

Coastal Management Program

Bonville and Pine Creek

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Prepared for
Coffs Harbour City Council

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Contact Information

Cardno (NSW/ACT) Pty Ltd
Trading as Cardno
ABN 95 001 145 035

Level 9, The Forum
203 Pacific Highway
St Leonards, NSW

Telephone: +61 2 9496 7700
Facsimile: +61 2 9439 5170

tanja.mackenzie@cardno.com.au
www.cardno.com.au

Author(s):
Jennifer Cornell - Environmental Engineer
Ester Groenendaal – Coastal Engineer

Approved By:
Tanja Mackenzie - Principal Environment

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Executive Summary

This Coastal Management Program (CMP) for the **Bonville and Pine Creek Estuary** has been prepared by Cardno for Coffs Harbour City Council (CHCC, or Council).

The primary purpose of a CMP is to set out the long-term strategy for coordinated management of the Bonville and Pine Creek estuary to meet local community needs in the short term and identify risks in the longer term. A series of actions is defined and program for implementation over the next 10 years is included. It outlines prioritised management actions which aim to achieve ecologically sustainable development for the social, cultural and economic well-being of the people in the catchment area and state.

This Coastal Management Program is developed according to the *Coastal Management Act 2016* (CM Act), State Environmental Planning Policy (Coastal Management) 2018 (SEPP CM) and Coastal Management Manual (OEH, 2018), and meets the following requirements:

- > This CMP is Stage 4 of the preparation process and follows on from Stage 1 Scoping Study (Cardno, 2017a), Stage 2 Estuary Condition and Community Uses Study (Cardno, 2017c) and Stage 3 Options development and assessment process and Business Plan (Cardno, 2017d).
- > Throughout the coastal management process, Cardno has reviewed existing literature and undertaken community and stakeholder consultation to identify the values and significance of the estuary to the community, and their desired outcomes for ongoing management. This CMP summarises the management issues and risks and presents a series of management actions to mitigate these risks.
- > Other aspects, key in development of a holistic and sustainable long-term strategy, have been considered throughout the CMP process include:
 - The Objects of the CM Act and objectives of the four coastal management areas (coastal wetland and littoral forests, coastal vulnerability areas, coastal environment areas, coastal use areas)
 - Existing and future planning timeframes (30 years, up to 50 and 100 years)
 - Impacts of long term aspects such as climate change, population growth and land use intensification.
- > The draft CMP for this estuary developed in 2017 has been updated to the requirements of the new legislative coastal management framework gazetted in April 2018.

Estuary description

Bonville and Pine Creek Estuary is located on the mid-north coast of New South Wales, nine kilometres south of Coffs Harbour and about 600 kms north of Sydney. The estuary drains a catchment area of about 115 km², discharging to the ocean south of Sawtell Headland.

About 50% of the catchment is developed. Most of the lower reaches of the catchment are within Bongil Bongil National Park, which is of high conservation value and includes areas of the littoral rainforests and coastal wetlands.

In recent years small acreages and hobby farms have become more common in the lower catchment. These small holdings are typically concentrated east from the Pacific Highway. This transition in land-use has seen an increase in clearing and conversion of land for cropping and grazing, which has likely led to increased runoff and nutrient loads.

The township of Sawtell is located on the coast north of Bonville Creek, extending to the north to Middle Creek. Middle Creek is a tributary that drains to Bonville Creek near the estuary entrance. The suburb of Toormina is also located in the Middle Creek catchment. Urban growth and use of land for agricultural purposes have led to land clearing which could jeopardise estuary health in future.

The historic town of Sawtell with the estuary is an attractive and popular recreational area that hosts an influx of tourists during peak holiday seasons. The majority of the wetlands are within the bounds of Bongil Bongil National Park and the SEPP CM 2018 mapping indicates some smaller wetlands extend beyond the National Park.

Land use in the upper catchment generally consists of agricultural (including cropping and grazing) and forestry. Cropping activities include banana plantations, orchards, melons, potatoes and blueberries with blueberry farming is expanding in the upper catchment in recent times. If not appropriately controlled this

intensive agriculture can lead to increases in flows, sediments, nutrients, pesticides and herbicides to the estuary with potential deleterious effects on the estuarine ecosystems. A search of the relevant databases found that a number of threatened species listed under the NSW *Biodiversity Conservation Act 2016* and/or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* occur within the Bongil Bongil wetland and hence the CMP includes consideration of the measures to protect and enhance the habitat of these species.

Management Objectives for the Estuary

The focus for the Bonville and Pine Creek Estuary for the upcoming 10 years is to:

- > Improve and maintain water quality;
- > Reduce estuary sedimentation and bank erosion;
- > Improve community amenity and facilities (resident and tourist);
- > Preserve / protect the natural environment and cultural heritage;
- > Maintain and improve riparian vegetation corridors;
- > Understand and improve fish stocks; and to
- > Support the ongoing use of the estuary as an educational resource and for research.

Threats and risks

Projections of climate change scenarios, population growth and land use intensification has led to the identification of threats that could jeopardise these objectives, and could threaten the health of the estuary and the well-being of the people living in (and visiting) the catchment area.

Of these threats, the following have been identified as **high risk** for the existing system and within the 30-year future planning horizon (encompassing the 20-year planning horizon), and are therefore a designated as a priority to be addressed:

- > Inundation of coastal wetlands, littoral rainforests and riparian vegetation caused by sea level rise, leading to decline of biodiversity;
- > Inundation of foreshore land, public infrastructure and recreational facilities caused by sea level rise, resulting in damage to or loss of facilities and degradation or loss of heritage sites;
- > Potential decline of fish population. The cause of the potential decline is unknown, but overfishing could be the cause and this could result in decline of key recreational or commercial fish stocks;
- > Vegetation clearing due to unrestricted cattle access causing bank erosion, loss of riparian vegetation and sedimentation of creeks;
- > Vegetation clearing due to agricultural land use, resulting in net loss of vegetation and decline in water quality; and
- > Increase of stormwater run-off and decline of stormwater quality due to more frequent and intense rainfall and land use intensification, causing erosion and sedimentation and decline in water quality.

Although mitigation of these threats is designated a priority, the risk of the additional threats is likely to increase over a long timeframe (50 to 100 year) and it is therefore essential these be considered in the development and assessment of management actions.

Management Actions

Thirty-one management actions have been developed during the CMP preparation. Preliminary assessment and prioritisation of these actions, resulted in a shortlist of the highest ranking, priority management actions that provide the greatest overall benefit for estuary management as summarised in the Table below (noting some changes to management actions following public exhibition, refer **Section 4.1.3**). These either contribute positively to the objectives, avoid or mitigate the negative impacts, or increase understanding of the systems to allow future improved planning of optimal and cost-efficient actions in the future.

This CMP is considered a 'living document' that is reviewed and updated over time. A strategic review of the CMP should occur at least once every ten years to assess the effectiveness of the CMP in achieving its objectives and to incorporate changes in light of new information and understanding of the system.

Table E-1 Priority Management Actions

Management Action	Improve and maintain water quality	Reduce estuary sedimentation and bank erosion	Improve community amenity and facilities (resident and tourist)	Preserve / protect the natural environment and cultural heritage	Maintain and improve riparian vegetation corridors	Understand and improve fish stocks	Support the ongoing use of the estuary as an educational resource and for research
Estuary Entrance Behaviour Investigation	✓	✓	✓	✓		✓	✓
Implementation of DCP	✓	✓	✓	✓	✓		
Community Education Program	✓		✓	✓		✓	✓
Community Conservation and Restoration Programs	✓	✓	✓	✓	✓		✓
Review LEP and DCP with respect to Intensive Agriculture / Horticulture	✓	✓	✓	✓	✓		
Coastal Inundation Monitoring			✓				
Climate Change Adaptation Plan			✓	✓			✓
Bank Stability Projects		✓		✓	✓		
Condition Assessment of Coastal Protection Works		✓	✓	✓			
EcoHealth Monitoring Program	✓	✓		✓	✓	✓	✓
Stormwater Management Assets	✓						
Environmental Protection Works		✓	✓	✓	✓		

The draft Bonville and Pine Creek CMP (RevA, Oct 2017) was presented to the CEMAC in 2017. The draft has been updated in accordance with CEMAC's feedback and requirements of the new Coastal Management legislation, gazetted in April 2018, resulting in preparation of a Final Draft CMP (RevD, Feb 2019).

The Final Draft CMP was subject to public exhibition from 27 March to 25 April 2019 in accordance with the requirements of the CM Act. No submissions were received during the public exhibition period; however, the CEMAC members and relevant agencies undertook a final review of the CMP and provided some feedback. This feedback has been assessed and where appropriate incorporated into the Final CMP.

This document, the Final CMP will now be presented for formal adoption by Council and submitted to the responsible NSW State Minister for certification.

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Glossary

Term	Definition
AHIMS	Aboriginal Heritage Information Management System
BC Act	NSW <i>Biodiversity Conservation Act 2016</i>
CEA	Coastal Environment Area CMA
CEMAC	Coastal and Estuary Management Advisory Committee
CHCC	Coffs Harbour City Council
CMA	Coastal Management Area
CM Act	NSW <i>Coastal Management Act 2016</i>
CMP	Coastal Management Program
CM SEPP	NSW State Environmental Planning Policy (Coastal Management) 2018
CWLR	Coastal Wetlands and Littoral Rainforest CMA
CUA	Coastal Use Area CMA
CVA	Coastal Vulnerability Area CMA
CZMP	Coastal Zone Management Plan
DCP	Development Control Plan
DECC	Former NSW Department of Environment Climate Change
DECCW	Former NSW Department of Environment Climate Change and Water
DoI	NSW Department of Industry
DPI	NSW Department of Primary Industries
DPIE	NSW Department of Planning, Industry and Environment (includes the former OEH)
EEC	Endangered Ecological Community
EPA	Environment Protection Authority
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
EPL	Environment Protection Licence
EPW	Environmental Protection Works
GPT	Gross pollutant trap
IP&R	Integrated Planning and Reporting framework
LEP	Local Environment Plan
LGA	Local Government Area
LALC	Local Aboriginal Land Council
MEMS	NSW Marine Estate Management Strategy 2018-2028 (DPI, 2018)
NP&W Act	NSW <i>National Parks and Wildlife Act 1974</i>
NPWS	NSW National Parks and Wildlife Service
OEH	NSW Office of Environment and Heritage (now part of OEH; the team that delivers the NSW Coastal Management Program is hereafter referred to as DPIE – Environment, Energy and Science)
Risk / Success Criteria	Terms of reference against which the significance of risk is evaluated
SEPP	State Environmental Planning Policy
TARA	Threat and Risk Assessment (under the MEMS)
WSUD	Water Sensitive Urban Design

1 Introduction

The NSW Government has overseen a process of reform of the coastal management program in NSW, and adopted the new *Coastal Management Act 2016* (CM Act) and State Environmental Planning Policy Coastal Management 2018 (SEPP CM 2018). Under the CM Act, Council is required to update the existing Estuary Management Plan for Bonville and Pine Creeks (Patterson Britton and Partners, 2004; CHCC, 2008) into a Coastal Management Program (CMP) to meet the requirements of the CM Act and SEPP CM 2018. The primary purpose of a CMP is to set out the long-term strategy for co-ordinated management of land within the coastal zone to meet local needs over a defined implementation period (OEH, 2018).

This CMP is developed for the Bonville Pine Creek estuary and its catchment. An estuary is primarily influenced by processes and activities in the catchment area and processes at the estuary entrance, where the estuary meets the sea. It can be considered as a relatively separate system from the open coast (as long as the inter relations are considered). The increasing pressures in the area due to emerging industries (e.g. blueberry farming), land use changes and population growth, called for prioritisation of an updated long-term Management Strategy for the estuary. It was considered prudent to initiate the estuary CMP and develop a CMP for the open coast as a separate exercise.

1.1 Study Area

Bonville and Pine Creeks are located on the mid-north coast of New South Wales, nine kilometres south of Coffs Harbour and about 600 kms north of Sydney. The estuary drains a catchment area of about 115 km², extending inland to Tuckers Nob State Forest and discharging to the ocean south of Sawtell Headland (refer **Figure 1-1**).

The catchment is located mainly in Coffs Harbour LGA, with a relatively small area located in Bellingen Shire Council in the upper reaches of the catchment, south west of the study area (**Figure 1-1**).

The Bonville Pine Creek estuary is part of the 'Urunga' sediment compartment which adjoins three LGAs: Coffs Harbour, Bellingen Shire and Nambucca Shire (**Figure 1-2**).

About 50% of the catchment is developed. Most of the lower reaches of the catchment are within Bongil National Park, encompassing the coastal fringe, downstream reaches of the estuary and parts of middle and upper Pine Creek. The National Park is of high conservation value, containing a regionally rich mosaic of vegetation types, including littoral rainforests and wetlands.

In recent years small acreages and hobby farms have become more common in the lower catchment. These small holdings are typically concentrated east from the Pacific Highway. This transition in land-use has seen an increase in clearing and conversion of land for cropping and grazing.

The township of Sawtell is located on the coast north of Bonville Creek, extending to the north to Middle Creek. Middle Creek is a tributary that drains to Bonville Creek near the estuary entrance. The suburb of Toormina is also located in the Middle Creek catchment (**Figure 1-3**).

The CMP area covers the defined coastal zone of the Bonville and Pine Creek catchment within Coffs Harbour LGA, however as the estuary catchment extends beyond the limit of the coastal zone the CMP may also include actions outside that zone to improve estuary condition.

1.1.1 Coastal Management Areas

The four coastal management areas identified for consideration in development of a CMP under the CM Act 2016 are:

- > Coastal wetlands and littoral rainforests;
- > Coastal vulnerability areas;
- > Coastal environment areas; and
- > Coastal use areas.

1.1.1.1 Coastal Wetlands and Littoral Rainforests

The Coastal Wetlands and Littoral Rainforests coastal management area (CMA1) applies to land that is mapped and displays hydrological and floristic characteristics typical of these communities. The mapped areas include a 100 m buffer around these mapped ecosystem community boundaries.

Coastal wetlands are mapped in the SEPP CM (2018) along Pine Creek (lower and upper) and in lower Bonville Creek (refer **Figure 1-4**). Littoral rainforests are mapped to the north of the Sawtell headland on the Sawtell Beach dunes (refer **Figure 1-4**). This area of littoral rainforest is on the border of the study area.

The majority of the wetlands are within the bounds of Bongil Bongil National Park, however, some of the mapped wetlands extends beyond the National Park, into the suburb of Bonville and small pockets throughout the area.

1.1.1.2 Coastal Vulnerability Areas

The Coastal Vulnerability Area coastal management area (CMA2) applies to land identified in the SEPP CM (2018) that are subject to coastal hazards such as beach erosion, shoreline recession, cliff failure and coastal inundation.

No coastal vulnerability areas are presently mapped in the SEPP CM (2018) for the study area; therefore the areas at risk of coastal inundation and erosion are as detailed in the Coffs Harbour Coastal Zone Management Plan (CZMP; BMT WBM, 2013) have been adopted here. This CZMP describes the inundation, recession and erosion risks for the existing, 2050 and 2100 planning horizons. It is considered that this CZMP adequately addresses the management of hazards in the Coastal Vulnerability Area for the Bonville and Pine Creek Estuary.

1.1.1.3 Coastal Environment Areas

The Coastal Environment Area coastal management area (CMA3) applies to land containing coastal features such as the coastal waters of the state, estuaries, coastal lakes and lagoons and land adjoining these water bodies including headlands and rock platforms; and specified buffers around these features.

The Coastal Environment Area comprises the estuary and lands within 100 m of the estuary (refer **Figure 1-5**) and includes:

- > Bonville Creek to Pine Creek Way;
- > Pine Creek to approximately 400 m east of the Pacific Highway; and
- > Middle Creek to Hulberts Road.

The Coastal Environment Areas of lower Pine Creek and lower Bonville Creek are within the Bongil Bongil National Park.

1.1.1.4 Coastal Use Areas

The Coastal Use Areas coastal management area (CMA4) applies to land identified by a State environmental planning policy to be the coastal use area for the purposes of the CM Act, being land adjacent to coastal waters, estuaries, coastal lakes and lagoons where development is or may be carried out (at present or in the future).

The coastal use area is shown in **Figure 1-6**.

1.2 Statutory Context

1.2.1 Coastal Management Act 2016

The CM Act provides the architecture for strategic management of our coastal areas into the future. The CM Act establishes requirements for the preparation of CMPs. These CMPs will replace existing CZMPs prepared under the former NSW *Coastal Protection Act 1979* (now repealed).

Under the CM Act, programs will have a strong emphasis on implementation within the local government Integrated Planning and Reporting (IP&R) framework. This includes performance auditing powers to ensure that CMPs are appropriately implemented.

Consultation is a strong component of the new CMP process. Consultation with the community, state agency stakeholders and other councils is required by the Act. The Act recognises that offshore sand and other sediment moves on a scale larger than local government boundaries (within areas known as sediment compartments). Consultation at the scale of these sediment compartments aims to ensure coastal management activities incorporate strategic issues on a regional scale.

All public authorities are required to have regard to relevant CMPs when carrying out their functions (such as coastal planning, management) and when undertaking infrastructure and other works in coastal areas.

The CM Act lists a series of management objects that must be considered when developing a CMP (refer Section 3 of the Act). There are also objectives provided for each of the four coastal management areas. A review of how this CMP supports the objects of the Act, including those for each coastal management area, is provided in **Table 1-1**.

Table 1-1 Objects of the CM Act and the Objectives of the Four Coastal Management Areas

Section 3 – Objects of the CM Act		Relevant Section of This CMP
The objects of this Act are to manage the coastal environment of New South Wales in a manner consistent with the principles of ecologically sustainable development for the social, cultural and economic well-being of the people of the State, and in particular		
(a)	to protect and enhance natural coastal processes and coastal environmental values including natural character, scenic value, biological diversity and ecosystem integrity and resilience, and	1.3.2, 2, 4.2
(b)	to support the social and cultural values of the coastal zone and maintain public access, amenity, use and safety, and	1.3.2, 2.2, 4.2
(c)	to acknowledge Aboriginal peoples' spiritual, social, customary and economic use of the coastal zone, and	1.3.2, 2.2.2
(d)	to recognise the coastal zone as a vital economic zone and to support sustainable coastal economies, and	1.3.2, 2.2.4, 2.4
(e)	to facilitate ecologically sustainable development in the coastal zone and promote sustainable land use planning decision-making, and	1.3.2
(f)	to mitigate current and future risks from coastal hazards, taking into account the effects of climate change, and	2.1, 2.3, 2.6 and Actions 16, 17, 20, 21, 23
(g)	to recognise that the local and regional scale effects of coastal processes, and the inherently ambulatory and dynamic nature of the shoreline, may result in the loss of coastal land to the sea (including estuaries and other arms of the sea), and to manage coastal use and development accordingly, and	2.1; Cardno (2017c)
(h)	to promote integrated and co-ordinated coastal planning, management and reporting, and	3, 5, 6
(i)	to encourage and promote plans and strategies to improve the resilience of coastal assets to the impacts of an uncertain climate future including impacts of extreme storm events, and	2.3, 2.6, 4.2
(j)	to ensure co-ordination of the policies and activities of government and public authorities relating to the coastal zone and to facilitate the proper integration of their management activities, and	This CMP, 3, Appendix D
(k)	to support public participation in coastal management and planning and greater public awareness, education and understanding of coastal processes and management actions, and	3, 4.2.6 and Actions 1,2 and 10; Cardno (2017c)
(l)	to facilitate the identification of land in the coastal zone for acquisition by public or local authorities in order to promote the protection, enhancement, maintenance and restoration of the environment of the coastal zone, and	Action 3
(m)	to support the objects of the <i>Marine Estate Management Act 2014</i> .	1.2.4
Section 6 (2) – Management objectives for coastal wetlands and littoral rainforests area		Relevant Section of This CMP
The management objectives for the coastal wetlands and littoral rainforests area are as follows -		

(a) to protect coastal wetlands and littoral rainforests in their natural state, including their biological diversity and ecosystem integrity,	
(b) to promote the rehabilitation and restoration of degraded coastal 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,	1.1.1.1, 2.2.1, 4.2
(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 rainforest management.	
Section 7 (2) – Management objectives for coastal vulnerability area	Relevant Section of This CMP
The management objectives for the coastal vulnerability area are as follows -	
(a) to ensure public safety and prevent risks to human life,	
(b) to mitigate current and future risk from coastal hazards by taking into account the effects of coastal processes and climate change,	
(c) to maintain the presence of beaches, dunes and the natural features of foreshores, taking into account the beach system operating at the relevant place,	
(d) to maintain public access, amenity and use of beaches and foreshores,	
(e) to encourage land use that reduces exposure to risks from coastal hazards, including through siting, design, construction and operational decisions,	
(f) to adopt coastal management strategies that reduce exposure to coastal hazards – (i) in the first instance and wherever possible, by restoring or enhancing natural defences including coastal dunes, vegetation and wetlands, and (ii) if that is not sufficient, by taking other action to reduce exposure to those coastal hazards,	
(g) if taking that other action to reduce exposure to coastal hazards – (i) to avoid significant degradation of biological diversity and ecosystem integrity, and (ii) to avoid significant degradation of or disruption to ecological, biophysical, geological and geomorphological coastal processes, and (iii) to avoid significant degradation of or disruption to beach and foreshore amenity and social and cultural values, and (iv) to avoid adverse impacts on adjoining land, resources or assets, and (v) to provide for the restoration of a beach, or land adjacent to the beach, if any increased erosion of the beach or adjacent land is caused by actions to reduce exposure to coastal hazards,	1.1.1.2, 2.1, 4.2
(h) to prioritise actions that support the continued functionality of essential infrastructure during and immediately after a coastal hazard emergency,	
(i) to improve the resilience of coastal development and communities by improving adaptive capacity and reducing reliance on emergency responses.	
Section 8 (2) – Management objectives for coastal environment area	Relevant Section of This CMP
The management objectives for the coastal environment area are as follows -	
(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,	1.1.1.3, 2.1.5, 2.2, 4.2
(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.	
Section 9 (2) – Management objectives for coastal use area	Relevant Section of This CMP
The management objectives for the coastal use area are as follows -	
(a) to protect and enhance the scenic, social and cultural values of the coast by ensuring that – (i) the type, bulk, scale and size of development is appropriate for the location and natural scenic quality of the coast, and (ii) adverse impacts of development on cultural and built environment heritage are avoided or mitigated, and (iii) urban design, including water sensitive urban design, is supported and incorporated into development activities, and (iv) adequate public open space is provided, including for recreational activities and associated infrastructure, and (v) the use of the surf zone is considered,	1.1.1.4, 2.2.4, 2.4, 4.2.4
(j) to accommodate both urbanised and natural stretches of coastline.	

