out. Signage and monitoring of known fragile systems.
Anonymous 7/10/2019 12:35 PM	On ground works
Anonymous 7/10/2019 12:39 PM	1. Eliminate camphor laurel from all lands government and private. Eradicate the rats of the sky the Indian Minor bird. Control of lantana within the encloised lands as they are a threat to native animals. Control of feral animals such as wild dogs , deer and pigs.

Anonymous 7/10/2019 01:32 PM	Council to purchase Yellow Rock Island (Urunga Island) for conservation purposes and protect the Beach Stone Curlew Enhance Urunga Boardwalk include installation of lighting to attract night time visitors Potentially plant trees along the beaches to provide shade and reduce sand dune erosion
Anonymous 7/10/2019 02:40 PM	More wilderness areas accessible only by foot or bicycle. Expanded marine parks which means protected fish nurseries. Increased limitations on motorboat activity on narrow rivers such as the Bellingen & Kalang rivers. Logging of native forests to cease & plantation industry of native species to commence on denuded, cleared land & perhaps unused agricultural land. And council planning that is thoughtful & does not simply permit scorched earth permission which is the current paradigm when approving developments. Healthy Mature trees must be preserved in all developments.
Anonymous 7/10/2019 06:48 PM	Stronger protection of rivers and coastline from human development
Anonymous 7/11/2019 06:56 AM	Restoration of riverbanks Kalang River. Training of Dalhousie Creek mouth by manual opening when needed.
Anonymous 7/12/2019 06:21 PM	THINK.
Anonymous 7/13/2019 03:29 PM	Clearer provision of information regarding flood studies, projections and planning implications from anticipated sea level rises and subsequent flood events.
Anonymous 7/18/2019 10:17 AM	Better management of agriculture - cows, pesticides - getting into the waterways
Anonymous 7/18/2019 01:15 PM	a proactive plan that delivers year on year, not one off grants & leave the commercial premises liable for maintaining council land
Anonymous 7/20/2019 01:40 PM	No real changes ,just maintain what we have .
Anonymous 7/20/2019 01:54 PM	Riverside erosion fixed, which is is and the Lido at Urunga being completed by summer 2019
Anonymous 7/20/2019 03:43 PM	The upgrade of Atherton Drive - protection of the forshores with bollards stopping cars from driving to the waters edge destroying the vegetation and erosion of the river banks.
Anonymous 7/21/2019 04:29 PM	More education to boat owners so they have more respect and understanding when using the rivers
Anonymous 8/01/2019 05:10 PM	Fencing stock to prevent direct river access to the Kalang and Bellinger Rivers.
Anonymous 8/01/2019 06:08 PM	Walkways through Wetlands off Bellingen Street. Ban dogs from boardwalk. Ban fishing from boardwalk.
Anonymous 8/03/2019 12:39 PM	A management plan for Dalhousie Creek

Anonymous 8/05/2019 11:46 AM	More funding for invasive spices
Anonymous 8/13/2019 07:15 PM	I'd like to see forward planning, setting revegetation zones behind the thin strip of riparian trees currently protecting the river bank (sentinel trees) so that new strong deep rooted vegetation is in place for when the sentinel trees eventually go.
Anonymous 9/04/2019 08:05 AM	Control of Dalhousie Creek outlet to minimise impacts to Hungry Head beach and Urunga Surf Club activities
Anonymous 9/04/2019 08:57 AM	Extensive river mouth dredging

Optional question (75 responses, 22 skipped)

Q19 How involved would you like to be in the Coastal Management Program.



Question options

- I would like to receive email updates through Create
- I have information I would like to provide (such as photographs, data, detailed observations over time)
- I am not interested in the development of the Coastal Management Program
- I will check the website to keep updated
- I would be interested in attending future information sessions and / or workshops

Optional question (89 responses, 8 skipped)

Q20 Please provide any other comments that you think may be relevant to Bellingen Shire's coastal management program.