A Coastal Strategy Statement has been developed that is consistent with the state-wide objects and management objectives for management of the NSW Coast. The Coastal Strategy Statement sets the long-term strategy for the integrated and coordinated management of the coastal zone with a focus on achieving the objectives of the Coastal Management Act. It includes a vision and seven management objectives for the estuary, and is developed throughout the CMP preparation process (refer **Section 1.3.2** and **Appendix B**).

Part 3 of the CM Act details the requirements for CMPs and makes reference to the SEPP CM 2018 and Coastal Management Manual (OEH, 2018).

1.2.2 State Environmental Planning Policy (Coastal Management) 2018

The SEPP CM establishes a new, strategic land use planning framework for coastal areas, and supports implementation of the management objectives set out in the CM Act. It contains mapping of designated coastal management areas for the entire NSW coastline.

The SEPP CM consolidated (and repealed) a number of previous SEPPs, including:

- > SEPP No. 14 (Coastal Wetlands);
- > SEPP No. 26 (Littoral Rainforests); and
- > SEPP No. 71 (Coastal Protection).

SEPP CM 2018 outlines a range of development controls that aim to help protect and manage coastal environments, manage risks from coastal hazards and support appropriate urban developments.

1.2.3 Coastal Management Manual

Section 14(1) of the CM Act requires that CMPs are prepared in the accordance with the Manual, which identifies the Mandatory Requirements that must be included in a CMP and provides guidance on how to go about preparing a CMP.

CMPs are developed through a staged process as set out in the NSW Coastal Management Manual (OEH, 2018). The five stages are:

- > Stage 1: Identify the scope of a CMP;
- > Stage 2: Determine risks, vulnerabilities and opportunities;
- > Stage 3: Identify and evaluate options;
- > Stage 4: Prepare, exhibit, finalise, certify and adopt the CMP; and
- > Stage 5: Implementation, monitoring, evaluation and reporting.

The mandatory requirements for preparing CMPs as set out in the Coastal Management Manual (OEH, 2018) are provided in **Appendix A**. The full details of each of these mandatory requirements can be reviewed in the Manual.

1.2.4 Marine Estate Management Act 2014

The NSW *Marine Estate Management Act 2014* (MEM Act) provides for strategic and integrated management of the whole marine estate, which is comprised of NSW marine waters, coasts and estuaries. Object (m) of the CM Act is to support the objects of the MEM Act and needs to be considered in the development of this CMP (refer **Table 1-1**).

The Act establishes the Marine Estate Management Authority (MEMA). MEMA undertook a state-wide Threat and Risk Assessment (TARA) to identify priority threats to the social, economic and environmental values of the NSW marine estate. **Section 1.1.3.1** identifies the Priority Regional Threats for the North region and which of these have also been identified in the risk assessment as being relevant for Bonville and Pine Creeks.

1.3 Management Context

1.3.1 Strategic Context

1.3.1.1 NSW Government Strategic Plans

NSW 2021 – State Plan

NSW 2021 (NSW Department of Premier and Cabinet, 2011) is a ten-year plan to rebuild the NSW economy, provide quality services, renovate infrastructure, restore government accountability and strengthen our local environment and communities.

NSW 2021 sets clear priorities and goals for government action. These may give councils a point of reference for identifying relevant issues for the development of local Community Strategic Plans. Some councils have chosen to directly link the strategic outcome areas in their Community Strategic Plan with goals found in NSW 2021 to clearly explain the connection between State, regional and local planning. All Community Strategic Plans must give due regard to the State Plan.

One of the strategies of NSW 2021 is to 'strengthen our local environment and communities'. Within this strategy sit seven goals which are applicable to the CMP:

- > Goal 22. Protect our natural environment;
- > Goal 23. Increase opportunities for people to look after their own neighbourhoods and environments;
- > Goal 24. Make it easier for people to be involved in their communities;
- > Goal 25. Increase opportunities for seniors in NSW to fully participate in community life;
- > Goal 26. Fostering opportunity and partnership with Aboriginal people;
- > Goal 27. Enhance cultural, creative, sporting and recreation opportunities; and
- > Goal 28. Ensure NSW is ready to deal with major emergencies and natural disasters.

North Coast Regional Plan 2036

The North Coast Regional Plan 2036 (DPE, 2017) guides the land use planning priorities and decisions to 2036. It provides an overarching framework to guide subsequent and more detailed land use plans, development proposals and infrastructure funding decisions.

The NSW Government's vision for the North Coast is to create the best region in Australia to live, work and play thanks to its spectacular environment and vibrant communities. To achieve this vision the Government has set four goals for the region:

- > The most stunning environment in NSW;
- > A thriving, interconnected economy;
- > Vibrant and engaged communities; and

- > Great housing choice and lifestyle options.

The NSW Government has established a dedicated new body, the North Coast Delivery, Coordination and Monitoring Committee, to oversee implementation of the vision, goals and actions in the Regional Plan. Responsibility for implementing actions and monitoring the intended outcomes in the Regional Plan is shared with our important regional stakeholders, including Councils, other State agencies, service providers and the development industry.

Marine Estate Management Strategy 2018-2028

The State's vision for the NSW marine estate is a healthy coast and sea, managed for the greatest wellbeing of the community now and into the future. The NSW Marine Estate Management Strategy 2018-2028 (the MEMS; DPI, 2018) details how the MEMA will achieve this vision over this ten-year period.

The opportunities associated with developing CMPs are:

- > Leveraging from and/or complementing the implementation of the MEMS (e.g. the ten-year monitoring program, implementation of the actions); and
- > Consideration of identified threats (regional or localised) identified in the TARA.

A TARA was performed to inform the MEMS, which defines priority threats to environmental assets and to social, cultural and economic benefits of the marine estate on a State level and on a regional level. The threats to estuaries identified in the TARA have been reviewed in light of the project team's appreciation of the management issues specific to the study area (refer **Table 1-2**). Text in bold italics identifies management issues raised in the TARA that are considered relevant to the CMP.

Table 1-2 Review of the TARA Results in Relation to Bonville and Pine Creeks

Top twenty Ranked Priority Threats to Estuaries - State Wide	Top twenty threats to environmental assets for the North Region
<ul style="list-style-type: none"> ▪ Agricultural diffuse source runoff ▪ Urban stormwater discharge ▪ Estuary entrance modifications and breakwaters ▪ Clearing riparian and adjacent habitat including wetland drainage ▪ Modified freshwater flows ▪ Recreation - boating and boating infrastructure ▪ Navigation & entrance management and modification, harbor maintenance etc. ▪ Foreshore development ▪ Sewage effluent and septic runoff ▪ Stock grazing of riparian and marine vegetation ▪ Climate Change (20 years) ▪ Recreation and tourism – Four-wheel driving ▪ Shipping - Large commercial vessels and associated port activities and industries (trade ships, cruise ships, etc.) ▪ Commercial fishing - estuary general ▪ Oyster aquaculture ▪ Passive recreational use ▪ Beach nourishment and grooming ▪ Recreational fishing - shore-based line and trap fishing ▪ Recreational fishing - boat-based line and trap fishing ▪ Deliberate introduction of plants and animals (e.g. foxes, bitou bush) 	<ul style="list-style-type: none"> ▪ Estuary entrance modifications ▪ Clearing riparian and adjacent habitat including wetland drainage (in estuaries) ▪ Agricultural diffuse source runoff (in estuaries) ▪ Climate Change (20 years) ▪ Urban stormwater discharge (in estuaries) ▪ Modified Freshwater flows (in estuaries) ▪ Recreation and tourism – Boating and boating infrastructure (in estuaries) ▪ Recreation and tourism – Four-wheel driving ▪ Foreshore development ▪ Navigation & entrance management and modification, harbour maintenance, etc. (in estuaries) ▪ Sewage effluent and septic runoff ▪ Stock grazing of riparian and marine vegetation (in estuaries) ▪ Commercial fishing – Ocean Trawl (in coastal and marine) ▪ Recreational fishing - shore-based line and trap fishing ▪ Recreational fishing – Boat-based line and trap fishing ▪ Commercial fishing - Ocean ▪ Trap and Line (in coastal and marine) ▪ Commercial fishing – Estuary General (in estuaries) ▪ Passive recreational use ▪ Deliberate introduction of plants and animals (e.g. foxes, bitou bush)

The risks relevant for this CMP are discussed further in **Section 2.6**.

1.3.1.2 Coffs Harbour City Council Strategic Plans

The Integrated Planning and Reporting (IP&R) Framework requires Council to produce a set of documents that articulate where Coffs Harbour wants to be in ten years and how Council will achieve these aspirations through details of its budgets, activities and performance measures. The framework allows NSW councils to draw their various plans together, understand how they interact and get the maximum leverage from their efforts by planning holistically and sustainably for the future.

The IP&R includes the following documents:

- > MyCoffs (Community Strategic Plan, 2017) - Long-term (minimum ten year) aspirations of the Coffs Harbour community;
- > Delivery Program - Council's four-year plan to address MyCoffs, 2017 (including four-year budgets);
- > Operational Plan - What Council will undertake in the current financial year in implementing the Delivery Program (includes detailed budgets as well as fees and charges schedules); and
- > Resourcing Strategy - Council's Long-Term Financial Plan, Asset Management Strategy and Workforce Management Plan.

The CMP feeds into the IP&R framework. The management actions proposed will be incorporated into Council's IP&R framework including its resourcing strategy and asset management plan.

MyCoffs (Community Strategic Plan)

MyCoffs (CHCC, 2017) sets out Council's plan for the future of the whole Coffs Harbour community. The Plan is broken into four key themes each with their own vision statements:

1. Community Wellbeing.
 - a. A vibrant and inclusive Place.
 - i. We recognise and acknowledge the traditional custodians of the Coffs Harbour local government area
 - ii. We foster a sense of community, belonging, and diversity
 - iii. We address the causes of disadvantage
 - iv. We enrich cultural life through art, learning and cultural endeavour
 - b. An active, safe and healthy community
 - i. We support our community to lead healthy active lives
 - ii. We facilitate positive ageing
 - iii. We nurture mental health, wellbeing and social connection
 - iv. We cultivate a safe community
2. Community Prosperity
 - a. A thriving and sustainable local economy
 - i. We champion business, events, innovation and technology to stimulate economic growth, investment and local jobs
 - ii. We attract people to work, live and visit in the Coffs Harbour local government area
 - b. A Community achieving its potential
 - i. We are best prepared to exploit opportunities now and, in the future,
3. A place for Community
 - a. Liveable neighbourhoods with a defined identity
 - i. We create liveable spaces that are beautiful and appealing

- ii. We undertake development that is environmentally, socially and economically responsible
 - b. A natural environment sustained for the future
 - i. We protect the diversity of our natural environment
 - ii. We use resources responsibly to support a safe and stable climate
- 4. Sustainable Community Leadership
 - a. Our Leaders give us confidence in the future
 - i. We foster informed and inspired leadership in our community
 - ii. We undertake effective engagement and are informed
 - b. We have effective use of public resources
 - i. We effectively manage the planning and provision of regional public services and infrastructure
 - ii. We collaborate to achieve the best possible future for all the Coffs Harbour area

1.3.2 Management Framework for the Bonville and Pine Creek Estuary

1.3.2.1 Vision

The CMP requires Council to develop a vision for the estuary, to guide the management actions and represents the “desired outcome” for the ongoing management of the estuary. This vision has been developed consistent with the objectives of the CM Act and the visions set out in the Community Strategic Plan (MyCoffs).

The vision statement is:

To provide for the holistic and coordinated management of the Bonville and Pine Creeks estuary for ecosystem health and the sustainable use and enjoyment of the natural environment by the community.

1.3.2.2 Management Objectives

Management objectives for the Bonville and Pine Creek Estuary have been developed throughout the CMP process. Key stakeholders and the community were provided with the opportunity to comment on the management objectives during their development. As a result of the community engagement in Stage 3, an additional management objective was included to acknowledge the educational importance of the estuary.

The management objectives also consider the objects of the CM Act, the future management of the estuary and the potential impacts of climate change. Climate change has the potential to impact multiple coastal and estuarine processes encompassing water quality, sedimentation and bank erosion, vegetation, habitat and more (refer **Section 2**). The potential impacts of climate change have been considered in the management objectives when assessing the management options (Cardno, 2017d).

The management objectives are:

- > Improve and maintain water quality;
- > Reduce estuary sedimentation and bank erosion;
- > Improve community amenity and facilities (resident and tourist);
- > Preserve / protect the natural environment and cultural heritage;
- > Maintain and improve riparian vegetation corridors;
- > Understand and improve fish stocks; and
- > To support the ongoing use of the estuary as an educational resource and for research.

1.3.2.3 Summary of Key Risks and Opportunities

Key risks, threats and opportunities were identified in the Estuary Conditions and Community Uses Study (Cardno, 2017c). Key threats identified as resulting in high risks for the existing system and/or future planning horizon include:

- > Land use changes;
- > Vegetation clearing;
- > Declining fish population due to overfishing;
- > Lack of knowledge on fish population leading to unrecorded decline in stocks;
- > Sea level rise; and
- > Increased storm intensity and frequency plus increased population.

1.4 Development and Purpose of the CMP

In developing the CMP, the following reports have been prepared as part of the staged process set out in the Manual:

- > Cardno (2017a) Scoping Study. Bonville and Pine Creek Coastal Management Program. Prepared for Coffs Harbour City Council, April 2017;
- > Cardno (2017b) Stakeholder and Community Engagement Plan. Bonville and Pine Creek Coastal Management Program. Prepared for Coffs Harbour City Council, April 2017;
- > Cardno (2017c) Estuary Conditions and Community Uses Study. Bonville and Pine Creek Coastal Management Program. Prepared for Coffs Harbour City Council, July 2017; and
- > Cardno (2017d) Business Plan. Bonville and Pine Creek Coastal Management Program. Prepared for Coffs Harbour City Council, July 2017.

The Coastal Strategy Statement has been developed throughout the coastal management process and sets the long-term strategy for the integrated and coordinated management of the coastal zone with a focus on achieving the objectives of the draft CM Act (these objectives have not been changed in the CM Act). This includes identification of coastal management issues and opportunities, and strategies and actions linked to coastal management areas covered by the CMP including a map of proposed actions. The Coastal Strategy Statement is presented in **Appendix B**.

The Business Plan was developed during Stage 3 of the coastal management process and is presented in **Section 5**. The Business Plan demonstrates viable funding mechanisms for proposed coastal management actions that are consistent with the IP&R Resourcing Strategy.

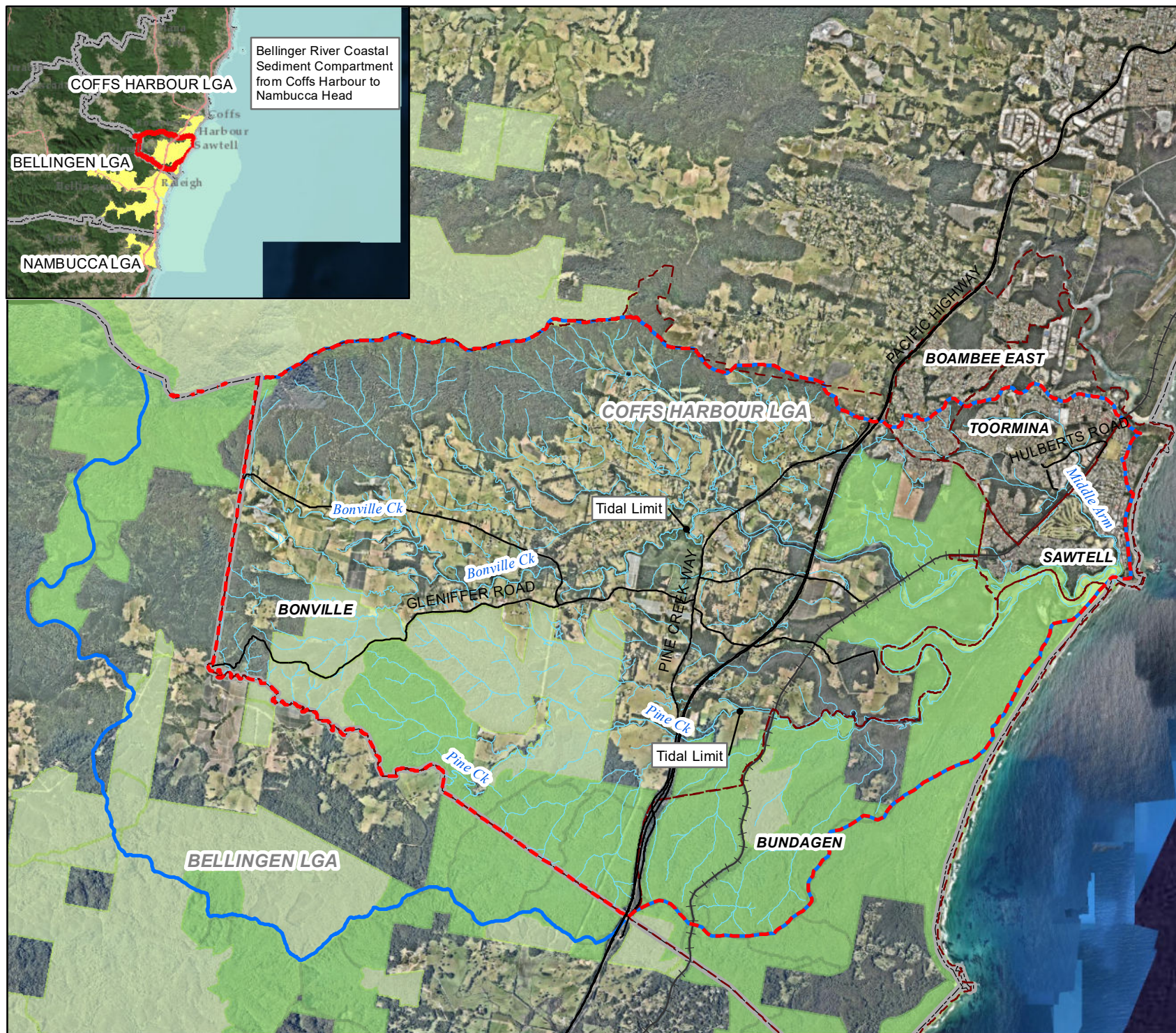
This report is the Coastal Management Program. The CMP is a deliverable of Stage 4 of the coastal management process, outlined in red in **Figure 1-7**.