Anonymous 6/19/2019 03:39 PM	the local beaches, creeks and river are the bread and butter of the shire going forward into the future, they should not be sacrificed to advantage the dairy or any other industry
Anonymous 6/19/2019 06:21 PM	The biggest stumbling block to any of these management programs is the fact that you have to deal with so many different departments of the Government both State and Federal, that`s why nothing ever gets done because it is all talk and committees and nobody is game enough to make a decision and see it through. Every coastal area is different so a blue print plan won`t fit all areas. Locally is good the people who have lived here for decades know what is needed as they have seen the changes to the area over time. Cheers Rick
Anonymous 6/20/2019 07:17 PM	I think you are doing your best
Anonymous 6/21/2019 09:21 AM	$10m will be spent on the Coffs Harbour jetty because of the economic benefit it brings to the community. Imanage the economic benefit to Urunga if it had an ocean boat ramp.
Anonymous 6/24/2019 09:23 AM	I note that this process has been undertaken previously and to no result (2009?) I assisted in organising community members for a session held at North Beach. As a member of the North Beach Community Alliance (Covering North Beach, Myelstom, Repton and Raleigh) myself and members have been involved in facilitating community consultation for BSC in a number of areas including. Bellingen Coast Regional Crown Reserve POM, Bellinger Heads State Park, and the required CAP Bellingen Shire Estuary Inundation Mapping Study Rock Fillets for Fish Fillets River bank restorations by Landcare and BSC Atherton Drive Alma Dopel Park Myelstom Putt Bennett Fishing Platform Mylestom Proposed Myelstom Disabled Fishing Platform Etc. We look forward to facilitating further information and consultation. Nick Young 0422017014 15 River St Repton
Anonymous 6/24/2019 06:22 PM	Good on you for doing this. I hope some concrete outcomes eventuate.
Anonymous 6/25/2019 08:22 AM	Enforce laws around dogs on beach and estuary and cars on beach to respect buffers zones especially near the breakwater and dunal areas.
Anonymous 6/30/2019 02:43 PM	We have got to get forestry’s activities at bay, change laws, create more national parks, this is what will drive our region’s economy...
Anonymous 6/30/2019 04:47 PM	Given climate change I think it's a waste of resources to expect the creeks to remain in their most convenient place. Having a flexible approach to providing life saving services where it is most appropriate over the week or month seems more feasible. Educating people on what an icoll is might mean they don't expect to have the same beach everyday.

Anonymous 7/07/2019 10:50 AM	Bellingen council needs to focus more on whats happening in Urunga River front properties
Anonymous 7/07/2019 11:27 AM	If too many people live here, it will have a bigger impact that makes it hard to manage.
Anonymous 7/07/2019 09:19 PM	Provision of designated ,properly maintained tar or gravel car parking areas and picnic facilities at beaches within the Shire, this would prevent damage by uncontroled vehicle access to beaches.
Anonymous 7/08/2019 04:50 PM	Keep up the good work Council!!
Anonymous 7/09/2019 03:11 PM	The Kalang and Bellingen River are major tourist attractions and every effort should be made to preserve the water quality and keep them an attractive environment for wildlife and future generations
Anonymous 7/09/2019 05:12 PM	Stop ALL logging. ..
Anonymous 7/09/2019 06:46 PM	I love this area, the beauty and the people. But its becoming unpoliced, with people taking advantage of the area and it's becoming ugly to spend time in, as a result of this. I completely avoid going outdoors during high season holiday times, but it's becoming awful even in the quiet periods.
Anonymous 7/09/2019 07:56 PM	Obviously land use is an issue in the ecosystem of the valley and rivers and logging is totally inconsistent with the objective of providing a sustainable goal of preserving the valley natural ecosystem
Anonymous 7/10/2019 12:35 PM	I'm really not interested in surveys as such. I would rather see actual initiatives put into place to restore land involving government agencies and communities/volunteers that have an ongoing and supported outcome in mind. This survey seems to be broad in what its collecting and not specific in what it will achieve.
Anonymous 7/10/2019 12:39 PM	There needs to be a concerted effort to remove introduced weeds and trees from the area. Control of feral animals and birds, birds in particular the Indian minor as they are in plague proportion with no effort to control them by the authorities. Control of the wild dog and domestic dog population, even pet dogs in groups become a threat to domestic and native animals.
Anonymous 7/10/2019 02:40 PM	Conservation of native forests & a green urban environment is important. No new development close to rivers & reclamation & replanting of river banks, & along ocean front
Anonymous 7/10/2019 06:48 PM	The council needs to be proactive and respond to notices of environmental damage near sensitive waterways. One such development in Urunga (near the main bridge) is a perfect example. A walk along the river near Bellingen Keys will provide many examples of vegetation removal to enhance views and improve personal access at the expense of river bank stability.
Anonymous 7/12/2019 06:21 PM	This is a chance to get the river foreshore restoration and protection right...!! If cost is the first consideration, then we'll get it wrong - again - and waste more money and time.
Anonymous 7/18/2019 10:17 AM	One of our greatest recreational and tourist assets now and to provide employment and enjoyment in the future, , needs to be protected with this in

	mind. Oysters, recreational fishing, boating, nature, low impact industries all contribute to our future here
Anonymous 7/20/2019 01:40 PM	We live in a beautiful part of the world let's strive to keep it that way for our children.
Anonymous 7/20/2019 01:54 PM	The coastal areas and waterways are what attracts a lot of visitors to the area, some first time others return annually so we need to keep as it, and not spoil it.
Anonymous 7/28/2019 10:48 PM	Pls ban 4WDs on our beaches as there is no need for people to treat them like roads, hooning along at ridiculous speeds endangering walkers, children and dogs off leash, chewing up the sand dunes and spoiling the peace of the place.
Anonymous 8/01/2019 06:08 PM	Where will the sewer outfall go when new subdivision opens?
Anonymous 8/03/2019 12:39 PM	As President of the Urunga SLSC our region needs to ensure locals, visitors and members have safe access onto the beach. Also our operation of junior programs iis negatively impacted when Dalhousie Creek is unable to be safely crossed. The club also is the emergency call out contact for marine rescues and this cannot be operated when access to the beach is flooded by water pooling directly in front of the access areas.
Anonymous 8/05/2019 11:46 AM	Consultation with Aboriginal Community
Anonymous 9/18/2019 02:14 PM	It's good to see the Boat Police policing the rivers for speeding power boats and jet skis.

Optional question (30 responses, 67 skipped)

Attachment C
First ARG Meeting Minutes

Minutes

Meeting	Working Group Workshop: Scope, purpose and vision.
Location	Bellingen Shire Council
Date and Time	27 May 2019 1:30-4:30 pm
Project	Bellingen Shire Coastal Management Program– Scoping Study
Attendess	Peter Baumann(Crown Lands), Lily Hawkes (Crown Lands), Sandy Eager (Bellingen Landcare) Anna Sedlak (Roads and Maritime Services), Shaun Morris (Local Land Services) Joe Pearce (Farm Advisory Service), John Schmidt (OEH), Jonathon Yantsch (DPI Fisheries), Nicholas Denshire (OEH) Peter Walsh (Forestry Corporation), Daniel Bennett (BSC), Amanda Carter (BSC), Alex Waldron (BSC), Cr Jennie Fenton (BSC)

Item

Management issues

Broad discussion on existing management issues, key points included:

- Foreshore structures and legacy issues from older structures reaching the end their design life and permitting issues faced by replacing these structures
- Challenges associated with Native Title claims
- Land tenure and the loss of crown land due to river bank erosion, increases the challenge of managing riparian zones – the golf course in Bellingen is a good example
- Unregulated camping in public areas
- Sewage management and onsite sewage management systems
- Weeds (coming down the catchment)
- Highly profitable intensive horticulture (i.e. blueberries, avocados) in the Valery and Never Never areas which create water quality issues
- Degradation of smaller floodplain wetlands on private land
- Lack of riparian vegetation throughout the estuary
- Shorebirds and sea level rise – opportunities for migration limited
- Limited recreational access to the estuary and facilities
- Capacity of land managers to manage riparian and floodplain areas is generally quite low
- Limited investment opportunities
- Low willingness for change in some sectors of the community
- Management actions typically reactionary and not proactive
- Water Sharing Plans have an over reliance on surface water management, groundwater only really utlised in towns. This is missed opportunity as a reduced reliance on surface water may provide more drought tolerance to the system which may provide business opportunities
- Bank erosion and sedimentation impacts on the oyster industry and aquaculture more broadly
- Highway bridge created floodplain flow paths concentrating flows and erosion issues
- Inconsistency of development plans across agricultural practices (lack of money provided for maintenance of fencing infrastructure)
- Succession planning and getting younger people into the agricultural industry
- Lack of understanding of the root cause of degraded water quality
- Landcare has 70 landholders waiting for help but insufficient resources to assist
- Only $1.4 M spent from the Environmental Levy – need a detailed prioritisation given the limited budget
- Urban development impacts including untreated stormwater
- Restricted migratory opportunities due to urban development
- Unsealed roads particularly in forested areas (major theme of MEMA)
- Water storages – currently not secure in Bellingen which extracts from the river
- Limited amenities in Bellingen and the Promised Land (i.e. toilets) create water quality issues
- Tourism a big threat
- Impacts of private forestry industry on the catchment unknown
- Aging population requires improved accessibility to coastline
- Informal camping at Oyster Creek
- Aboriginal cultural values unknown