The purpose of the CMP is to:

- > Set out the long-term strategy for co-ordinated management of land within the coastal zone;
- > Set out the proposed actions to meet the coastal management objectives;
- > Address coastal management issues applicable to the study area; and
- > Identify integrated and strategic actions.

1.5 Maps

The maps / figures accompanying the text in **Section 1** are provided over page.



Study Area

BONVILLE AND PINE CREEK
COASTAL MANAGEMENT
PROGRAM

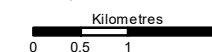
FIGURE 1-1

Legend

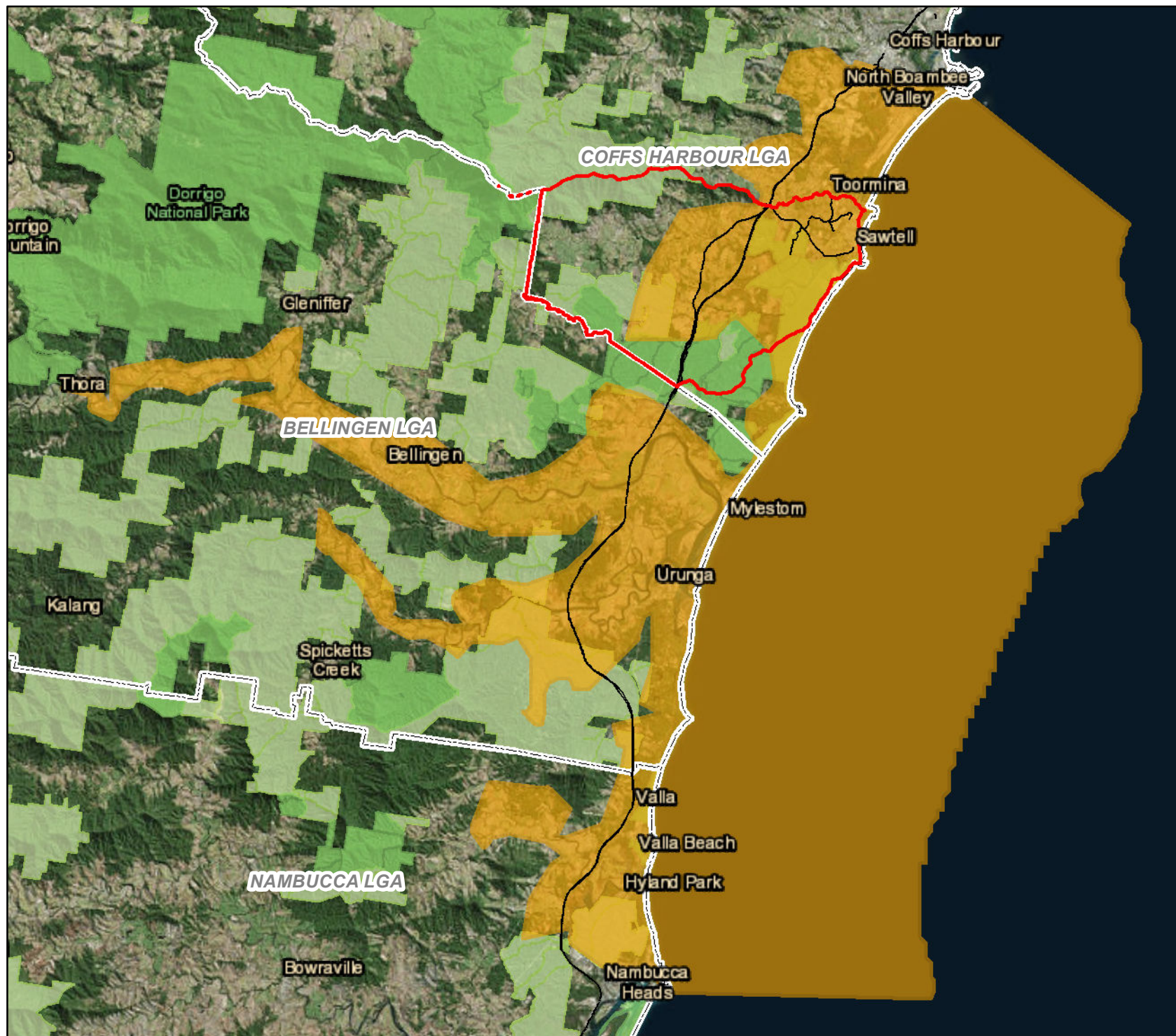
- Bonville and Pine Creek Study Area
- Roads
- + + Railway
- Stream
- Suburb
- Local Government Area
- Estuary Drainage Catchment
- National Park
- State Forest



1:80,000 Scale at A4



Map Produced by W&E NSW/ACT
Date: 2019-02-08
Coordinate System: GDA 1994 MGA Zone 56
Project: 59917103_CMP
Map: 59917103-GS-021-CMP_StudyArea.mxd 01



Sediment Compartments

BONVILLE AND PINE CREEK
COASTAL MANAGEMENT
PROGRAM

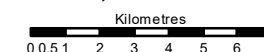
FIGURE 1-2

Legend

- Study Area
- Roads
- Local Government Area
- Urunga Sediment Compartment
- National Park
- State Forest



1:220,000 Scale at A4



Map Produced by W&E NSW/ACT
Date: 2019-02-08
Coordinate System: GDA 1994 MGA Zone 56
Project: 59917103_CMP
Map: 59917103-GS-02-CMP_SedimentCompartments.mxd 01
Imagery supplied by ESRI 2019



COFFS HARBOUR
CITY COUNCIL

Sawtell and Toorima Townships

BONVILLE AND PINE CREEK
COASTAL MANAGEMENT
PROGRAM

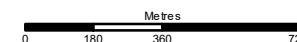
FIGURE 1-3

Legend

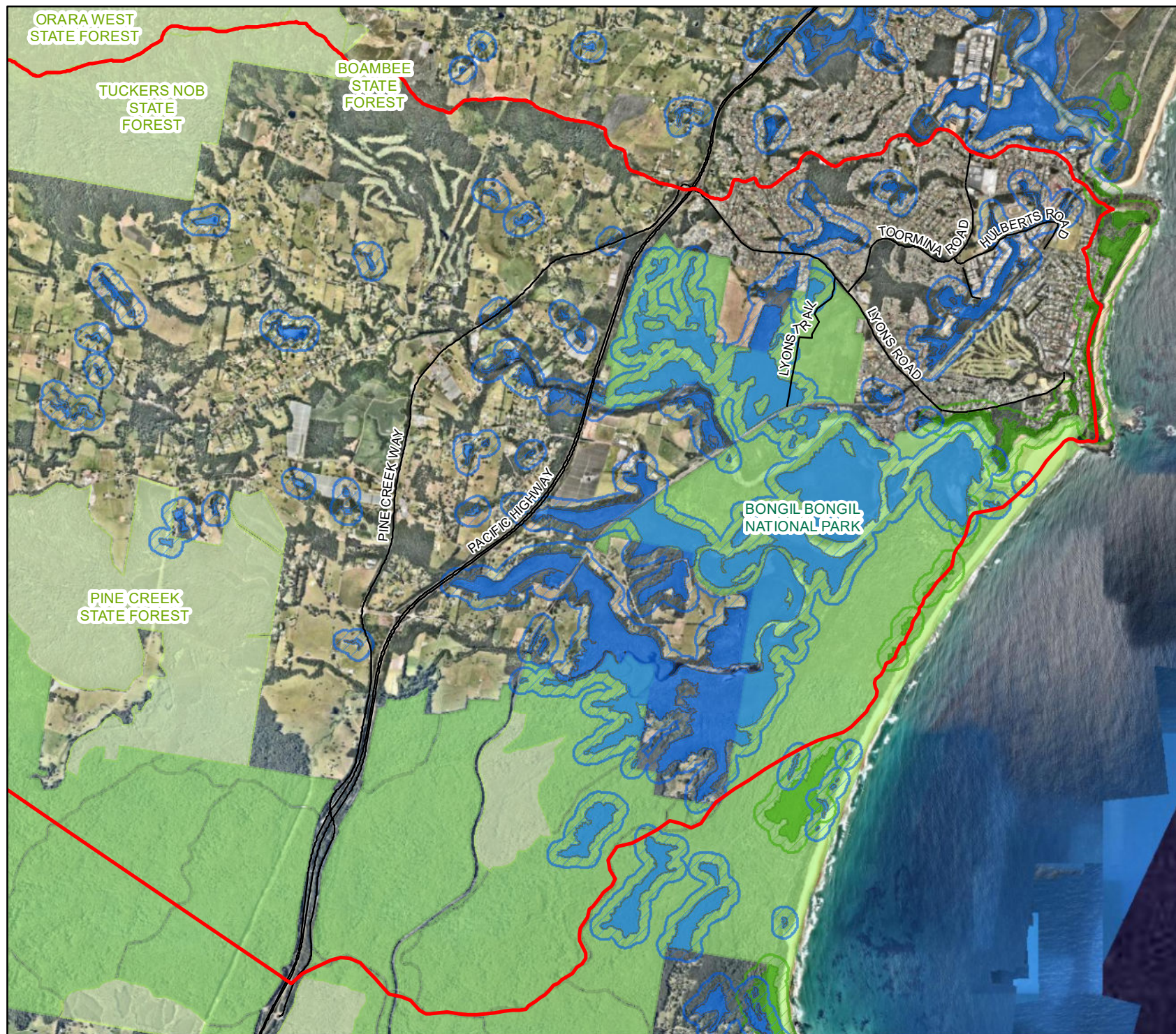
- Bonville and Pine Creek Study Area
- Roads
- ++ Railway
- Stream
- Suburb
- Local Government Area
- Estuary Drainage Catchment



1:20,000 Scale at A4



Map Produced by W&E NSW/ACT
Date: 2019-02-08
Coordinate System: GDA 1994 MGA Zone 56
Project: 59917103_CMP
Map: 59917103-GS-023-CMP_Townships.mxd 01



COFFS HARBOUR
CITY COUNCIL

Coastal Wetlands and Littoral Rainforests

(SEPP CM 2018)

BONVILLE AND PINE CREEK
COASTAL MANAGEMENT
PROGRAM

FIGURE 1-4

Legend

Study Area

— Roads

SEPP CM 2018

Coastal Wetlands

Coastal Wetlands Proximity Area

Littoral Rainforest

Littoral Rainforest Proximity Area

National Park

State Forest

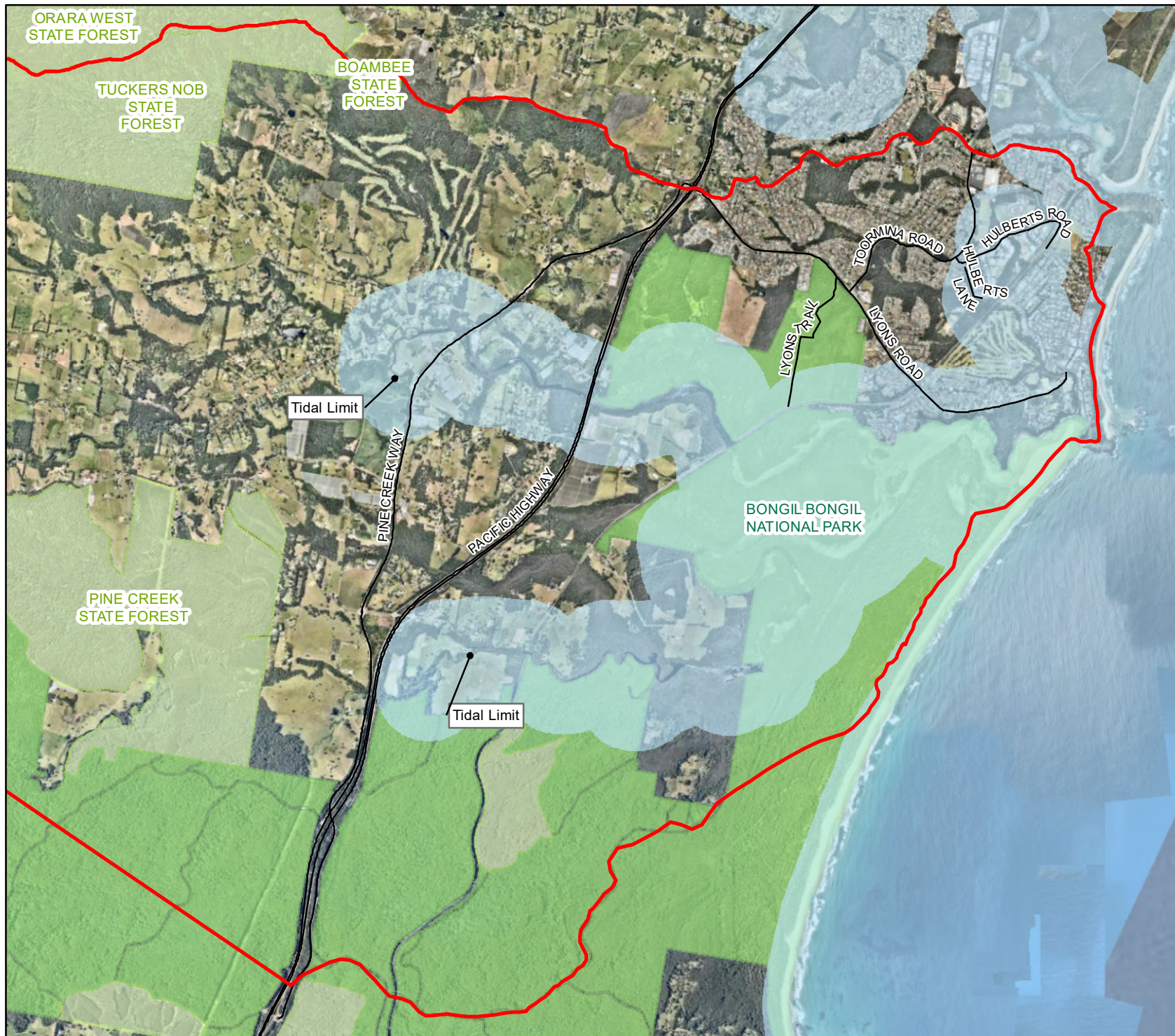


1:50,000 Scale at A4

Meters
0 250 500 1,000 1,500



Map Produced by W&E NSW/ACT
Date: 2019-02-08
Coordinate System: GDA 1994 MGA Zone 56
Project: 59917103
Map: 59917103-GS-024-CMP_CMA_WetlandLitFormxd 01
Imagery supplied by neamap 2018



Coastal Environment Area (SEPP CM 2018)

BONVILLE AND PINE CREEK
COASTAL MANAGEMENT
PROGRAM

FIGURE 1-5

Legend

Study Area

— Roads

SEPP CM 2018

Coastal Environment Area

National Park

State Forest



1:50,000 Scale at A4

Meters
0 250 500 1,000 1,500



Map Produced by W&E NSW/ACT
Date: 2019-02-08
Coordinate System: GDA 1994 MGA Zone 56
Project: 59917103_CMP
Map: 59917103-GS-025-CMP_CMA_EnvArea.mxd 01
Imagery supplied by neamap 2018



Coastal Use Area

(SEPP CM 2018)

BONVILLE AND PINE CREEK
COASTAL MANAGEMENT
PROGRAM

FIGURE 1-6

Legend

- Study Area
- Roads
- National Park
- State Forest
- SEPP CM 2018**
- Coastal Use Area



1:50,000 Scale at A4

Meters
0 250 500 1,000 1,500



Map Produced by W&E NSW/ACT
Date: 2019-02-08
Coordinate System: GDA 1994 MGA Zone 56
Project: 59917103_CMP
Map: 59917103-GS-026-CMP_CMA_UseArea.mxd 01
Imagery supplied by neamap 2018

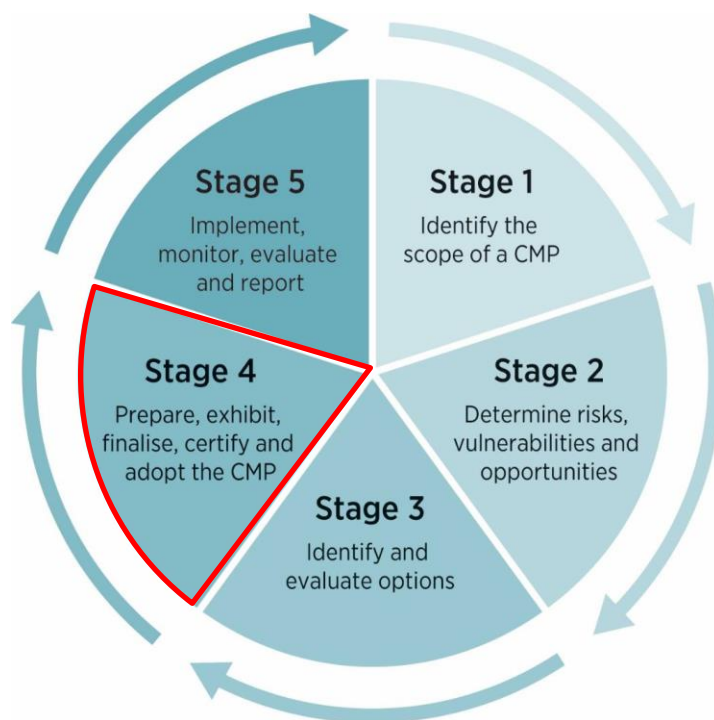


Figure 1-7 **Process for preparing a CMP in accordance with the CM Act**

2 Estuary Processes, Issues and Risk Assessment

An Estuary Condition and Community Uses Study (Cardno, 2017c) was prepared for the estuary as part of Stage 2 of the coastal management process. The Estuary Condition and Community Uses Study comprised a review of critical processes, vulnerabilities and opportunities for each of the four coastal management areas. Natural processes, demographic characteristics, development patterns and anticipated future changes to natural and built environments were considered for the estuary. The report is summarised in this section.

2.1 Estuary Processes

The Bonville and Pine Creek estuary condition is influenced by complex interactions between physical, chemical and biological processes, and these processes may vary over both short and long timeframes. Generally speaking, the estuarine condition at any given time reflects the relative influence of catchment driven forces such as freshwater and fluvial sediment inputs, and coastally driven forces such as tidal exchange and wave action.

The typical processes that influence estuary condition are summarised in **Table 2-1**.

Table 2-1 Overview of estuary processes

Process	Description
Catchment processes	<ul style="list-style-type: none"> The principal catchment processes that affects each an estuary are the spatio-temporal variations in stormwater runoff and pollutant loads (e.g. nutrients, sediments and contaminants) delivered to the waterway. The climate, soil types, terrain and development condition will all affect the volume and rate of runoff, as well as the sediment loading in the runoff and the type and mass of contaminants delivered to the estuary. The magnitude of influence that catchment inflows will have on estuarine processes is dependent upon the relative size of the estuary waterway and its catchment. Where the surface area and volume of a lagoon is large relative to the catchment size, catchment inflows will generally have a lesser impact on the estuary (and vice versa). When rain falls on the catchment, a range of pollutants may become entrained in the flow of stormwater runoff and make their way into the estuary via tributary creeks and drainage lines. The amount (or loadings) of these different pollutants will vary depending upon the specific characteristics of each catchment. Depending upon the characteristics of the receiving waterbody, this may result in impacts on estuarine processes such as estuarine siltation and sedimentation, or algal blooms due to high nutrient concentrations (or eutrophication).
Hydraulic processes	<ul style="list-style-type: none"> The water movements within an estuary are driven by a range of processes including water inflows from the catchment, atmospheric exchange at the water surface and oceanic influences, all three of which affect the exchange of water between the estuary and adjacent ocean. Typically, the estuarine hydraulics will be dominated by the ocean water levels and tidal processes. During catchment flood events, however, catchment inflows dominate, significantly influencing estuarine water levels and flow velocities, and overriding the tidal signal. Atmospheric exchange of gases and water vapour resulting in evaporation and changes in, salinity, nutrients and dissolved oxygen concentrations. Light penetration and heat exchange (temperature changes) result in water density (salinity and temperature) changes and density driven currents that are important drivers of the estuarine water quality response.
Morphology and sediment dynamics	<ul style="list-style-type: none"> Estuaries exhibit dynamic morphology over short and long-time frames. The transport and re-distribution of sediments delivered to the estuary by marine sand ingress and fluvial sediment loads from the catchment is affected by the hydrodynamics, and this in turn determines the morphological evolution of the estuary. Marine sand may be delivered to the estuary by waves and tidal currents as they propagate into the entrance channel. During regular rainfall events, erosion in the catchment delivers sediments to the creeks where they may be transported downstream to the estuary. As the freshwater inflows enter the main estuary basin they spread out and slow down, causing sedimentary material to fall out of suspension and onto the estuary bed forming a fluvial delta.

Process	Description
	<ul style="list-style-type: none"> During catchment flood events, high velocity flows can cause significant bed scour of the river and/or estuary bed, which can result in the transport of large volumes of sediments within the system.
Water quality processes	<ul style="list-style-type: none"> Water quality is a general term that is used to describe concentrations of various constituents in a water body. Constituents are generally grouped into the following broad categories of variables: <ul style="list-style-type: none"> Physio-chemical variables (e.g. temperature, salinity, pH, oxygen); Nutrients (e.g. nitrogen, phosphorous); Microalgae (measured as chlorophyll-a or algal cell counts); Heavy metals (e.g. iron, manganese, mercury, zinc, etc.); Organic compounds (e.g. pesticides and herbicides); and Pathogens (e.g. faecal coliforms, enterococci). Concentrations of these constituents within an estuary vary depending upon a range of physical and biogeochemical processes, and have important implications for higher life forms (or trophic levels), and for human recreation. Typically, water quality processes are driven by a balance between inputs from the catchment, biogeochemical processing (internal changes) within the estuary and tidal flushing (or export from the estuary). Mixing of the lagoon waters will also be determined by wind energy inputs, freshwater inflows and surface heating and cooling processes that control vertical water density stratification and mediate the metabolic rates of microorganisms. Even when an estuary is well flushed by tidal exchange there may be locations within an estuary where mixing and flushing is more limited and there is potential for water quality issues to occur. Under well flushed conditions, estuarine waters would comprise well mixed brackish waters, with low levels of turbidity. Light penetration through the water column would be high, with both pelagic and benthic primary productivity possible where water depths permit. At these times nutrient inputs are relatively low, and concentrations would be influenced by biological processes in the water column and biogeochemical processes that lead to exchange between the water column and the estuary bed. During high catchment inflow events, the freshwater inflows will be laden with suspended sediments that affect light penetration (and the photic depth to which photosynthesis can occur) and nutrients, that provide a food source to micro and macro algae. There will be a recovery period after the flood event when poor water quality conditions persist for a number of days, particularly in the upper estuary, as tidal exchange again becomes the dominant mechanism of flushing the estuary and water quality conditions stabilise.
Ecological processes	<ul style="list-style-type: none"> The ecological processes that determine estuarine ecosystem characteristics and functioning are a complex interplay between the hydrological, hydrodynamics, bio-geochemical, floral and faunal processes. These processes operate at a range of space and time scales within the estuary and the system characteristics at any given point in time are a result of the antecedent conditions over days that affects water quality, weeks and months for algal blooms, seasons that affect fish breeding and migration and changes in seagrass cover and adjustments due to weather patterns.

2.1.2 Entrance Dynamics and Coastal Protection Works

The entrance to Bonville Creek is subject to moderate to high energy wave climate. It is exposed to prevailing ocean swell conditions from the south-east and south, and is protected from the north-east by Bonville Headland.

The estuary entrance berm is a dynamic system and cycles through open and closed conditions. When closed, the water levels in the estuary can rise and cause localised flooding. High rainfall in the catchment can result in entrance breakouts. The sand build-up is generally associated with periods of low ocean waves (beach building conditions) and either catchment flooding induced breakouts or ocean storm waves on top of high ocean water levels that erode the beach and berm.

The entrance dynamics and wave conditions create an erosive environment in the Bonville and Pine Creek estuary. Bank erosion and scour are significant issues and have been noted at several locations in the estuary mouth. Coastal protection works have been constructed at several of these locations, however, this protection is insufficient in some places, and other areas remain unprotected and hence vulnerable to events causing erosion.

Climate change has the potential to exacerbate erosion risk in the estuary. More severe storm events may result in increased erosion of the entrance dunes and erosion of the bank material in the lower estuary as waves propagate up the channel. Loss of the entrance berm would significantly alter the entrance dynamics, mixing and water flows in the entrance. Increased rainfall will result in higher runoff which can erode the banks of the channel and modify entrance breakout regularity.

Additional infrastructure occurs within National Parks estate; however, this is outside the scope of this CMP.

2.1.3 Sedimentation

Sedimentation, including the sources and mechanisms of transport, is discussed in detail in the Estuary Processes Study (Patterson Britton and Partners, 2003). The major factors affecting sediment movement in estuaries are (Patterson Britton and Partners, 2003):

- > Freshwater and tidal currents – the faster these currents, the greater the shear stress and turbulence generated at the bed, the greater the movement of sediment by bedload and suspended load transport; and
- > Residual sediment fluxes – arise when there is a significant difference between peak flood tide velocities and peak ebb tide velocities. Tidal distortion and gravitational circulation can cause net upstream movement of bed material. This is the main mechanism within the lower Bonville estuary causing extensive upstream migration of marine sediments.

In general, sediment build-up appears to be occurring in the lower more tidally active reaches upstream to Dolmans Point (Patterson Britton and Partners, 2003). At the time of preparation of the Estuary Processes Study, sedimentation of marine sands was evident to about 1 km above the confluence of Pine and Bonville Creeks, indicating the estuary is in a state of dynamic sediment settlement and deposition. A review of aerial photography (www.nearmap.com) indicates that as of May 2017, sedimentation is evident in Bonville Creek about 400 m above the confluence of Pine and Bonville Creeks, and about 1 km above the confluence in Pine Creek. This may be a result of a flood event between 2003 and 2017 that washed sediment down the estuary.

2.1.4 Sediment Compartment

Bonville Pine Creek estuary is part of the 'Urunga' sediment compartment which extends from Coffs Harbour to Nambucca North Head (**Figure 1-2**).

According to CoastAdapt, the dominant regional processes influencing coastal geomorphology in this region are the south-easterly swells driving northerly longshore transport in the northern part, and the El Niño-Southern Oscillation (driving beach erosion/accretion cycles, cyclone frequency). Onshore winds also play a significant role in beach dune building, transporting marine sediments from the lower beach face to the coastal dune system. Regional hazards or processes driving large scale rapid coastal changes include: East Coast Lows (extra-tropical cyclones), mid-latitude cyclones (depressions), and storm surges (<1m).

There are several tertiary compartments that have trapped sand as beach ridge barriers. Bonville Beach is backed by a relatively wide barrier.

The (net) northerly longshore transport could influence the geomorphologic development at the entrance of the estuary, and vice versa. Sediments suspended in the surf zone are advected into the estuary via tidal currents where they are deposited in the form of a flood tide delta. These sediments are periodically scoured during rainfall events when they are transported from the estuary entrance area to the open coast sediment transport pathways.

2.1.5 Wetland Hydrology and Water Quality

Wetlands provide important hydrological and ecosystem functions. They improve water quality by trapping sediments, filtering out pollutants and absorbing nutrients that might otherwise result in poor water quality downstream. Wetlands reduce the risk of flooding by slowing down the movement of floodwaters along rivers and releasing water over time.

Wetland hydrology incorporates ground and surface water flow, including tidal flows, and evapotranspiration (Lee *et al.*, 2006). Hydrological regimes interact with sediment and nutrient supplies, and are impacted by topography, vegetation types, rainfall, and land uses (Lee *et al.*, 2006).

Urbanisation in the upper catchment may result in changes in the hydrological regime that supports coastal wetlands. Bonville has been identified as an urban release area. Urbanisation can have the following impacts on the hydrological regime of wetlands (Lee *et al.*, 2006):

- > Decreased surface storage of stormwater and increased surface runoff which results in increased surface water input to wetlands;
- > Increased impervious areas and therefore stormwater discharge, leading to more erosion in creeks increasing sedimentation in the lower estuary. This can also cause scour in wetlands;
- > Reduced water quality (increased turbidity and nutrients, decreased dissolved oxygen); and
- > Decreased groundwater recharge and decreased groundwater flow resulting in reduced base flow in streams which has implications for stream flow in dry conditions.

Alterations in wetland hydrology can also lead to shifts in vegetation composition. Some wetland species are more tolerant to waterlogging and/or salinity than others.

The entrance condition is an important consideration for water quality in the Bonville and Pine Creek estuary. The entrance is predominantly open, but can close on occasion, which tends to result in higher water levels in the lower estuary. This can cause localised short-term flooding, which is alleviated when a rainfall event causes the higher creek flow that can scour the lower estuary sand build-up and re-open the entrance. The entrance is not actively managed by Council.

While the periodic opening and closing of the entrance is characteristic of these types of estuaries, it is noted that the entrance behaviour can impact the composition of vegetation and ecological communities that occur around the estuary due to changed patterns of inundation.

Water quality monitoring has been undertaken by Ryder *et al.* (2012) as part of the Coffs Harbour Region EcoHealth Project and again in 2014-2015 (Ryder *et al.*, 2016). In summary, an extended suite of parameters was tested in 2014-15 compared to 2011 and it was concluded that water quality improved in the Bonville Creek compared to the 2011 EcoHealth study and water quality in Pine Creek slightly deteriorated compared to 2011.

Sources of potential pollution include point sources and diffuse sources. The Environmental Protection Licences (EPLs) issued by the EPA were searched to identify potential licensed point sources of pollution in the catchment. No active EPLs were in force in the catchment. Other point sources include stormwater outlets.

Potential diffuse sources include:

- > Agricultural runoff including nutrients, pesticides and herbicides;
- > Urban runoff including sediments and fertilisers (for example from Council parks, Sawtell Golf Course and private properties);
- > Sewage from septic tanks in the upper estuary;
- > Suspended solids from catchment or bank erosion; and
- > Runoff from major transport corridors (including the Pacific Highway, Pine Creek Way and the North Coast Railway).

2.2 Estuary Values

2.2.1 Ecological Values

2.2.1.1 Coastal Wetlands

Coastal wetlands are mapped in the SEPP CM along Pine Creek (lower and upper) and in lower Bonville Creek. There are approximately 257 ha of wetlands mapped in the study area, with an additional buffer area of about 330 ha.

Wetlands provide an important biological function. They provide habitat for birds, fish and other marine animals. Seven endangered ecological communities (EECs) protected under the NSW *Biodiversity Conservation Act 2016* (BC Act) are present within the mapped coastal wetlands and buffer areas including:

- > Coastal Saltmarsh;
- > Freshwater Wetlands;
- > Littoral Rainforest;
- > Lowland Rainforest;
- > Subtropical Coastal Floodplain Forest;
- > Swamp Oak Floodplain Forest; and
- > Swamp Sclerophyll Forest.

In addition, the majority of the estuarine macrophytes are located in the mapped coastal wetlands (with the exception of seagrasses).

The majority of the wetlands are within the bounds of Bongil Bongil National Park; however, some of the mapped wetlands extend beyond the National Park into the suburb of Bonville. The wetlands in the National Park are protected under the *National Parks and Wildlife Act 1974* (NP&W Act) and managed under the Bongil Bongil National Park Management Plan (NPWS, 1999). An updated management plan, the Bongil Bongil National Park Draft Plan of Management (NPWS, 2017), was on public exhibition (closed 14 August 2017).

2.2.1.2 Littoral Rainforests

Littoral rainforests are mapped to the north of the Bonville Headland on the Sawtell Beach dunes. This area of littoral rainforest, about 3.6 ha with an additional 14.6 ha of buffer, is on the border of the study area. One EEC protected under the BC Act (Littoral Rainforest EEC) is present in the mapped littoral rainforest and buffer areas.

2.2.1.3 Estuarine and Riparian Habitats

Bonville and Pine Creek estuary provides diverse habitat including rocky intertidal shores, sandflats, mangroves, saltmarsh, seagrass and riparian vegetation. Seven endangered ecological communities are present within the study area that provide vital wildlife corridors and habitat for threatened and migratory species.

2.2.1.4 Other EECs and Threatened and Protected Species and Populations

Cardno (2017c) provides a description of the biodiversity of the study area, including EECs, threatened species and populations, and protected species and populations. The key findings of the review presented in that study are as follows:

- > There are seven EECs are present in the study area (refer **Sections 2.2.1.1 and 2.2.1.2** of this report);
- > Searches for threatened species returned records for a range of species, including:
 - 39 plants, six amphibians, 70 birds, 20 mammals (terrestrial and marine), seven reptiles and eight fish species listed under the BC Act, Fisheries Management Act 1994 and/or Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) that either have previously, or have potential to occur within the LGA, and
 - 51 migratory species (both terrestrial and marine) protected under the EPBC Act were also identified as having been previously recorded in, or having the potential to utilise the study area for the purposes of feeding, resting, reproducing or as part of a migratory route (Cardno 2017c, Section 6.5.3). ;
- > Threatened species of note include:
 - Black Grass-dart Butterfly (*Ocybadistes knightorum*) and Floyd's Grass (*Alexfloydia repens*): Floyd's grass is restricted to the Coffs Harbour to Macksville regions of NSW and is the sole known food plant and provides critical habitat for the black grass-dart butterfly (NPWS, 2017),
 - Little Terns (*Sternula albigula*) are listed as endangered under the BC Act. Bongil Spit (the sand berm at the entrance to the estuary), in Bongil Bongil National Park, is now the largest and most productive Little Tern and Pied Oystercatcher (*Haematopus longirostris*) breeding colony in northern NSW

(NPWS, 2016). In 1997 the Little Tern was thought to be locally extinct and a recovery program was initiated to restore the ecosystem these shorebirds need for seasonal breeding (NPWS, 2016). The Little Tern Recovery Plan (NPWS 2003) is currently managed under the NSW Saving our Species Program, and

- Pied Oystercatcher (*Haematopus longirostris*): Bongil Spit is a large and productive breeding colony for the species.

2.2.2 Cultural and Heritage Values

2.2.2.1 Aboriginal Heritage Values

Wetlands are of high cultural significance to Aboriginal people (OEH, 2013). The study area is within the Country for the Gumbaynggirr People. The Coffs Harbour and District Local Aboriginal Land Council (LALC) was contacted as part of stakeholder consultation. The LALC noted that Bonville and Pine Creek were used extensively by Gumbaynggirr people for the abundant resources, for travel, trade and ceremony. The area remains significant for the Gumbaynggirr people. The LALC would like the traditional custodians to be acknowledged and valued within the CMP and promoted to the wider community. It was suggested that one of the objectives in the CMP should be to “preserve, protect and promote the natural environment and the cultural heritage of Gumbaynggirr people”.

There are several sites of Aboriginal cultural heritage significance that have been formally recorded in the study area, and numerous additional sites are predicted to occur along undisturbed sections of the coastline and along the creeks (NPWS, 2017). The Estuary Processes Study (Patterson, Britton and Partners, 2003) indicated that ten Aboriginal sites are located within the Bonville and Pine Creek catchment, with eight of these located within estuarine limits. The sites include shell middens, open camp sites, and a carved tree. A search of the Aboriginal Heritage Information Management System (AHIMS) database conducted in May 2017 returned records for 26 Aboriginal sites located in the lower estuary.

It should be noted that the AHIMS search only includes information on Aboriginal objects and places provided to the NPWS. There may exist numerous Aboriginal objects or sites of cultural heritage value that have not been recorded in the AHIMS database.

Aboriginal cultural heritage is currently protected under the NP&W Act, and any activities that may impact on a site or feature listed in the AHIMS database must be assessed in accordance with the Due Diligence Guidelines (OEH, 2015b). It is recognised that there is potential for previously unrecorded Aboriginal heritage items to occur in the study area, and this should be considered in any proposals in the study area.

It is noted that Aboriginal cultural heritage legislation is currently in a process of reform. It is expected that once complete a new standalone instrument will remove provisions in the current NP&W Act and create a new Act to manage Aboriginal cultural heritage. It is not clear when these reforms will be implemented but the implications for estuary management will need to be reviewed at such time.

2.2.2.2 Historic Heritage Values

Wetlands have historical and social significance because of their contribution to the development of inland regions (OEH, 2013). The Estuary Processes Study (Patterson Britton and Partners, 2003) provides a detailed description of European settlement in the region, summarised herein. The study area has an extensive history as part of the timber industry and agricultural development. European settlement began in the 1830s and 1840s with the arrival of cedar cutters and sheep and cattle pastoralists. Sawmills were set up in or near the forests and tram and light railway tracks were built. Some remnants of these old tracks are present in some areas in the catchment. The North Coast Railway was completed in 1915 linking Coffs Harbour to Sydney. Two fishing trawlers also operated in the estuary anchoring near the Old Boat Shed. By the 1950's recreational activities were becoming increasingly popular leading to the development of walking tracks.

Listed heritage in the catchment includes:

- > Bonville Creek Underbridge listed under S.170 NSW State Agency Heritage Register, owned by the Australian Rail Track Corporation. The Bonville Creek Underbridge is a good representative example of a large steel truss bridge built over a major waterway in the early 20th century as part of the North Coast Railway;

- > High Conservation Value Old Growth Forest (across 15 LGAs Upper North East NSW) listed under the State Heritage Register, Listing No. 01487; and
- > There are numerous local heritage listings in the catchment with the majority in the suburb of Sawtell: Bonville Headland and Sawtell Reserve are also listed under the LEP.

2.2.3 Community and Recreational Values

The estuary is a very valuable part of the landscape for the local community. It provides recreational opportunities, visual amenity, and a refuge for wildlife and habitat conservation. The community survey asked respondents to consider what features of the estuary are important. The values in order from most important to least important are:

1. Access to, and enjoyment of, the estuary waterway and foreshores;
2. Water quality (for swimming and boating);
3. Natural beauty and the landscape character;
4. Ecological values of the estuary;
5. Bongil Bongil National Park;
6. Recreational infrastructure (boat ramps, picnic tables, access tracks, public toilets);
7. Community infrastructure (roads, water and sewage pipes);
8. The opportunity to live in the area;
9. Tourism infrastructure (e.g. the Caravan Park); and
10. Agricultural / horticultural activities.

Access to and use of the estuary is considered very important to the majority of respondents, followed by natural beauty and ecological features including Bongil Bongil National Park.

Access to the estuary is available at various locations, as described below:

- > Bonville Headland provides walking paths and views over the estuary;
- > The park on Boronia Street provides a stairway to the waterway;
- > Sawtell Beach Holiday Park provides access to the waterway via stairs and ramps;
- > Micks Retreat, off Lyons Road, provides access to the waterway via a ramp;
- > Dolmans Point, accessed from Lyons Road, has a picnic area, BBQ and lookout over the entrance;
- > The boat ramp off Lyons Road is the only Council owned and operated boat ramp to the estuary;
- > Bongil Bongil National Park has several walking tracks providing access to the estuary foreshores;
- > Bongil Picnic Area off Williams Road has a boat ramp, which is owned and operated by NPWS; and
- > An informal access point to Bonville Creek is available from Pine Creek Way.

2.2.4 Public Infrastructure and Socio-economic Values

2.2.4.1 *Public Infrastructure*

Urban development is concentrated around Middle Arm Creek and the lower reaches of Bonville Creek at Sawtell and Toormina. The majority of the catchment is rural or undeveloped National Park and State Forest land. The developed parts of the coastal environment area include residential and rural residential development, commercial, tourism facilities (e.g. Caravan Park), and Council assets. Council assets in the coastal environment area include local roads, public amenities (toilets, seating, etc.), community buildings (sports sheds, clubhouses, etc.), parks and sporting facilities, bike racks, bus shelters, footbridges and boardwalks, footpaths and cycle ways, and a boat ramp off Lyon's Road. The upper reaches of the coastal environment area are typified by rural residential and agricultural properties.

The majority of stormwater pits, pipes and headwalls (or outlets) are concentrated around Middle Arm Creek and the lower reaches of Bonville Creek. Sewer lines, rising mains and pumping stations are also concentrated around Middle Arm Creek. Two gross pollutant traps (GPTs) treat stormwater runoff from the catchment. One of these GPTs is owned and managed by Council, and is located on Fourth Avenue, Sawtell near Sawtell Beach.

Typical pollutants found in urban stormwater runoff include gross pollutants (e.g. rubbish or leaf litter), sediments, heavy metals, nutrients and faecal pathogens from animal waste and human waste in sewer overflows. The concentrations of these different pollutants will vary depending on the specific characteristics of individual sub-catchments. Typical pollutants associated with agricultural and horticultural activities include nutrients (nitrogen and phosphorus), pesticides, herbicides and sediments. Depending on the attributes of the receiving waterbody, this may result in impacts on estuarine processes such as siltation and sedimentation, or algal blooms due to high nutrient concentrations or faecal contamination from intensive animal farming lots.