- Unrestricted stock access throughout the estuarine reaches
- No permanent Council staff to manage river and coastal areas
- Bushfire risks given forested catchment

ACTIONS:

Alluvium to review all management issues and prioritise based on feedback provided during broader stakeholder and community engagement, literature review and risk assessment. Final priority management issues to be outlined in scoping study.

Current management arrangements

Broad discussion on current management arrangements, key points include:

- State Government less involved than historically and rely on Council who have limited resources
- Landcare working with ten landholders near Thora – in early stages of planning
- Working with Koala habitat near Hydes Creek
- Newry Island was recently sewered
- Limited compliance officers or enforcement of diffuse polluters

ACTIONS:

Alluvium to review all management arrangements and determine progress against previous management plans – key learnings to be incorporated into future CMP stages

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SWOT Analysis

Discussion of the strengths, weaknesses, opportunities and threats for both the study area and the broader CMP were outlined:

Strengths:

- Pristine reputation of LGA
- Forested catchment
- LGA covers catchment area
- Environment protection zone
- Lots of previously completed science, planning and engagement
- Strong indigenous engagement
- CMP is a 10 year strategy, provides authority to act, whole of government
- Priority threats can be addressed
- Environment valued by the community
- Water based infrastructure funding readily available
- Unregulated catchment – natural flow and fluvial regimes
- New landholders moving into the area that want to do the right thing
- Resilient open coastline
- Strong Landcare network
- Coastal community values a natural coastline
- Shire of Bellingen 2027 Community Vision

Weaknesses:

- Budget constraints
- NSW government does not enforce compliance (i.e. diffuse pollution)
- Highly prescribed Act and manual, onerous to implement
- May develop actions which do not consider the budgetary constraints, need to prioritise based on budget
- Limited capacity of council to drive CMP due to staff resourcing issues
- Differing community views/ priorities in different areas

Opportunities:

- Need to have targeted community engagement
- One long term framework better than a smaller short term one

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- Joint opportunities for funding
- Opportunity to work with Marine Estate Management Authority and working within the Marine Estate Management Strategy - Initiatives for MEMA similar to CMP objectives
- Identify high priority threats and risks and funding mechanisms. Only work on priority issue.
- Catchment management, water quality and diffuse runoff are now part of NSW government policy
- OEH risk-based framework provides guidance on accessing MEMA funding
- Development of a catchment friendly farming program/ certification – provide incentives to manage catchments better (i.e. remove Environment levy)
- Aboriginal stewardship and cultural values (high uptake of language in the region)
- Tourism opportunity
- Stormwater levy
- Waterways partnership
- Urban stormwater management
- Iconic species – (i.e. Turtle)

Threats:

- Climate change and the impacts of flooding and tidal inundation
- Forested catchment and risk of bushfires and associated erosion and water quality impacts
- Corporate dominance of land use
- Onerous studies in Stage 2 and delay in implementation - don't do planning for planning sake given the existing understanding is strong
- Tourism
- Short term political cycles
- New landholders moving in

ACTIONS:

- *Alluvium to incorporate above analysis into scoping study*

Vision

Broad discussion on the vision statement for the CMP and the requirement to link with the Shire of Bellingen 2027 Community Vision. Key themes to consider for the statement include:

- Connected
- Sustainable
- Catchment to coast
- Practical
- Adaptable/Adaptive
- Achievable
- Equality/Inclusive/Interconnected Linkages
- Catchment consciousness
- Healthy rivers/estuary is the community's greatest asset

ACTIONS:

- *Alluvium to develop some draft vision statements for discussion at the next Working Group meeting*

Objectives

Discussion on the objectives for the CMP given these can be broad in Stage 1 and refined in later stages of the CMP. Key values and their desired outcomes were discussed and include:

Value	Desired outcome
Aquaculture production	Improve reliability
Swimming	Improve water quality
Recreational access	Understand the range of access requirements (passive vs active) and determine desired outcome to project other values
Ecosystem health	Improve the functionality of ecosystems
Sustainable industries	Promote industries which are local and sustainable

Tourism	Promote tourism which is nature and adventure based and inclusive
Cultural values	Promote and protect cultural values and connections to land, water and the community

. *ACTIONS:*

- *Alluvium to develop some draft objectives for discussion at the next Working Group meeting*

Next Steps

Discussion on next steps in the scoping study. These include:

- Implement the next tasks in the Community and Stakeholder Engagement Plan for the scoping study including engaging with traditional owners, community survey and targeted phone calls and meetings with relevant stakeholders
- Prioritise management issues based on feedback from engagement tasks, literature review and risk assessment
- Review historical and contemporary management arrangements and their adequacy – determine why they may have failed
- Outline recommendations for future stages of the CMP to address priority management issues

Attachment D
Supporting economic information

Economic supporting data

Unit rates/values and relevant reference sources

Table 35. Discussion of key asset classes (including indicative damage/loss estimate)

Type	Component	Units	Low estimate	High estimate	Reference/Comment
Pipes	Pipe (sewerage)	$/linear m	164	201	Coastal hazards (e.g. inundation and erosion) threaten the stability and performance of the pipe network. Data measuring the metres of pipe affected by coastal hazards at each township in Bellingen will be determined during Stage 2 of the analysis. The damage can then be approximated in dollars using the replacement costs taken from Rawlinsons (2018).[11] If the Shire has site specific data this will be preferred to Rawlinsons.
	Pipe (stormwater)	$/linear m	213	260	
Road infrastructure	Roads	$/lane km	$150,000		Similar to the pipe network, roads are threatened by coastal hazards. The costs of the road per kilometre will vary depending on the type of road – i.e. whether a road is a major road or minor road. Gargett (2017) estimates the current value of a paved undivided road at $150,000 per km.[12] The cost of traffic signals and culverts has been taken from Rawlinsons (2018).
	Traffic signals	$ per set	110,000	137,000	
	Culvert	$/linear m	1,565	1,915	
Residential / Commercial buildings	Flood damage (slab on ground)	$/m^2	Variable		See discussion under *Economic costs of flood risk* (below) on the stage-damage relationship of different asset types. A preliminary estimation of damage/loss for residential assets has been included below under the heading *Preliminary damage/loss assessment for key land use types*.
	Flood damage (raised)				
	Flood damage (industrial)				
	Flood damage (other commercial)				
	Erosion damage	$/m^2	1,324	2,866	Erosion threatens the integrity of a structure. It differs from flooding because erosion will likely compromise the stability of the foundations and therefore put the entire structure at risk. At this stage of the process it is likely that an asset will be assumed irreparably damaged if it is within the erosion

[11] Rawlinsons (2018) Australian Construction Handbook is viewed as a leading authority on the various aspects of Australian construction costs.
[12] Gargett (2017). Growth in the Australian Road System. Department of Infrastructure and Regional Development: Information Sheet. Australia Government. Accessed at <https://www.bitre.gov.au/publications/2017/files/is_092.pdf> on 22/11/2019.

Type	Component	Units	Low estimate	High estimate	Reference/Comment
					zone (in a given time period) – determined Stage 2. Construction costs can be estimated using the online tool provided by BMT Quantity Surveyors (https://www.bmtqs.com.au/construction-cost-table). At this stage of the CMP process adjustments have not been made to convert replacement cost estimates from Brisbane (as the closest major city) to Bellingen Shire.
Other infrastructure	Carpark	$/structure	n/a	n/a	Further research required (to be completed at a later stage, if necessary)
	Jetty	$/structure	n/a	n/a	Further research required (to be completed at a later stage, if necessary)
	Bridge	$/structure	n/a	n/a	Further research required (to be completed at a later stage, if necessary)
Agriculture / Aquaculture	Beef	Gross margin[13] ($/ha)	140	320	Inundation and erosion threaten the productivity of agricultural enterprises. Permanent inundation and erosion permanently reduces the amount of productive land. Temporary inundation will reduce profits for a given time period. For example, salt water inundation to pasture and crops can stunt plant /pasture growth. This temporarily reduces crop yields or the carrying capacity of pastoral enterprises. Gross margins are calculated as the revenue minus the variable costs (i.e. all costs that are not fixed). The gross margin for beef was approximated by using a recent publication from the Department of Primary Industries (April 2019)[14] and the gross margin on dairy from the NSW Dairy Farm Monitor Project Annual Report (2017-18).[15] Presently, these are approximates only and will be refined at a later stage of the CMP process. A preliminary estimation of damage/loss for agricultural land has been included below under the heading *Preliminary damage/loss assessment for key land use types*.
	Dairy	Gross margin ($/ha)	2,200	2,800	
	Oysters	Gross margin ($/m)	TBC	TBC	Given there are less than five oyster operators within the Bellinger River, DPI NSW cannot release the economic production data for this system due to confidentiality considerations. Consequently, it is not possible at this time to determine the economic value of oyster production and the gross margins secured. The gross margin for oysters will need to be confirmed in the following stages of the CMP.
Natural / environmental assets	Coastal forests and wetlands	$/ha/yr	543	3,692	Natural assets provide a range of 'services' that contribute to human wellbeing through both their extent and condition. Some of the key services include tourism (recreation and visual aesthetic), attenuation of wave energy and erosion protection, carbon storage and sequestration, and maintaining nursery. The initial unit estimations have been determined using a benefit transfer process, which is

[13] The gross margin equals the revenue minus the variable (non-fixed) costs of production.
[14] DPI (2019). Farm Enterprise Budget Series. Accessed at <https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/175533/Summary.pdf> on 01/11/2019.
[15] DPI (2018). Dairy Farm Monitor Project NSW Annual Report 2017-18. Accessed at <file:///C:/Users/jtait/Downloads/201718%20NSW%20Dairy%20Farm%20Monitor%20Project%20Annual%20Report.pdf> on 01/11/2019.

Type	Component	Units	Low estimate	High estimate	Reference/Comment
	Mangroves	$/ha/yr	3,591	9,563	where the benefits identified in a primary study in a given location are then adjusted for a different location. The values provided here represent the benefit from the Whitsundays (with no adjustment), which will be adjusted (where necessary) for the Bellingen Shire catchment at a later stage of the CMP process.
	Beach	$/ha/yr	3,000,000	5,400,000	It should be noted that beach assets generate three values. Firstly, use values associated with visitation. Secondly existence values (they are valued by the community purely because they exist). Thirdly, as they provide a degree of coastal protection to assets inland of the beach (beach absorbs energy from storm events). These values are highly variable depending on the specific beach asset. A preliminary estimation of damage/loss for natural / environmental assets has been included below under the heading *Preliminary damage/loss assessment for key land use types*.
Tourism	Average spend per night	$/night	99	137	Tourism Research Australia publishes data relating to tourism at the local government level. The adjacent data is based on a four-year average from 2015 to 2018 (TRA 2018). From a desktop analysis, it is difficult to appreciate the extent of the tourism market in Bellingen and the visitors' preferences. At later stages of the CMP, it will be valuable if Council could help contextualise the Bellingen Shire tourism sector and ground-truth estimations. See discussion under *Tourism – a case study of Urunga* (below) for a preliminary insight into the potential losses to the tourism industry resulting from coastal hazards.

Economic costs of flood risk to building assets

The economic cost of flood risk to building assets (the consequence component of a risk assessment) varies with the depth of flooding and building type. Depending on the flood event, the costs may include:

- Direct internal damage (e.g. wall linings, floorings, wiring, curtains etc.)
- Direct external damage (e.g. window frames, external wall materials)
- Direct structural damage (e.g. footings for elevated houses)
- Indirect damage (e.g. chattels).