Council maintains a Water Sensitive Urban Design (WSUD) Policy which states that “the principles of WSUD (as contained in the CHCC WSUD Guideline (CHCC, 2012)) are to be applied, to ensure all urban infrastructure is compatible with the natural features of the site, thereby reducing negative impacts on the natural water cycle and protecting and improving the health of aquatic ecosystems and riparian vegetation, including surface and ground water resources, rivers, streams, wetlands, estuaries and marine environments” (CHCC, 2013). The widespread implementation of WSUD principles is critical to the protection of the estuarine ecosystems and is being increasingly applied as a way of minimising the impacts of urbanisation on waterways (Engineers Australia, 2010).

2.2.4.2 Land Use

The main land uses in the catchment include agriculture, conservation (including National Park and State Forest), residential and recreation.

Residential areas are clustered in the north-east corner of the study area, north of the entrance to Bonville and Pine Creeks. The main residential suburbs within the catchment are Sawtell and Toormina and a small section of Boambee East. The suburbs of Bonville and Bundagen make up the west and south of the catchment respectively.

Sawtell and Toormina are made up of R2 Low Density and R3 Medium Density Residential zoned areas with an IN1 General Industrial area and B2 Local Centres. The suburbs are interspersed with areas zoned as RE1 Public Recreation. Bongil Bongil National Park and the lower estuary is zoned as E1 National Parks and Nature Reserves. The majority of the suburb of Bundagen is made up of the National Park and the rest is zoned E2 Environmental Conservation, RU2 Rural Landscape and RU3 Forestry. Bonville is a mix of R5 Large Lot Residential, RU2 Rural Landscape and RU3 Forestry. Bonville Golf Course (RE2 Private Recreation) is located off Pine Creek Way.

The upper catchment, Bonville, is generally made up of agricultural properties including cropping and grazing, and forestry. Cropping activities include banana plantations, orchards, melons and potatoes (Patterson Britton and Partners, 2003) as well as blueberries. Blueberry farming is expanding in the upper catchment. A review of aerial photography between 2004 and 2016 shows a 28-ha increase in white netting which is indicative of blueberry farming (from less than 1 ha in 2004).

2.2.5 Educational and Scientific Values

The estuary has educational and scientific value to the local community and scientific community:

- > The estuary is utilised as an educational resource for local schools;
- > The Little Tern Recovery Program has been a significant success resulting from the community partnering with state government agencies; and
- > University of New England conducts research in the estuary, including the EcoHealth monitoring program.

2.3 Climate Change

Climate is a dominant factor in the behaviour of the catchment and ocean influences on the estuary characteristics. This CMP has considered climate change projections, the potential impacts of climate change and whether these need to be taken into account for the ongoing adaptive management of the estuary.

Key climate processes that are likely to influence estuaries under climate change include:

- > Sea level rise;
- > Rainfall;
- > Temperature and evaporation;
- > Solar radiation;
- > Wind speed and direction;
- > Wind waves; and
- > Ocean acidification.

The key climate change projections of relevance for the Bonville and Pine Creeks estuary is found in the North Coast Climate Change Snapshot (OEH, 2014c), which summarises the NSW and ACT Regional Climate Modelling (NARClIM) project, which has produced downscaled modelling for various regions in south-east Australia.

Council's Climate Change Policy 2013 adopts a projection of 0.91 m sea level rise above 1990 mean sea level by 2100.

Bonville and Pine Creek estuary is a barrier, or wave dominated, estuary. Glamore et al, 2016 has determined the vulnerability of this type of estuary to various climate variables, which have been considered in this study (Cardno, 2017d).

The potential impact of climate change on various aspects of the coastal management areas have been considered in Stage 2 of the CMP preparation and a detailed overview is to be found in Estuary Conditions and Community Uses Study (Cardno, 2017c). Keys potential impacts of climate change include:

- > Erosion risk in the estuary is exacerbated by severe storm events and increased rainfall;
- > More frequent inundation of low-lying areas round the estuary due to sea level rise and increased stormwater surcharge and higher water groundwater levels;
- > More frequent and severe instances of overland flooding due to heavier rainfall;
- > Salt water intrusion of groundwater due to sea level rise;
- > Decline in water quality as the sediment load may increase due to higher air temperatures, increased evaporation, and increased sediment mobilisation from the catchment into the estuary;
- > Loss of habitat for wading birds including threatened species (eg Little Tern, Sooty Oystercatcher) due to permanent inundation of intertidal areas due to sea level rise;
- > Loss of saltmarsh due to landward migration of mangroves due to sea level rise; and
- > Seagrass is potentially negatively impacted due to decline in light penetration.

2.4 Projected Demographic and Land Use Changes

Urban expansion and intensification of land use can have several implications of the coastal management areas. For example, urban development may pose threats to water quality (through runoff, stormwater and sewerage), erosion and sedimentation, and loss of biodiversity (through land clearing).

Population growth and land use intensification projections have been addressed in the Community and Stakeholder Engagement Plan (Cardno, 2017b) and during Stage 2 of this CMP (Cardno, 2017c). A review of the demographic characteristics of the study area was undertaken with reference to the 2011 Census conducted by the Australia Bureau of Statistics. The Bonville and Pine Creeks estuary catchment boundary

is largely coincident with the Sawtell – Boambee Statistical Area Level 2 (ABS, 2017). The key demographics were:

- > 19.8% of the population are under the age of 15 years and 17.6 are aged 65 years or older;
- > The total number of respondents identifying as being an Indigenous Australian was 4.6% for Sawtell – Boambee; and
- > Almost all residents speak English at home.

Other key considerations include the following:

- > The Coffs Harbour LGA population is projected to increase by 16,800 to 2036 (from 75,850 in 2016 to 92,650 in 2036), with a projected increase in 8,950 dwellings during this time period (DPE, 2016);
- > As identified in the North Coast Regional Plan 2036 the locality of Bonville has been identified as an Urban Release Area totalling approximately 59 ha in Bonville off Pine Creek Way and North Bonville Road near Bonville Golf Course. The urban release areas are zoned for 550 m² lots and 1,200 m² lots with a total of 1,035 lots proposed;
- > There is no information available about potential changes in demographics a result of the projected population growth and it is assumed they would stay roughly similar to the present day. Similarly, there is no information available on seasonal fluctuations in population (e.g. due to holiday makers) but it is understood the population significantly increases over the summer holiday and other holiday periods;
- > Blueberry farming is expanding in the upper catchment; and
- > Climate change projections have been considered in relation to land use intensification and urban development. With projections of intense storms with higher rainfall and longer dry periods, it is important that future urban developments and land releases are planned appropriately to protect life, natural ecosystems and property.

2.5 Snapshot of Issues

Key issues and threats were derived from the estuary conditions and community uses assessment, stakeholder engagement and community survey. This also includes the considerations related to projections in relation to climate change, population growth and land use (refer **Sections 2.3 and 2.4**).

The following threats that could undermine the management objectives and the objectives of the coastal management areas were identified for each management area:

- > Coastal wetlands and littoral rainforests
 - Urbanisation of the catchment altering the hydrological and sedimentation regimes in the estuary and associated coastal wetlands and littoral rainforest;
 - Edge effects on coastal wetlands and littoral rainforests, including weed infestation;
 - Clearing and fragmentation of vegetation;
 - Climate change impacts, including inundation from sea level rise, erosion of coastal dunes, changes to rainfall and flooding regimes, increased temperatures and droughts; and
 - Recognition of the Aboriginal cultural heritage and historical heritage values.
- > Coastal vulnerability areas
 - Adequacy of coastal protection works in the estuary mouth;
 - Bank erosion and scouring in the estuary mouth up to Dolmans Point and into Middle Arm Creek; and
 - Impacts of climate change on coastal vulnerability areas.
- > Coastal environment areas
 - Limited public access to the estuary waterway and foreshores;
 - Inundation of public access, and public infrastructure as a result of sea level rise;

- Increased development in the catchment impacting the coastal environment area;
 - Lack of information relating to fish stocks and threatened species;
 - Clearing of riparian vegetation due to increased agriculture (cropping and stock access) and urbanisation in the middle and upper catchment;
 - Reductions in water quality as a result of increased development and agriculture in the middle and upper catchment;
 - Climate change impacts on infrastructure and development;
 - Climate change impacts on soils and water quality;
 - Climate change impacts on estuarine biodiversity; and
 - Recognition of the Aboriginal cultural heritage and historical heritage values.
- > Coastal use areas
- Urban expansion and intensification of development including opposition to development;
 - Blueberry farming and the impacts of the intensive agriculture on the estuary;
 - Climate change impacts on urban development; and
 - Recognition of the Aboriginal cultural heritage and historical heritage values.

These threats were used to derive risk statements for the risk assessment to identify high risks for the existing case and future planning horizons.

2.6 Risk Assessment

A risk assessment was conducted as part of Stage 2 and is documented in the Estuary Condition and Community Uses Study (Cardno, 2017c). The risk assessment methodology and results are presented in **Appendix C**.

2.6.1 Summary of Results

The risk assessment includes existing and future planning horizons. Population growth projection data is available up to 2036. A detailed assessment has therefore been performed for 30-year planning horizon (2050 – which encompasses the 20-year planning horizon required under the final Coastal Management Guidelines), and an indicative risk assessment for 50-year and 100-year planning horizons to foresee issues and trends in longer timeframes.

2.6.1.1 *Existing and 30-year Future Planning Horizon (2050)*

Those risks that are High or Extreme are considered unacceptably high levels of risk in the context of the management objectives. Key threats identified as resulting in high risks (at existing and/or at 30-year future planning horizon) include:

- > Coastal wetlands and littoral rainforests:
 - Sea level rise causes inundation, erosion of some areas causing potential decline (high risk in 30-year future planning horizon), and
 - Increased storm intensity and frequency in combination with increased population (resulting in ongoing land use change) results in increase of stormwater runoff, and decline of stormwater quality, which could negatively impact coastal wetlands and littoral rainforest (high risk in 30-year future planning horizon);
- > Coastal vulnerability area:
 - Sea level rise causing inundation, erosion of foreshore land, public infrastructure, facilities and loss of heritage sites (high risk in 30-year future planning horizon);
- > Coastal environment area:

- Vegetation clearing due to unrestricted cattle access and agricultural land usage (high risk in 30-year future planning horizon),
 - Declining fish population due to overfishing (high risk in 30-year future planning horizons),
 - Lack of knowledge on fish population leading to unrecorded decline in stocks (high risk in existing and 30-year future planning horizons),
 - Sea level rise causing degradation of riparian vegetation (high risk in 30-year future planning horizon), and
 - Increased storm intensity and frequency plus increased population (high risk in 30-year future planning horizon);
- > Coastal use area:
- Vegetation clearing for agricultural land uses resulting in net loss of vegetation and decline in water quality (high risk in 30-year future planning horizon),
 - Declining fish population (high risk in existing and 30-year future planning horizons),
 - Sea level rise (high risk in 30-year future planning horizon), and
 - Increased storm intensity and frequency plus increased population (high risk in 30-year future planning horizon).

These threats encompass the key issues of development and human impacts, water quality, bank erosion, fishery impacts, aquatic habitats, and maintenance of the aesthetic attributes of the estuary.

It is noted that the 30-year future planning horizon encompasses the 20-year planning horizon required under the final Coastal Management Guidelines (OEH, 2018).

2.6.1.2 50- and 100-year Future Planning Horizons (2070 and 2120)

Threats and risks in the longer planning timeframes (50 and 100 years) have been assessed as to whether they are expected to increase, stay the same or decrease compared to 2070.

In summary, the risks of threats related to climate change, population growth and land use intensification are all likely to increase over time. This means that the risk of almost all identified threats in this CMP are likely to increase over a 50-100-year timeframe, as they're all influenced by these aspects. The threats that are identified as 'Medium' risk at 30-year timeframe (**Appendix C**) could develop into a 'High' or even 'Extreme' risk in 50-100 years' time. Without appropriate mitigation measures the threats identified as 'High' at 30-year timeframe (**Section 2.6.1.1** and **Appendix C**) are likely to develop into an 'Extreme' Risk in future.

The Risk Assessment led to the following recommendations:

- > All identified threats in this CMP (refer **Appendix C**) are to be considered and reviewed at the next CMP review (10 years);
- > This CMP focusses on the threats that have a High risk identified at existing and 30-year future planning timeframe (encompassing the 20-year horizon), whilst considering the threats at 50 and 100-year planning time frames; and
- > Start and/or continue monitoring key indicators of estuary health to gain more understanding of the estuary condition and facilitate more accurate assessment of the threat in future reviews of the impact of management actions (**Section 6.2**).

3 Consultation

3.1 Engagement Strategy

A Stakeholder and Community Engagement Plan (Cardno, 2017b) was prepared during Stage 1 of the Bonville and Pine Creek coastal management process. The Engagement Plan set out the details of the consultation activities undertaken to inform the development of the CMP and was prepared in accordance with Council's Community Engagement Policy and the requirements of the CM Act.

One of the overarching objectives for the preparation of the Bonville and Pine Creeks Estuary CMP was to "involve the community in the preparation of the CMP, including making information relating to the plan publicly available". The Stakeholder Community Engagement Plan has been designed to ensure that the views of the community and key stakeholders were heard and that opportunities were provided to allow for input into the CMP.

Consequently, the objectives of the Engagement Plan were to:

- > Partner with Council to engage with the community and stakeholders in an effective fashion;
- > Increase community appreciation of estuary processes and the NSW Estuary and Coastal Management Program;
- > Engage with the community and stakeholders to seek information on existing community uses of the estuary, management issues and opportunities for action;
- > Ensure the community and stakeholders have opportunity to inform decision making on management options; and
- > Foster community and stakeholder ownership of the CMP.

3.2 Stakeholder Engagement

3.2.1 CEMAC

The key mechanism for consultation and the provision of technical advice to inform estuary management is via Council's Coastal and Estuary Management Committee (CEMAC). The CEMAC has a number of representatives from Council, state Government authorities and the community, including:

- > Councillor(s);
- > Council staff from strategy and implementation;
- > National Parks and Wildlife Service (NPWS);
- > Department of Primary Industries (DPI) – Marine Parks;
- > DPI – Fisheries;
- > Southern Cross University – Marine Science Centre;
- > State Emergency Service;
- > DPIE – Coasts and Estuaries (formerly OEH);
- > Northern Rivers Local Land Services (formerly the Catchment Management Authority);
- > Roads and Maritime Services (Maritime);
- > Department of Industry (DoI) - Lands & Water (Crown Lands) (DoI – Crown Lands);
- > Local Aboriginal Land Council;
- > Coffs Landcare; and
- > Three community representatives.

Members of CEMAC were engaged throughout the CMP development stages as described in **Table 3-1**.

Table 3-1 Stakeholder engagement activities

Date(s)	Description of engagement activity	Evaluation
17 May 2017	<p>CEMAC Meeting to inform stakeholders of the commencement of the Bonville and Pine Creeks CMP. A letter was also issued to CEMAC members to:</p> <ul style="list-style-type: none"> Identify external stakeholders that wish to have an ongoing involvement in the project. Assess whether the existing list of management issues is still relevant, and if there are any emerging issues. Prioritise management issues. Obtain inputs (e.g. data, studies, etc.) to the subsequent stages of the CMP. Seek to establish buy-in to the development of the CMP. 	Two responses to the letter were received (LALC and Southern Cross University).
25 August 2017	A letter was sent to stakeholder agencies identified as having primary or secondary responsibility for the identified management options seeking support for the implementation of these options.	<p>Responses indicating concurrence were received from DPI Fisheries, Roads and Maritime Services (Maritime), Environment Protection Agency (EPA), North Coast Local Land Services, National Parks and Wildlife Services (NPWS), and Office of Environment and Heritage (OEH; now DPIE – Coasts and Estuaries).</p> <p>Appendix D provides a summary of the concurrence received.</p>
11 October 2017	<p>Presentation to CEMAC:</p> <ul style="list-style-type: none"> To seek feedback and confirm that the draft CMP (RevA, Oct 2017) has adequately considered the input provided by the CEMAC. To seek the endorsement of the CEMAC for the draft plan (RevA, Oct 2017). To ensure the Committee members have a sense of ownership of the CMP. 	CEMAC endorsed the draft CMP after providing comments (Appendix D, Concurrence)
March 2019	<p>Public exhibition of the Final Draft CMP (RevD, Feb 2019)</p> <ul style="list-style-type: none"> To seek feedback and confirm that the draft CMP (RevD, Feb 2019) has adequately considered the feedback and views of CEMAC. To ensure CEMAC has a sense of ownership of the CMP. 	Several agencies provided further feedback on the CMP. This resulted in some modifications to the management actions, as discussed in Section 4 .

3.2.2 Adjoining Councils

As part of the Stakeholder Engagement Plan (Cardno, 2017b) the adjoining Councils Bellingen Shire Council and Nambucca Shire Council have been considered, and the following was the result:

- > Bellingen Shire Council has been identified as stakeholder in the process on 'Inform' level. The upper reaches of the Bonville Pine Creek catchment extends to and over the border of Bellingen Shire LGA. It involves a small undeveloped area. Bellingen Shire Council has been notified that preparation of the CMP was underway in May 2017 and a copy of the draft CMP has been supplied for their information and comment during the exhibition period, however no comments were received; and
- > As the Estuary can be considered a closed system with negligible impact on the far south coastline Nambucca Shire Council has not been included as stakeholder in the preparation of this CMP.

3.3 Community Engagement

The community was provided with the opportunity to participate in the development of the CMP at a number of points throughout the CMP process as described in **Table 3-2**.

Table 3-2 Community engagement activities

Date(s)	Description of engagement activity	Evaluation
21 April 2017 to 12 May 2017	<p>Online community survey targeting management issues, values, and opportunities for management</p> <ul style="list-style-type: none"> To improve awareness of the Coastal and Estuary Management Process. Assess whether the existing list of management issues is still relevant, and if there are any emerging issues. To understand what values the community associates with the study area. To identify the type of management options that may be supported by the community. To ensure the community feel they have had opportunity to provide input to the project. 	159 survey responses
20 July 2017	<p>Community workshop</p> <ul style="list-style-type: none"> To provide an update on the CMP. To directly incorporate feedback from the community into the options assessment. To report back on the survey findings. To demonstrate that community feedback has been considered. To ensure the community feel they have had opportunity to provide input to the project. 	Eleven attendees
24 July 2017 to 4 August 2017	Online community survey targeting comments on the proposed vision, management objectives, and the identified management options	29 survey responses
27 March to 25 April 2019	<p>Public exhibition of the Final Draft CMP:</p> <ul style="list-style-type: none"> To seek feedback and confirm that the draft CMP has adequately considered the feedback and views of the community. To ensure the community has a sense of ownership of the CMP. 	No submissions were received from the community

4 Management Actions

Management options were developed as part of Stage 3 of the CMP preparation process with the aim to:

- > Identify potential management actions and responses to address coastal issues, and identify opportunities to enhance coastal values;
- > Evaluate strategic responses and actions and identify which of these are possible, practical and feasible

Potential management options have been drawn from the following sources:

- > The management actions identified in the Bonville and Pine Creeks Estuary Management Plan, Draft Revision (CHCC, 2008);
- > The risks and opportunities identified in the Estuary Conditions and Community Uses Study (Cardno, 2017c);
- > Suggestions made by the community in response to the Stage 2 community survey; and
- > The Cardno study team (compiled of relevant experts) based on their experience in coastal management.

The Statutory and Management Context as per **Section 1.3** has been an essential consideration during this process, as well as input from the Community and Stakeholders (refer **Section 3**).

A list of 30 management options were identified for assessment. These options were assessed for their feasibility and viability (**Section 4.1**) leading to a ranked list which identified the options that provide the most benefit and prioritise funding (**Appendix E**).

Following public exhibition of the Final Draft CMP, several agencies provided some final comment on the CMP and the management actions contained therein. This resulted in some changes to the list of management actions, including:

- > Removal of four management actions from the list of actions for implementation in the first 10 years of operation of this CMP; and
- > Addition of one new management action.

These are discussed in **Section 4.1.3**.

Each management option was assigned a unique identifier consisting of a number (e.g. Option 1). For purposes of traceability, the unique identifiers have been maintained throughout the optioneering process and carried over as the options have been translated into management actions in this CMP.

4.1 Options Assessment Methodology

The options assessment process adopted for this project has been developed to enable direct comparisons between each option, and to rank options in a transparent and unbiased (as far as practicable) manner, so as to identify those having the greatest overall benefit for estuary management. In recognition of the fact that the resources for implementation of these options are limited, the process of ranking management options will also assist in prioritising options for implementation. Once management options are selected for inclusion in the CMP they are referred to as management actions.

The options assessment methodology was developed in accordance with the Manual (OEH, 2018) which incorporates a feasibility assessment, and a viability evaluation.

4.1.1 Feasibility Assessment

Options were assessed for their feasibility which included an assessment of the legality of the option, whether the option aligns with the objectives of the CMP, consistency of the option with Council's long-term financial plan and capacity, and community acceptability of the option.

A multi-criteria assessment matrix-based framework was implemented. The multi-criteria matrix allows options to be assessed on a common basis using a quadruple bottom line approach (accounting for social, environmental, governance, and economic factors).

The benefit index assessment has been prepared using the following environmental, social, governance and economic indicators:

- > Environmental and social factors in accordance with the stated objectives of the CMP:
 - Water quality,
 - Sedimentation and erosion,
 - Riparian vegetation corridors,
 - Fish stocks,
 - Natural environment and cultural heritage,
 - Educational resource,
 - Community amenity and facilities,
 - Community acceptability;
- > Governance:
 - Consistent with statutory and non-statutory framework,
 - Consistency with Council long term financial plan and capacity,
 - Compatibility with policy and legislative framework; and
- > Economic (considered in the viability assessment):
 - Capital cost of implementation,
 - Annual recurrent costs.

Each management option was scored to assess how well it performed against each of the assessment criteria in accordance with the methodology described in **Table E-1 of Appendix E**. These scores were then summed to calculate a raw benefit index with possible values between -23 and +23. A positive score indicates a level of benefit while a negative score indicates a net disadvantage in the option considered.

4.1.2 Viability Assessment

The viability assessment included an assessment of the capital and ongoing costs for the option to determine the net present value.

Options were costed using professional judgement and in consultation with Council and DPIE – Coasts and Estuaries regarding projects of similar scope. The capital cost of implementation, and the annual recurrent costs were estimated. The Net Present Value of each option was calculated based on a function of the preliminary estimate of capital cost and the annual recurrent cost over a 10-year period of implementation, adopting a 7% discount rate.

The Cost: Benefit Index is calculated based on a function of the Net Present Value and the Net Benefit Index (identified during the feasibility assessment). The Cost: Benefit Index was then used to rank the options and identify the preferred option(s), which can be found in **Table E-2 in Appendix E**.

4.1.3 Changes to Management Actions Following Public Exhibition of the CMP

As indicated in **Section 4.1**, following public exhibition of the Final Draft CMP, additional feedback was received from relevant agencies on the management actions. This has resulted in some changes to the management actions as follows:

- > **Fish Study (Action 11):** While DPI Fisheries manages fish stocks on a State-wide basis using a suite of monitoring assessment techniques, they do not routinely undertake specific monitoring or studies in individual estuaries. The focus of their activities is aimed at improving State-wide management outcomes and policy, and any other activities they undertake are subject to funding or need. The proposed fish study is not considered a priority for their organisation within this context, and they therefore do not consider it appropriate to take responsibility for this management action at this time. On this basis it is recommended that Action 11 be removed from the list of priority actions for implementation in the CMP,

noting that it can be re-adopted in the event a suitable source of funding for the Fish Study becomes available in future, whether implemented by Council or DPI Fisheries.

- > **Fish Stocking (Action 14):** DPI Fisheries undertakes re-stocking but this occurs on a case-by-case basis and is subject to need and funding on a State-wide basis. As funding of this action cannot be guaranteed, it was considered appropriate to remove Action 14 from the list of actions in the CMP. In the event that there is an opportunity in future to secure funding for fish stocking, the action could be adopted.
- > **Review of Recreational Boating and Improved Management (Action 15):** Having initially supported this proposed management action, RMS subsequently advised that they could not take primary responsibility for this management action. Although they prepare Boating Management Plans to manage boating safety, Bonville and Pine Creek Estuary is not considered a priority for development of a Plan at this time. Given Council does not have authority under the *Marine Safety Act 1998* to regulate navigation, they have decided to remove this action from the CMP. In the event boating safety in the Estuary becomes a higher priority on a State-wide basis in the future, there is opportunity to re-adopt this action under the CMP.
- > **Enforcement of Fishing Regulations (Action 28):** As noted by DPI Fisheries, this action is undertaken by as part of their routine compliance activities across NSW and that there will be no additional resources allocated to increasing the frequency or length of compliance activities that may occur within the Bonville Pine Creek area. As such, it was considered appropriate to remove this action from the CMP.
- > **Develop guiding principles for recreational areas within the study area (Action 18):** As noted by DoI – Crown Lands, with the commencement of the *Crown Land Management Act 2016*, there is a requirement for Council managers of Crown land under the *Local Government Act 1993* to develop Plans of Management consistent with the new Act. Action 18 has been re-worded to reflect this new requirement. Further detail on the updated Action 18 are provided in **Appendix F**.
- > **Environmental Protection Works (New Action 31):** Council currently undertakes a range of routine environmental protection works (such as vegetation and weed management activities) across the LGA. A new action has been developed for inclusion in the list of priority management actions in the CMP to provide for the ongoing implementation of environmental protection works, as required, in the Study Area. Further details are provided in **Section 4.2.5**.


4.2 Priority Management Actions to be Implemented by Council or by Public Authorities

The analysis described in the **Section 4.1** resulted in a ranked list of management actions. The highest ranking management actions have been shortlisted as priority management actions (noting the changes described in **Section 4.1.3**) and are further detail is provided in **Sections 4.2.1-4.2.7** below.




An indicative timeframe for the completion of the CMP is provided in **Appendix G**.

4.2.1 Further Investigations

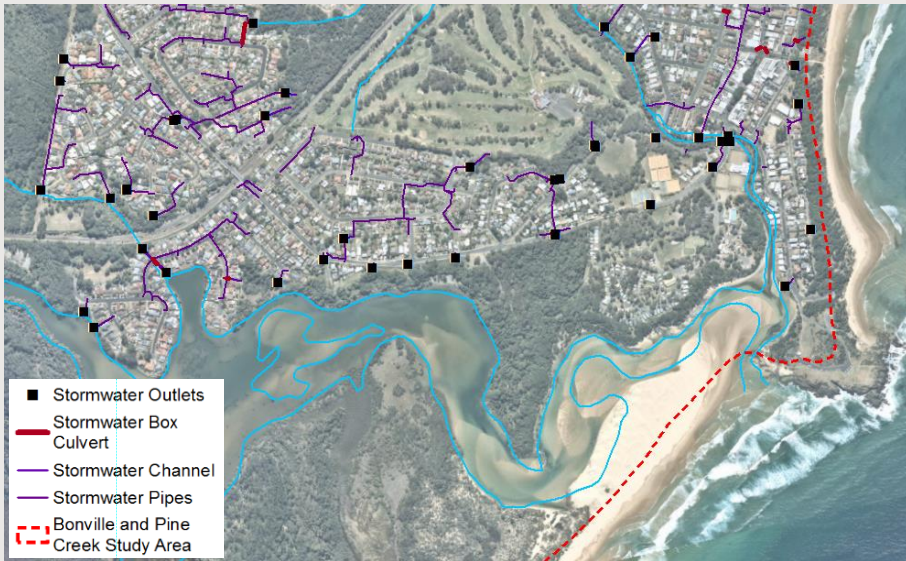
Action:	Estuary Entrance Behaviour Investigation	Action ID: 16 Rank: 1
Description	<p>Undertake an investigation of historic and potential future estuary entrance behaviour. Assess the interaction between the entrance condition, flooding and coastal processes, and how these impact on built and natural assets. Based on the outcomes of the assessment, consider the need to develop an entrance management plan and/or undertake stabilisation works (refer Actions 6, 12 and 17).</p> <p>It is important to understand the entrance dynamics of the estuary in order to properly plan for the management of the coastal zone. The entrance dynamics play a significant role in local flooding, sediment transport and local wave conditions in the estuary. In addition, entrance dynamics can have significant impacts on the ecological aspects of the estuary. The coastal processes within the sediment compartment (across Bellinghen and Nambucca Shire Councils) would also need to be considered as input for this study.</p> <p>It is considered prudent to understand and plan for the potential impacts of climate change on estuaries including hydrology, entrance behaviour and ecology.</p> <p>It is possible that the investigation may recommend capital works, however it is not possible to cost these at this time. In the event capital works are recommended, they would be considered actions under this CMP.</p> <p><u>Tasks</u></p> <ul style="list-style-type: none"> Model entrance behaviour under existing and climate change scenarios. Assess the likely hydrological changes resulting from sea level rise scenarios. This can include investigation of tidal planes and phasing, tidal prism volumetric analysis, tidal flushing, and changes to shoaling behaviour and water levels throughout the estuary. Assess the likely ecological impacts as a result of hydrological changes. This is to include assessment of at-risk species and ecological communities such as mangroves, saltmarsh and Floyds Grass. Assess the likely changes to entrance behaviour (including historical events) and consider mitigation and/or management actions. Assess the inter-relation between estuary and the sediment compartment it is part of, under existing conditions, sea level rise scenarios and potential mitigation and/or management actions. This assessment is to be informed by coastal processes of the open coast, which may be subject to separate studies. <p><u>History of entrance closure</u></p> <ul style="list-style-type: none"> Entrance closure is a rare event with known closures occurring in 2012 and in the 1970s. Both times this has occurred following a flooding event where the mouth of creek was realigned further south and the entrance berm was overtopped. This resulted in the removal of vegetation along the entrance berm. Due to ongoing south-easterly winds and lack of protective vegetation, the sand was transported into the entrance and closed the entrance off. During the 2012 closure there was pressure from residents to artificially re-open the entrance due to sustained inundation on their gardens (mainly lawns). At this time, Council advised the community that this would not be a trigger to mechanically open the estuary. Assessment of sewer and water infrastructure indicate that these assets would not be impacted by inundation. The trigger to open the entrance in 2012 was the impact on Floyd's Grass, an endangered species, which was dying as a result of inundation. Floyd's Grass is also the sole food plant for the caterpillar of the Endangered Black Grass-dart Butterfly (<i>Ocybadistes knightorum</i>) (OEH, 2017) and it was nearing breeding season for this butterfly. <p><u>Guiding principles for planning entrance management strategies</u></p> <ul style="list-style-type: none"> Collaboration and communication with NPWS. The entrance berm is within the Bongil Bongil National Park and flooding is known to impact Floyds Grass, an endangered species, which is known to occur in the National Park. Triggers for entrance opening are to be agreed by Council and NPWS. Consideration should be given to water levels, length of inundation, season (i.e. breeding season for the Black Grass-dart Butterfly), and weather forecast. Review and update (if required) of entrance management procedures should occur every 5-10 years with consideration given to climate change impacts such as sea level rise, inundation and salinisation of ground waters noting that Floyd's Grass does not tolerate high salinity levels (OEH, 2017). Review impact of entrance management procedures on hydrodynamic and geomorphologic processes on regional scale (including climate change scenarios). Relevant stakeholders would 	

Action: Estuary Entrance Behaviour Investigation		Action ID: 16 Rank: 1
	need to be considered and involved in the process if required (eg Bellingen Shire Council, Nambucca Shire Council).	
Threat/Hazard Addressed and Risk Rating	Existing coastal protection works providing insufficient protection from coastal hazards resulting in damage to infrastructure	Medium (existing and future)
	Climate change (increased storm intensity and frequency, storm surge, sea level rise) altering entrance behaviour and estuarine processes, impacting public infrastructure and increasing bank instability	Low to medium (existing) Medium to high (future)
	Flooding, ocean waves, tidal currents and storm surge resulting in damage to infrastructure and bank instability / erosion	Medium (existing and future)
	Sedimentation of the estuary reducing amenity and recreational uses	Medium (existing) Medium to high (future)
Coastal management objective addressed	<input checked="" type="checkbox"/> Improve and maintain water quality; <input checked="" type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input checked="" type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
Cost	Capital cost: \$60,000 (to engage external consultant) Annual cost: \$0	
Responsibility	Primary: Council and National Parks and Wildlife Service (NPWS) Secondary: N/A	
Timeframe for implementation	Short: 1-2 years	
Location Map		

Action:	Condition Assessment of Coastal Protection Works	Action ID: 17 Rank: 10
Description	<p>Assess condition of existing coastal protection and bank stabilisation works at Boronia Park. This is to include consideration of where coastal protection works may need to be extended or retrofitted to manage ongoing and future risk, and consideration of environmentally friendly seawalls.</p> <p>The Estuary conditions and Community Uses Study (Cardno, 2017c) identified that the existing coastal protection works along Boronia Avenue are not sufficient; failure has occurred in some places and erosion is evident along the banks. Following the investigation of the entrance behaviour (Action 16), a condition assessment of existing coastal protection works should be undertaken to allow for proper management options to be considered.</p> <p>In assessing management options for coastal protection works, consideration should be given to environmentally friendly seawalls. Environmentally friendly seawalls are built to minimise environmental impacts, more closely mimic natural foreshores and provide greater environmental value (e.g. greater habitat potential) than traditional seawalls (OEH & SMCMA, 2012). The following guideline, Environmentally Friendly Seawalls: A Guide to Improving the Environmental Value of Seawalls and Seawall-lined Foreshores in Estuaries (OEH & SMCMA, 2012), should be consulted when considering environmentally friendly seawalls.</p> <p>This action aligns with Action FS.10 in the Coffs Harbour CZMP (BMT WBM, 2013), to conduct an investigation of existing seawall protection to determine protection for houses and roadway. The option in this CMP relates specifically to Boronia Avenue and the protection of the public reserve, however, the option may also be used to inform potential protection measures for land along Middle Creek (refer Action 12) and Sawtell Reserve.</p> <p><u>Tasks</u></p> <ul style="list-style-type: none"> Engage specialist consultant to undertake investigation Initiation and review. Review of results of estuary entrance behaviour investigation (Action 16), review of historical overtopping data (if available), legislative and regulatory framework for coastal protection works, consultation with Council and landholders. Data collection. Site visit to review existing coastal protection works at Boronia Avenue including survey works. Data analysis. Assessment of wave run-up and overtopping (including climate change scenarios) for the existing coastal protection works at Boronia Avenue. Recommendations. If remedial works are recommended, identify management options and the costs of such works. Reporting. The condition assessment outcomes would be documented in a report. Council can then schedule works into the IP&R framework as required 	
Threat/Hazard Addressed and Risk Rating	Existing coastal protection works providing insufficient protection from coastal hazards resulting in damage to infrastructure	Medium (existing and future)
	Climate change (increased storm intensity and frequency, storm surge, sea level rise) altering entrance behaviour and estuarine processes, impacting public infrastructure and increasing bank instability	Low to medium (existing) Medium to high (future)
	Flooding, ocean waves, tidal currents and storm surge resulting in damage to infrastructure and bank instability / erosion	Medium (existing and future)
Coastal management objective addressed	<input type="checkbox"/> Improve and maintain water quality; <input checked="" type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
Cost	Capital cost: \$50,000 (to engage external consultant) Annual cost: \$0	

Action:	Condition Assessment of Coastal Protection Works	Action ID: 17 Rank: 10
Responsibility	Primary: Council Secondary: N/A	
Timeframe for implementation	Medium: 2-5 years Trigger: Completion of Option 16: Estuary Entrance Behaviour to understand wave heights and estuary entrance condition to inform review of coastal protection work.	
Location Map		
		
	Coastal protection along Boronia Street looking back towards the ocean.	Coastal protection works at stairway leading to estuary on Boronia Street

Action:	Stormwater Management Assets	Action ID: 5 Rank: 12
Description	<p>Review Council's stormwater management assets with a view to reducing impacts on estuarine water quality and hydrology. Issues for consideration include:</p> <ul style="list-style-type: none"> ▪ The location and/or orientation of stormwater outlets in relation to sensitive ecosystems. ▪ Scour and sedimentation around stormwater outlets. ▪ Opportunities to improve existing or implement new stormwater quality improvement devices. <p><u>Background</u></p> <p>Council has approximately 300 stormwater assets in the catchment. This review of assets will focus on those outlets that discharge into Bonville Creek, Pine Creek or Middle Arm Creek.</p> <p>This option involves a review of stormwater outlets that discharge into the estuary to identify those assets that may require upgrading and/or maintenance to improve estuarine health. As the catchment becomes more urbanised, stormwater discharge will be altered and can have downstream impacts to estuarine health. Impacts of urbanisation include:</p> <ul style="list-style-type: none"> ▪ Increased volume of stormwater flow which can result in scour around outlets. Potential for mitigation of scour may include installation of rock or riprap and/or geotextile around the outlet to slow stormwater flow and prevent scour. ▪ Changes in stormwater flow can also result in a build-up of sediment around outlets that can block flow. Potential for mitigation may include installation of stormwater quality improvement 	

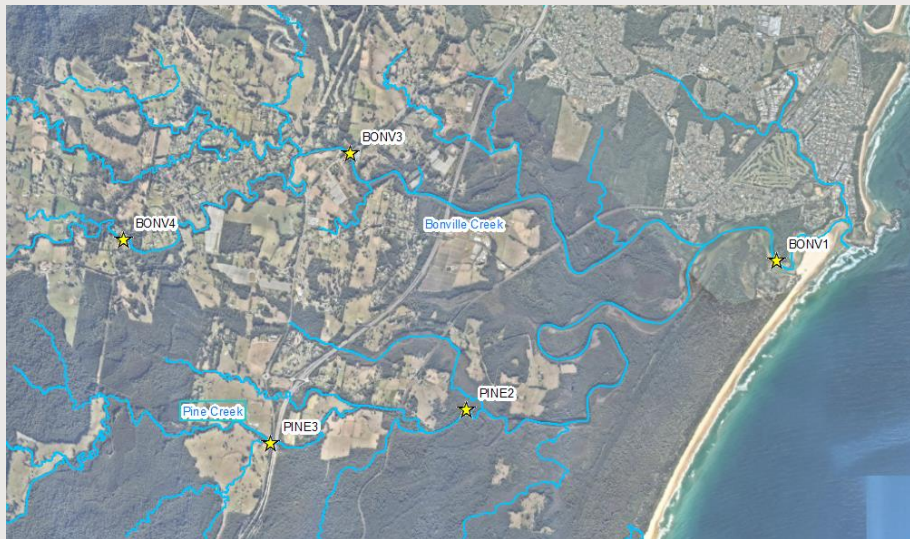
Action: Stormwater Management Assets		Action ID: 5 Rank: 12
	<p>devices to capture and retain sediment, or altering the orientation of stormwater outlets to allow for tidal flows to remove built up sediment.</p> <ul style="list-style-type: none"> Changes in stormwater quality (such as nutrients and suspended solids) which can influence downstream estuarine water quality. Potential for mitigation may include installation of stormwater quality improvement devices. <p><u>Tasks</u></p> <ul style="list-style-type: none"> Initiation and review. Data collation. Identify stormwater outlets discharging to estuary. Undertake visual inspection of stormwater outlets and identify any issues (e.g. scour, build-up of debris such as leaf litter or plastics, blockages). Conduct limited water sampling near outlets to identify those areas that may require installation of a stormwater quality improvement device. Review location of sensitive ecosystems (such as seagrass and saltmarsh) against the location of stormwater outlets and their orientation. Data analysis: identify works to improve conditions of stormwater outlets. Develop identifiable trigger points for asset improvement works. Reporting. Collation of all information into final report and update of asset register. Ongoing management. Periodic review of trigger points and implementation of works as required. 	
Threat/Hazard Addressed and Risk Rating	Land use changes (increasing urbanisation, intensive agriculture) altering nutrient loads and modifying stormwater runoff	Medium (existing and future)
	Climate change impacts (altered rainfall patterns, storm surge, flooding, sea level rise)	Low to medium (existing) Medium to high (future)
Coastal management objective addressed	<input checked="" type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
Cost	Capital cost: \$75,000 (to engage external consultant) Annual cost: \$0	
Responsibility	Primary: Council Secondary: N/A	
Timeframe for implementation	Short: 1-2 years	
Location Map		