Using vulnerability curves developed by Geosciences Australia and insurance damage cost data from the 2011 floods in South East Queensland (updated to 2019 values), it is possible to estimate stage-damage curves for different flood heights for different build asset types.[16] The stage-damage relationship for residential and commercial buildings is shown in Figure 45.[17] The relationships indicate that slab-on-ground and raised construction builds (both including residential assets) are significantly affected at 100mm height and then trends at a flatter incline after that. A key driver of this is the susceptibility of internal wiring within the house that will most likely be destroyed during a flood. Alternatively, the stage-damage profile for industrial (e.g. a warehouse) and other commercial buildings exhibit a steadily increasing relationship reflecting the different purpose, needs and construction of the asset.

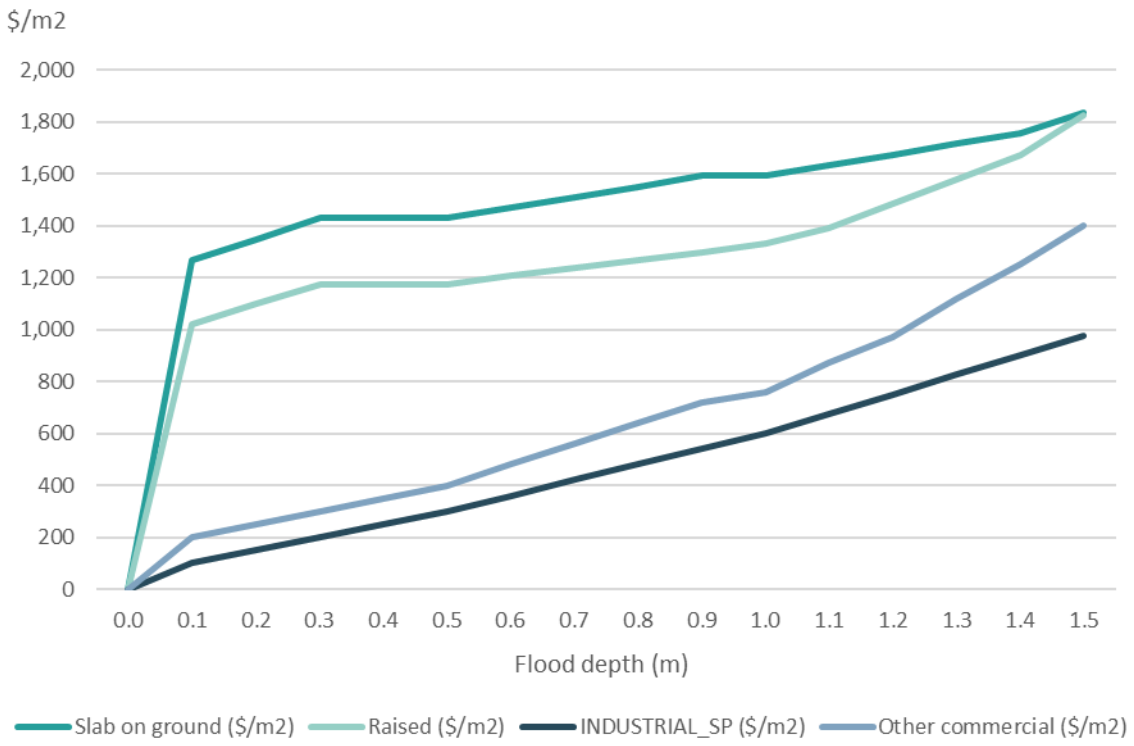

Figure 45. Estimated direct stage-damage curves for buildings ($/m²)

Source: NCEconomics modelling based on Geoscience Australia (2017) Vulnerability of Australian Houses to Riverine Inundation. Analytical and empirical vulnerability curves, BMT-WBM (2017) Brisbane River Strategic Floodplain Management Plan. Technical Evidence Report.

[16] The data presented captures the stage-damage relationship in South East Queensland. In the following stages of the CMP process it may be appropriate to adjust the relationship reflecting conditions in Bellingen.

[17] The stage-damage curves are based on the modelled estimates used for the Brisbane River Strategic Floodplain Management Plan (BMT-WBM (2017) Brisbane River Strategic Floodplain Management Plan. Technical Evidence Report).