4.2.2 Environmental Monitoring

Action: Coastal Inundation Monitoring		Action ID: 23 Rank: 7
Description	<p>Monitor frequency, depth and spatial extents of coastal inundation events propagating up the estuary (see corresponding action M.2. in the Coffs Harbour CZMP (BMT WBM, 2013)). The information can be used to gain a greater appreciation of potential climate change impacts and potential impacts of climate change on estuarine ecology, and inform adaptive management.</p> <p>It is important to collect data which can be used to inform management actions over the long term. The purpose of this option is to gather data regarding inundation depths and extents, and potential impacts on estuarine ecology. This information should be added to a database such that trends can be identified and inundation events can be compared. This data can also be fed into risk assessments, for example, when updating the CMP.</p> <p><u>Tasks</u></p> <ul style="list-style-type: none"> Identify monitoring locations and locate with GPS for input into GIS system. Develop database. Information to be gathered may include: <ul style="list-style-type: none"> Date of event, Depth of inundation; Period of inundation and period of peak of inundation; Information about the inundation event (e.g. rainfall, entrance berm status, storm intensity etc.); Proximity of significant features such as erosion escarpments, sedimentation fans, etc. (this information can be used to develop "triggers" for management / mitigation measures to be employed); and Impacts on estuarine ecology, in particular intertidal vegetation and EECs. Event based monitoring: During and after each inundation event, identify depth of inundation at each marker point. Reporting. The results of monitoring should be analysed for trends and change and reported to inform possible and future management. 	
Threat/Hazard Addressed and Risk Rating	Climate change impacts (sea level rise, storm surge)	Low to medium (existing) Medium to high (future)
	Inundation of assets (flooding, storm surge, ocean waves, tidal currents) Inundation of areas riparian vegetation, coastal wetland and littoral rainforest species, with potential for sub-lethal or lethal impacts.	Medium (existing and future) Medium (existing) to High (future)
Coastal management objective addressed	<input type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
Cost	Capital cost: \$0 Annual cost: \$5,000 (Council officer time to maintain database)	

Responsibility	Primary: Council Secondary: DPIE
Timeframe for implementation	Medium: 2-5 years
Location Map	N/A

Action: EcoHealth Monitoring Program		Action ID: 7 Rank: 11
Description	<p>Continue financial support for the EcoHealth monitoring program to inform understanding of the estuarine health and facilitate adaptation management.</p> <p>Continuation of this monitoring program has been recommended by this CMP as a way to continually monitor changes in the estuary and provide data to identify whether other management activities are contributing to the improvement or detriment of estuary health.</p> <p><u>Background</u></p> <p>EcoHealth is a four-yearly monitoring program undertaken by the University of New England and financially supported by Council and DPIE's Energy, Environment and Science group. The program is a standardised monitoring program to assess the health of coastal catchments in the LGA. The study monitors thirty-one sites (freshwater and estuarine) which includes three estuarine sites and two freshwater sites in the Bonville and Pine Creek catchment. The monitoring program includes assessment of:</p> <ul style="list-style-type: none"> ▪ Geomorphic condition; ▪ Riparian condition; ▪ Mangrove, seagrass and saltmarsh cover; ▪ Water quality; ▪ Aquatic macroinvertebrates; and ▪ Fish community condition. <p>Two baseline datasets have currently been collected (2011 and 2014-15).</p> <p><u>Tasks</u></p> <ul style="list-style-type: none"> ▪ Initiation. Provision of funding for 2018-19 (and ongoing) EcoHealth monitoring program. ▪ Data collection. Completion of field monitoring. ▪ Reporting. Collation of all information and comparison of new results with previous monitoring rounds. ▪ Ongoing management. Should the program identify ongoing management priorities and opportunities, these should be included in the CMP for implementation. <p><u>Notes</u></p> <ul style="list-style-type: none"> ▪ DPI Fisheries supports the undertaking of fish community condition assessments as part of the proposed EcoHealth assessments, if specific external funding is made available 	
Threat/Hazard Addressed and Risk Rating	Vegetation clearing and fragmentation resulting from agricultural land uses, and/or recreational pursuits. Impacts to riparian areas and water quality.	Medium (existing) Medium to high (future)
	Land use changes (increasing urbanisation, intensive agriculture) altering runoff	Medium (existing and future)
	Climate change (increased storm intensity and frequency, changing rainfall patterns, storm surge, sea level rise) resulting changes in water quality	Medium (existing and future)
	Flooding, ocean waves, tidal currents and storm surge resulting in bank instability and erosion	Medium (existing and future)
Coastal management objective addressed	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Improve and maintain water quality; <input checked="" type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input checked="" type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input checked="" type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research 	

Action: EcoHealth Monitoring Program		Action ID: 7 Rank: 11
Cost	Capital cost: \$0 Annual cost: \$15,000	
Responsibility	Primary: Council Secondary: Office of Environment and Heritage	
Timeframe for implementation	Short: 1-2 years	
Location Map		

4.2.3 Capital Works

With respect to any management actions that involve capital works, it is noted that any such works would be subject to further feasibility assessment. More detailed investigation may identify constraints that could result in modification of the project, or impact the project budget or timeline.



For example, more detailed investigations may identify contaminated land or Acid Sulfate Soils that require management. Ecological or heritage constraints may also result in modification of the proposed works and/or require adoption of design modifications, additional investigations or additional mitigation measures that have cost implications.

Further, each proposal would require environmental impact assessment under the EP&A Act, and may be subject to other environmental permits, licences or approvals, such as:

- > Landowner consent from DoI - Crown Lands under the Crown Lands Management Act 2016; or
- > A permit from DPI - Fisheries under the Fisheries Management Act 1994.

Appropriate stakeholder engagement should be undertaken, not only to meet the requirements of the EP&A Act and/or other legislation, but also to manage risk through project delivery. Due to the potential to encounter Aboriginal cultural heritage sites and artefacts, it is recommended that consultation with the CH&D LALC be undertaken in relation to any works proposed within the estuary, or along the estuary banks or riparian zones.

Action: Bank Stability Projects		Action ID: 6 Rank: 9
Description	<p>This action provides for a bank condition assessment to identify priority areas:</p> <ul style="list-style-type: none"> For improved maintenance / conservation of riparian vegetation and/or protection of the riparian zone from livestock. Subject to bank erosion or instability that may need stabilisation works, with due consideration of enhancing riverine / estuarine health and habitats. <p>Develop actions for these areas and incorporate them into the relevant program of works, whether under a Landcare program run by LLS, Council's program of works under their IP&R framework or another relevant program.</p> <p>It is noted that any recommendations for capital works arising out of this study are considered actions under this CMP, and would meet the definition of "coastal protection works" under the <i>Coastal Management Act 2016</i>.</p> <p><u>Tasks</u></p> <p>These tasks have been suggested assuming an initial assessment of the whole estuary and has been adopted for costing purposes. The actual tasks required to implement this action will need to consider the outcomes of the Estuary Entrance Behaviour Investigation, in addition to this proposed task list.</p> <ul style="list-style-type: none"> Engage specialist consultant to undertake bank condition assessment Initiation and review. Review of historical data, legislative and regulatory framework for bank works, consultation with Council and landholders. Data collection. Field assessment of the condition of the banks of the estuary to identify areas of erosion, sedimentation, weed infestation, natural vegetation and condition of natural vegetation, areas where stock access is evident, areas where fencing is present etc. Data analysis. Mapping of all data collected in the field into a GIS program. Identification of areas which require management. Prioritisation of areas. A review of land tenure / ownership and zoning should also be carried out at this stage to identify what types of management works can be undertaken. Recommendations. For each area, identify management actions / works required (e.g. soft treatments such as weeding, jute mats, planting, or hard treatments such as seawalls, or fencing to prevent stock access) and the costs of such works. Reporting. Collation of all information into a final report. Council can then schedule works into the works program as required, and liaise with Landcare and other community groups to undertake works. 	
Threat/Hazard Addressed and Risk Rating	Vegetation clearing and fragmentation resulting from agricultural land uses, and/or recreational pursuits. Expected to intensify as a result of population increases and land use zoning changes in the catchment in the future.	Medium (existing) Medium to high (future)
	Land use changes (increasing urbanisation, intensive agriculture)	Medium (existing and future)
	Climate change (increased storm intensity and frequency, storm surge, sea level rise) resulting in bank erosion and degradation of habitat	Medium (existing) Medium to high (future)
	Flooding, ocean waves, tidal currents and storm surge resulting in bank instability and erosion	Medium (existing and future)
Coastal management objective addressed	<input type="checkbox"/> Improve and maintain water quality; <input checked="" type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input checked="" type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
Cost	<p>Capital cost: \$75,000 (engage external consultant to undertake bank assessment)</p> <p>Annual cost: \$35,000 (Council officer to manage and liaise with Landcare over implementation period)</p>	

Action:	Bank Stability Projects	Action ID: 6 Rank: 9
Responsibility	Primary: Council Secondary: Local Land Services	
Timeframe for implementation	Medium: 2-5 years Concurrent with Action 2: Community Conservation and Restoration Programs	
Examples of erosion issues	 <p>Bank erosion adjacent to the stairway to the water on Boronia Street</p>  <p>Bank slumping at Micks Retreat opposite the Bongil Spit.</p>	

4.2.4 Recommended Actions Relating to the Relevant Planning Controls

Action:	Implementation of DCP	Action ID: 4 Rank: 3
Description	<p>Continue to implement DCP to support development and environmental protection in the catchment, taking into account the biodiversity and coastal statutory reforms.</p> <p>Key issues for estuarine health include:</p> <ul style="list-style-type: none"> Stormwater management from both urban and rural areas Visual impacts and landscape character, to ensure maintenance of existing rural and bushland character Vegetation management and restrictions on clearing Landscaping in urban areas to reduce heat impacts and promote greening. 	
Threat/Hazard Addressed and Risk Rating	Vegetation clearing and fragmentation resulting from agricultural land uses, and/or recreational pursuits. Expected to intensify as a result of population increases and land use zoning changes in the catchment in the future.	Vegetation clearing and fragmentation resulting from agricultural land uses, and/or recreational pursuits. Expected to intensify as a result of population increases and land use zoning changes in the catchment in the future.
	Land use changes (increasing urbanisation, intensive agriculture) altering nutrient loads in catchment runoff, modifying stormwater runoff, and altering the visual amenity and rural character of the catchment	Land use changes (increasing urbanisation, intensive agriculture) altering nutrient loads in catchment runoff, modifying stormwater runoff, and altering the visual amenity and rural character of the catchment
	Climate change impacts (increased temperatures, altered rainfall patterns)	Climate change impacts (increased temperatures, altered rainfall patterns)
Coastal management objective addressed	<input checked="" type="checkbox"/> Improve and maintain water quality; <input checked="" type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input checked="" type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
Cost	<p>Capital cost: \$0</p> <p>Annual cost: \$50,000 (continued implementation of DCP)</p>	
Responsibility	<p>Primary: Council</p> <p>Secondary: N/A</p>	

Action:	Implementation of DCP	Action ID: 4 Rank: 3
Timeframe for implementation	Short: 1-2 years DCP is already implemented by Council.	
Examples of erosion issues	N/A	

Action:	As per the Rural Lands Strategy outcomes, review LEP and DCP with respect to intensive agricultural / horticultural activities		Action ID: 24 Rank: 6
Description	<p>Review Council's LEP and DCP with respect to regulation and control of development for intensive agriculture / horticulture. In particular, identify opportunities for regulation of certain activities as development requiring consent, and for additional development controls as required for monitoring the impacts of these types of development.</p> <p>The community survey undertaken as part of the Community Uses Assessment identified that the community is concerned about an increase in intensive agriculture in the upper catchment and the impact this is having on the catchment and runoff (including water quality impacts, sedimentation of the waterway, and the visual character of the catchment). The survey highlighted concerns about a lack of oversight and identified monitoring, reporting and financial penalties as management options.</p> <p>Consent is not currently required for agricultural activities in the upper catchment. This option would seek to identify whether development consent would provide more oversight for intensive agriculture and potentially limit negative impacts arising from increases in this type of development.</p> <p><u>Tasks</u></p> <ul style="list-style-type: none">▪ Investigate practices and potential impacts of different agriculture/horticulture activities▪ Review consent provisions in DCP / LEP▪ Introduce consent provisions in DCP / LEP (if required)		
Threat/Hazard Addressed and Risk Rating	Land use change to intensive agriculture (increased nutrient loads, vegetation clearing, visual amenity)	Land use change to intensive agriculture (increased nutrient loads, vegetation clearing, visual amenity)	
	Vegetation clearing (decline in water quality, unrestricted access to creeks causing erosion and sedimentation)	Vegetation clearing (decline in water quality, unrestricted access to creeks causing erosion and sedimentation)	
Coastal management objective addressed	<div><input checked="" type="checkbox"/> Improve and maintain water quality;</div> <div><input checked="" type="checkbox"/> Reduce estuary sedimentation and bank erosion;</div> <div><input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist);</div> <div><input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage;</div> <div><input checked="" type="checkbox"/> Maintain and improve riparian vegetation corridors;</div> <div><input type="checkbox"/> Understand and improve fish stocks; and</div> <div><input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research</div>		
Cost	Capital cost: \$5,000 (Council officer time) Annual cost: \$2,500		
Responsibility	Primary: Council Secondary: N/A		
Timeframe for implementation	Short: 1-2 years		
Examples of erosion issues	N/A		

4.2.5 Environmental Management

Action: Environmental Protection Works in the Study Area		Action ID: 31 Rank: new action
Description	<p>This CMP to enable Environmental Protection Works (EPW) to be undertaken in Coastal Wetland and Littoral Rainforest Areas (a defined by clause 10 of the SEPP CM) within the Study Area by Public Authorities under Part 5 of the EP&A Act.</p> <p>The following notes apply to this action:</p> <ul style="list-style-type: none"> EPW include those works that would meet the definition in the LEP, that is: 'environmental protection works means works associated with the rehabilitation of land towards its natural state or any work to protect land from environmental degradation, and includes bush regeneration works, wetland protection works, erosion protection works, dune restoration works and the like, but does not include coastal protection works'; EPW are typical activities undertaken by Council on an as needs basis as part of their general environmental management works; An important consideration for any vegetation removal in the Coastal Wetland and Littoral Rainforest Area (which may form part of EPW), is that it may trigger a Biodiversity Development Assessment Report (BDAR) under the BC Act (this does not include marine vegetation protected under the <i>Fisheries Management Act 1994</i>). Other works not including EPW in the Coastal Wetland and Littoral Rainforest Area would be deemed Designated Development under the EP&A Act. <p>The following activities meet the definition of EPW:</p> <ul style="list-style-type: none"> Revegetation works; Weed control; Dune rehabilitation; Bush regeneration; Erosion control*; and Bank protection and stabilisation*. <p>For those items marked with an asterisk (*), the primary intent of the works must be other than for coastal protection. For example, the works may be intended to protect the health of a waterway by preventing erosion and sedimentation, to re-establish riparian vegetation and/or improve its growth and retention, to provide fish habitat, etc.</p> <p><u>Tasks</u></p> <ul style="list-style-type: none"> Identify EPW, as required; Undertake appropriate environmental assessment under Part 5 of the EP&A Act, and considering other relevant approvals (if required); Implement works. 	
Threat/Hazard Addressed and Risk Rating	The public has a poor appreciation of habitat values and undertakes activities that lead to negative impacts on habitat condition and/or extent.	Medium (existing) Medium (future)
	Unrestricted cattle access causes bank erosion, loss of riparian vegetation and sedimentation of creeks.	Medium (existing) High (future)
	Establishment of weeds along banks and in riparian vegetation displaces native species resulting in degradation of the natural environment and riparian corridors.	Medium (existing) Medium to high (future)
	Vegetation clearing and fragmentation results in edge effects, and the degradation of vegetation quality through weed invasion and/or pollution.	Medium (existing) Medium to high (future)
	Boating activities and elevated water levels cause bank erosion and sedimentation and/or damage to habitat. This negatively impacts estuarine biota, and can result in reduced amenity or access for the community, or damage to facilities.	Low (existing) Medium to high (future)
	Erosion and Sedimentation negatively impact community access and/or recreational facilities, leading to reduced amenity.	Medium (existing) Medium (future)

Action:	Environmental Protection Works in the Study Area	Action ID: 31 Rank: new action
	Storm surge propagates up the estuary, causing bank erosion and sedimentation, and degradation of riparian habitats.	Medium (existing) Medium to high (future)
Coastal management objective addressed	<input type="checkbox"/> Improve and maintain water quality; <input checked="" type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input checked="" type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
Cost	Already subject to ongoing funding by Council (e.g. Environment Levy)	
Responsibility	Primary: Council Secondary: N/A	
Timeframe for implementation	For full duration of CMP implementation Environmental Protection Works are already part of Council's routine works.	
Location Map	Study Area	

4.2.6 Community Involvement and/or Education

Action:	Community Education Program	Action ID: 1 Rank: 4
Description	<p>Develop and implement a community education program on estuarine health and community uses of the estuary. This may include placement of educational signage promoting key features of the estuary such as littoral rainforests and important bird life and/or Aboriginal cultural heritage (e.g. at Pine Creek Way, Sawtell Beach dune and/or the boat ramp). Note: this will be done in consultation with LALC and elders.</p> <p>Public education can significantly improve the community's awareness of the environment, their understanding of how they impact on the environment, and what they can do to minimise their impacts and improve the condition of the estuary. Residents may not be aware of what constitutes best environmental management practice. The education programs would provide information to residents to inform them of these aspects. The materials used for education purposes may comprise brochures, posters, advertisements or relevant articles in the local newspaper or on Council's website.</p> <p>Key messages that may be conveyed include:</p> <ul style="list-style-type: none"> Historical and cultural significance of littoral rainforests and the surrounding area Ecological importance of littoral rainforests; Significant bird life in the estuary; What individuals can do to protect estuarine ecosystems. <p><u>Tasks</u></p> <ul style="list-style-type: none"> Collaboration with LALC and elders regarding educational opportunities and identify key messages to be conveyed. Design and install interpretive signage near Sawtell dunes, and public access areas to the estuary. Issue press releases to local media detailing the new signage, the importance of managing the estuary. Design and produce pamphlets for distribution in council buildings, the Caravan Park and/or shops. 	
Threat/Hazard Addressed and Risk Rating	Lack of understanding by community with regards: to habitat values, activities impacting habitat condition, importance of coastal wetlands and littoral rainforests to Aboriginal people and the social and cultural significance.	Medium (existing and future)

Action: Community Education Program		Action ID: 1 Rank: 4
	The illegal clearing of vegetation for public recreation pursuits or agriculture results in the degradation of coastal wetlands and littoral rainforest.	Low (existing) Medium (future)
Coastal management objective addressed	<input checked="" type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input checked="" type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
Cost	Capital cost: \$10,000 (preparation of materials, printing, and installation of signage) Annual cost: \$1,000 (ongoing maintenance of signage, and printing of brochures)	
Responsibility	Primary: Council Secondary: N/A	
Timeframe for implementation	Medium: 2-5 years	
Location Map	N/A	

Action: Community Conservation and Restoration Programs		Action ID: 2 Rank: 5
Description	<p>Continue to work with key stakeholders to engage with, and involve, community members in environmental conservation and restoration projects (e.g. via Bushcare, Landcare and Coastcare) in the catchment.</p> <p>This action provides for the ongoing support of existing Bushcare, Landcare and Coastcare programs within the study area and includes funding for expenses such as plants, landscaping supplies, training, or other equipment. Labour is provided by the community on a volunteer basis.</p> <p>Community consultation undertaken for this CMP has shown a desire for more community projects and community involvement in managing the estuary. Promotion of community programs such as Bushcare, Landcare and Coastcare by Council as well as provision of expert advice and resources will provide benefit to the community and to the environment. Community programs provide additional benefits by educating the community as to the importance of estuarine ecology, weed species management, and other ways that the community can improve the area in their everyday lives.</p> <p>This option can be initiated at any time; however, completion of Option 6 will provide a list of priority areas that can be targeted.</p> <p><u>Tasks</u></p> <ul style="list-style-type: none"> Provision of advice by Council to community groups regarding key areas for restoration. Mapping of community projects to prevent overlap and allow for follow-up investigation Ongoing liaison with community groups (include collection of data such as types of weeds in project areas, density of weeds, etc.). 	
Threat/Hazard Addressed and Risk Rating	Vegetation clearing and fragmentation resulting from agricultural land uses, and/or recreational pursuits. Expected to intensify as a result of population increases and land use zoning changes in the catchment in the future.	Medium (existing) Medium to high (future)
	Land use changes (increasing urbanisation, intensive agriculture)	Medium (existing and future)
	Establishment of weeds along banks and in riparian vegetation displaces native species resulting in degradation of the natural environment and riparian corridors.	Medium (existing and future)

Action: Community Conservation and Restoration Programs		Action ID: 2 Rank: 5
	Climate change impacts on bank stability and riparian habitats (inundation, storm surge, wave propagation)	Medium (existing and future)
Coastal management objective addressed	<input checked="" type="checkbox"/> Improve and maintain water quality; <input checked="" type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input checked="" type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input checked="" type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
Cost	Capital cost: \$0 Annual cost: \$25,000 (materials/supplies; volunteer community labour)	
Responsibility	Primary: Council Secondary: N/A	
Timeframe for implementation	Medium: 2-5 years Trigger: Review of Action 6 Bank Stability Projects: For those projects that may be completed by a local community group. This option should be undertaken concurrently with Action 10.	
Location Map	N/A	

4.2.7 Strategies and Plans

Action: Climate Change Adaptation Planning		Action ID: 21 Rank: 8
Description	Review Council's Climate Change Adaptation Plan (CCAP) and implement actions or update as appropriate. <u>Tasks</u> <ul style="list-style-type: none"> Initiation and review of CCAP Reporting: Which actions have been implemented, the success of the actions in achieving their goals, which actions have not been implemented and why they have not been implemented. 	
Threat/Hazard Addressed and Risk Rating	Climate change impacts to infrastructure and development	Low to medium (existing) Medium to high (future)
Coastal management objective addressed	<input type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input checked="" type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
Cost	Capital cost: \$4,000 (Council officer time) Annual cost: \$0	
Responsibility	Primary: Council Secondary: N/A	
Timeframe for implementation	Long: 5-10 years Concurrent with Action 19: Support for Greenhouse Gas Emissions Reduction Initiatives	
Location Map	N/A	

4.2.8 Lower Priority Management Actions

Even though the actions listed in **Sections 4.2.1-4.2.7** are identified as priority management actions, it should be recognised that this CMP needs to retain sufficient flexibility such that Council (or other responsible agencies) may implement any of the management actions at any time, regardless of their ranking. Such an opportunity may arise, for example:

- > If Council has success in implementing the priority management actions in the first phase of the CMP implementation (i.e. over the first 5-10 years); or
- > Where funding becomes available through a specific grant or funding program which would allow for the implementation of a lower ranking action before a higher-ranking action.

Further, it is noted that Bonville and Pine Creek Estuary is only one of several estuaries within the Coffs Harbour LGA. The Coffs Harbour LGA covers approximately 70 kilometres of coastline, extending from Bundagen in the south to Station Creek in the north, and funding for coastal management is limited and must be prioritised appropriately across the whole LGA.

To provide Council with sufficient flexibility, the 15 additional lower priority management actions are described and included in **Appendix F**.

5 Business Plan

A *Business Plan* has been prepared in accordance with Stage 3 of the Coastal Management Process for preparing a Coastal Management Program (CMP) as set out in the Coastal Management Manual (OEH, 2018).

The Business Plan includes estimates of the full cost of the program, cost-sharing arrangements, funding and financing mechanisms, and scheduling of implementation.

5.1 Potential Funding Mechanisms

Council funding is allocated based on the Resource Strategy, Long Term Financial Plan, which supports the Delivery Program (four-yearly) and the Operational Plan (yearly) under the IP&R System.

While some actions may be identified as a priority for implementation in the CMP, it is recognised that the Plan needs to retain sufficient flexibility such that Council (or other responsible agencies) may implement any of the management actions at any time on an opportunistic basis, regardless of their priority. Such an opportunity may arise where, for example, funding becomes available through a specific grant or funding program.

5.1.1 Ordinary Rates

Council collects residential, farmland and business ordinary rates on an annual basis summing to around \$45 million per year. Ordinary rates fund a range of Council operations and services, including community services, sporting and recreation services, environmental planning, public health, environmental protection and waste collection, and treatment and disposal. They are therefore one of the revenue streams that could be drawn upon to support the implementation of the activities in this CMP.

5.1.2 Environmental Levy

Council collects an Environmental Levy as a means of undertaking environmental management works. The levy currently raises around \$1.5 million per annum for local environmental works at an average cost of \$45 per rate payer.

Environmental Levy funds are administered by the Environmental Levy Committee consisting of Councillors, Directors (or their delegate) and community representatives. Each year the committee selects projects through a competitive application process to ensure the community is provided the best value in return for the levy funding.

The selection criteria for Environmental Levy funding are primarily based upon the MyCoffs Community Strategic Plan (CSP) theme that relate to the objective 'A natural environment sustained for the future'. All projects must support these objectives and clearly demonstrate how they will be achieved and in what ways this can be measured.

Examples of projects funded under the Environmental Levy Program include bushland regeneration, community awareness and education campaigns, sustainable living programs, water quality assessments, and weed control programs. Of the total revenue generated by the Environment Levy, \$80,000 was allocated to Coastal Hazard and Estuary Studies in 2020/21, with this amount supplemented by the NSW Government under their Coasts and Estuaries Grants Program on a 2:1 basis.

In addition, 25% of the revenue is allocated to the Environment Levy Grants Program to support achievement of the MyCoffs Community Strategic Plan - A natural environment sustained for the future:

- > We protect the diversity of our natural environment (C2.1); and
- > We use resources responsibly to support a safe and stable climate (C2.2).

Grants may be awarded to community and other organisations to undertake activities or research that support these objectives (e.g. Landcare groups).

Funding collected under the Environment Levy could potentially be allocated to Environmental Protection Works implemented under this CMP.

5.1.3 Other Council Grants

Council offers a series of community grants that may be used to fund community projects as described in **Table 5-1**.

Table 5-1 Council funding for community projects

Grant Description	Available funding
<p>Community Capital Infrastructure Grants Program</p> <ul style="list-style-type: none"> The program aims to assist not-for-profit and community organisations to undertake capital projects that enhance the economic, social and environmental well-being of the local community. Projects that could be eligible for funding may include new community infrastructure projects, refurbishment of existing infrastructure, projects that build capacity into infrastructure and innovative projects that serve a community benefit. 	\$250,000 for FY20/21
<p>Community Arts and Cultural Development Grants</p> <ul style="list-style-type: none"> The Arts and Cultural Development Grant Program offers grants of between \$2,000 and \$5,000 to community groups, to support the enjoyment of a rich cultural life within the Coffs Harbour region. Projects seeking funding should have a strong community benefit and be inclusive of all people across the community. 	Around \$40,000 available for grants of between \$2,000 and \$7,000

5.1.4 External Funding

Potential external funding opportunities are detailed in **Table 5-2**. It should be noted that this is not an exhaustive list of all funding opportunities available and Council needs to remain vigilant of new funding schemes and programs to seize opportunities as they arise.

The Action IDs refer to the priority management actions as described in **Section 4.2.2-4.2.7** and lower priority management actions in **Appendix F**.

Table 5-2 External funding opportunities

Name	Provider	Description	Funding available	Potential funding pathway for Action ID:
Coastal and Estuary Grants Program	DPIE	<p>The NSW Government's Coastal and Estuary Grants Program provides technical and financial support to local government to assist in managing the coastal zone. The program's objectives are to support local government in managing the risks from coastal hazards, such as coastal erosion; restoring degraded coastal habitats; and improving the health of NSW estuaries, wetlands and littoral rainforests.</p> <p>There are currently five streams under the Coastal and Estuary Grants Program: one for planning and studies, which includes investigation and design, and cost-benefit analysis; and four for implementing works identified in certified coastal zone or estuary management plans.</p> <p>The objectives of the Coastal and Estuary Grants Program is to support local government in:</p> <ul style="list-style-type: none"> Managing the risk from coastal hazards Coastal erosion Restoring degraded coastal habitats Improving the health of NSW estuaries, wetlands and littoral rainforests. <p>Under the Program, projects are funded on a 2:1 basis with the grants program providing up to two thirds of the funds for projects.</p> <p>http://www.environment.nsw.gov.au/coasts/coastalgrants.htm</p>	Projects are funded on a 2:1 basis with the grants program providing up to two thirds of the funds for projects.	All actions adopted by Council in the certified CMP
Increasing Resilience to Climate Change	DPIE	<p>This is a partnership program between LGNSW and the NSW DPIE to address identified climate change risks and vulnerabilities facing NSW councils.</p> <p>The Increasing Resilience to Climate Change program has been established to encourage:</p> <ul style="list-style-type: none"> Implementation of actions to address identified climate risks Regional consideration of climate change impacts in decision making Implementation of climate change adaptation actions beyond business as usual projects and programs Enhanced adaptive capacity. <p>https://www.lgnsw.org.au/Public/Public/Policy/Increasing-Resilience-to-Climate-Change.aspx</p>	Grants of between \$10,000 and \$30,000 are available.	<ul style="list-style-type: none"> 3 19 20 21 22
Floodplain Management Grants	DPIE	<p>The NSW Government's floodplain management grants support local government to manage flood risk. Funding is available for flood studies, preparation or review of a floodplain risk management study and plan, investigation, design and/or feasibility study (where required) for works identified in a floodplain risk management plan, and implementation of actions identified in a flood plain risk management plan.</p>	Projects are funded with \$2 from government for every \$1 provided by the applicant.	<ul style="list-style-type: none"> 16 23

Name	Provider	Description	Funding available	Potential funding pathway for Action ID:
Marine Infrastructure Grants	Marine Infrastructure Delivery Office (MIDO)	<p>The NSW State Government released the NSW Maritime Infrastructure Plan (MIP) for 2019-2024, which will include a proposed new maritime infrastructure grants program. This plan will be used to inform future State Government investment, which will include a proposed new maritime infrastructure grants program. Roads and Maritime develop strategies to implement the Plan, whilst no immediate funding is currently available, there may be funding available in the future.</p> <p>There are two grant programs run by MIDO that may be of relevance to the CMP:</p> <ul style="list-style-type: none"> The NSW Boating Now recreational boating infrastructure delivery program (https://www.rms.nsw.gov.au/maritime/projects/boating-now/index.html) NSW Boating Access Dredging Program (https://www.rms.nsw.gov.au/maritime/projects/nsw-boating-access-dredging-program/index.html) 	N/A	<ul style="list-style-type: none"> 26
Crown Reserves Improvement Fund Program	DoI – Crown Lands	<p>The Crown Reserves Improvement Fund Program provides financial support for the development, maintenance and improvement of Crown reserves. Grant and loan funding can be applied for each year when the applications are open. A number of different activities are funded each year in the following categories:</p> <ul style="list-style-type: none"> General development, maintenance and protection activities on any eligible Crown reserve. Pest and weed projects on Crown land. <p>https://www.industry.nsw.gov.au/lands/reserves/funding/improvement-fund</p>	N/A	<p>For those projects on Crown land which may include some aspects of the following actions:</p> <ul style="list-style-type: none"> 2 10 18 Environmental protection works
Saving Our Species Program	DPIE	<p>Saving our Species sets out the NSW Government's threatened species management plan and what needs to be done to secure NSW's threatened species in the wild for the next 100 years.</p> <p>The Saving our Species program:</p> <ul style="list-style-type: none"> Consults extensively with experts and applies independent peer reviewed science to species, populations and ecological communities projects Takes a rigorous and transparent approach to prioritising investment in projects that ensure benefit to the maximum number of species Provides targeted conservation projects that set out the actions required to save specific plants and animals on mapped management sites Regularly monitors the effectiveness of projects so they can be improved over time Encourages community, corporate and government participation in threatened species conservation by providing a website and a database with information on project sites, volunteering and research opportunities. <p>http://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/saving-our-species-program</p>	N/A	<ul style="list-style-type: none"> 2 3

Name	Provider	Description	Funding available	Potential funding pathway for Action ID:
Recreational Fishing Trust	DPI Fisheries	<p>When fishing in NSW waters, both freshwater and saltwater, recreational fishers are required by law to pay the NSW Recreational Fishing Fee. All money raised by the NSW Recreational Fishing Fee is placed into the Recreational Fishing Trusts and spent on improving recreational fishing in NSW. These trusts are overseen by two committees made up of recreational fishers - one for saltwater and one for freshwater.</p> <p>Projects include recreational fishing education, fishing access and facilities, research on fish and recreational fishing, recreational fishing enhancement, aquatic habitat rehabilitation and protection, and enforcement of fishing rules.</p> <p>https://www.dpi.nsw.gov.au/fishing/recreational/recreational-fishing-fee/licence-fees-at-work/apply-for-funds</p>	No funding limit	<ul style="list-style-type: none"> 26
Protecting our Places	DPIE	<p>The Protecting Our Places Program is a contestable grants program for Aboriginal community groups and organisations, seeking to achieve long-term beneficial outcomes for the NSW environment.</p> <p>Funded by the NSW Environmental Trust, the program encourages and empowers Aboriginal communities to protect, conserve and restore cultural landscapes and waterways that are of importance to local Aboriginal communities.</p> <p>The objectives of the program are:</p> <ul style="list-style-type: none"> To facilitate the sharing and protection of Cultural knowledge with and between Aboriginal groups, government and public stakeholders, to contribute to the improvement and the management of environmental and cultural resources on country. To increase the amount of culturally significant Aboriginal Land protected, restored, enhanced and managed by local Aboriginal groups, land managers and stakeholders and support connection to country. The Protecting our Places program is an appropriate, effective and sustainable mechanism to deliver Government policy, priorities and outcomes. <p>https://www.environment.nsw.gov.au/funding-and-support/nsw-environmental-trust/grants-available/protecting-our-places#:~:text=The%20Protecting%20our%20Places%20program,3pm%2C%20Monday%2022%20March%202021.</p>	Grants up to \$65,000 with \$10,000 for planning and \$50,000 for implementation	<ul style="list-style-type: none"> 1 30
NSW Heritage Grants	DPIE	<p>The Heritage Grants Program is designed to help owners, managers and communities to know, value and care for their heritage.</p> <ul style="list-style-type: none"> Aboriginal Heritage: \$20,000 to \$70,000 with matching funding required from Councils but not other applicants Community Heritage Projects (peak organisations): Up to \$150,000 Community Heritage Projects: \$25,000 to \$50,000 Local Heritage Places: Up to \$10,000. Matching may be required for some Councils Local Government Heritage Planning Studies: Up to \$40,000. Matching may be required for some Councils 	Up to \$150,000 depending on funding stream.	<ul style="list-style-type: none"> 1 30

Name	Provider	Description	Funding available	Potential funding pathway for Action ID:
Environmental Restoration and Rehabilitation Program	NSW Environmental Trust	https://www.heritage.nsw.gov.au/grants/ <p>The Restoration and Rehabilitation Program is a contestable grants program seeking to achieve long-term beneficial outcomes for the NSW environment.</p> <p>The purpose of the program is to assist community and government organisations to contribute to the ongoing sustainable management and stewardship of significant environmental assets and services in NSW. Applications to the 2020-21 Environmental Restoration and Rehabilitation program were required to address at a practical level, how their project will contribute to the delivery of either one or both of the following two immediate funding priorities from the NSW Environmental Trust Strategic Plan 2020-24:</p> <ul style="list-style-type: none"> Supporting threatened species recovery Addressing climate change impacts on the natural environment – both mitigation and adaptation. https://www.environment.nsw.gov.au/funding-and-support/nsw-environmental-trust/grants-available/environmental-restoration-and-rehabilitation	Grants of up to \$170,000	<ul style="list-style-type: none"> 6 10
Community Development Grants Program	Commonwealth Department of Infrastructure and Regional Development	<p>The Australian Government has established the Community Development Grants Program to support needed infrastructure that promotes stable, secure and viable local and regional economies.</p> https://www.regional.gov.au/regional/programs/community-development-grants.aspx	N/A	<ul style="list-style-type: none"> 26
Coastal Lands Protection Scheme	DPIE	<p>The Coastal Lands Protection Scheme is used to bring significant coastal lands into public ownership and provides for their long-term management and care. The Department administers the Scheme, which receives an annual budget allocation of \$3 million for strategic acquisitions.</p> <ul style="list-style-type: none"> Public access: to promote public access to the coastal foreshore Scenic quality: to maintain the scenic quality of the NSW coast Ecological values: to protect ecological sites of regional, state and/or national significance. https://www.planning.nsw.gov.au/Policy-and-Legislation/Coastal-and-marine-management/Coastal-Lands-Protection-Scheme	N/A	<ul style="list-style-type: none"> 3

5.2 Business Case

Table 5-3 provides an overview of the estimated costs of the full program, the cost-sharing arrangements, potential funding and financing mechanisms for priority management actions.

A business case for lower priority management actions is provided in **Appendix F**.

Table 5-3 Business Case – Priority Management Actions

Action no.	Management Action	Cost (Capital)	Annual Cost (Operational & Maintenance)	Responsibility	Funding & Cost Distribution	Benefits (Management Objective)	Timeframe for implementation
16	Estuary Entrance Behaviour Investigation	\$60,000 (to engage external consultant)	\$0	Primary: Council and NPWS Secondary: N/A	Coastal & Estuary Grant program: 66% DPIE 33% Council & NPWS (equal split)	<input checked="" type="checkbox"/> Improve and maintain water quality; <input checked="" type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input checked="" type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	Short: 1-2 years
4	Implementation of DCP	\$0	\$50,000 (continued implementation of DCP)		100% Council Existing budgets / internal staff time	<input checked="" type="checkbox"/> Improve and maintain water quality; <input checked="" type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input checked="" type="checkbox"/> Maintain and improve riparian vegetation corridors;	Short: 1-2 years DCP is already implemented by Council.
1	Community Education Program	\$10,000 (preparation of materials, printing, and installation of signage)	\$1,000 (ongoing maintenance of signage, and printing of brochures)	Primary: Council Secondary: N/A	Council-DPIE 2:1 Protecting our Places grant Environmental Levy	<input checked="" type="checkbox"/> Improve and maintain water quality; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input checked="" type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	Medium: 2-5 years
2	Community Conservation and Restoration Programs	\$0	\$25,000 (materials/supplies; volunteer community labour)	Primary: Council Secondary: N/A	100% Council Environmental Levy	<input checked="" type="checkbox"/> Improve and maintain water quality; <input checked="" type="checkbox"/> Reduce estuary sedimentation and bank erosion;	Medium: 2-5 years Trigger: Review of Option 6 Bank

Action no.	Management Action	Cost (Capital)	Annual Cost (Operational & Maintenance)	Responsibility	Funding & Cost Distribution	Benefits (Management Objective)	Timeframe for implementation
						<input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input checked="" type="checkbox"/> Maintain and improve riparian vegetation corridors; <input checked="" type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	Stability Projects: For those projects that may be completed by a local community group. This option should be undertaken concurrently with Action 10.
24	Review LEP and DCP with respect to Intensive Agriculture / Horticulture	\$5,000 (Council officer time)	\$2,500	Primary: Council Secondary: N/A	100% Council Existing Budgets / internal staff time	<input checked="" type="checkbox"/> Improve and maintain water quality; <input checked="" type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input checked="" type="checkbox"/> Maintain and improve riparian vegetation corridors;	Short: 1-2 years
23	Coastal Inundation Monitoring	\$0	\$5,000 (Council officer time to maintain database)	Primary: Council Secondary: DPIE – Coasts and Estuaries	Council DPIE 2:1 through Coastal and Estuary Grants Program	<input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist);	Medium: 2-5 years

Action no.	Management Action	Cost (Capital)	Annual Cost (Operational & Maintenance)	Responsibility	Funding & Cost Distribution	Benefits (Management Objective)	Timeframe for implementation
21	Climate Change Adaptation Plan	\$4,000 (Council officer time)	\$0	Primary: Council Secondary: N/A	100% DPIE Increasing Resilience to Climate Change program	<input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input checked="" type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	Long: 5-10 years Concurrent with Action 19: Support for Greenhouse Gas Emissions Reduction Initiatives
6	Bank Stability Projects	\$75,000 (engage external consultant to undertake bank assessment)	\$35,000 (Council officer to manage and liaise with Landcare over implementation period)	Primary: Council Secondary: Local Land Services	Council DPIE 2:1 through Coastal and Estuary Grants Program	<input checked="" type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input checked="" type="checkbox"/> Maintain and improve riparian vegetation corridors;	Medium: 2-5 years Concurrent with Option 2: Community Conservation and Restoration Programs
17	Condition Assessment of Coastal Protection Works	\$50,000 (to engage external consultant)	\$0	Primary: Council Secondary: N/A	Council DPIE 2:1 through Coastal and Estuary Grants Program	<input checked="" type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage;	Medium: 2-5 years
7	EcoHealth Monitoring Program	\$0	\$15,000	Primary: Council Secondary: DPIE	Council DPIE 2:1 through Coastal and Estuary Grants Program	<input checked="" type="checkbox"/> Improve and maintain water quality; <input checked="" type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input checked="" type="checkbox"/> Maintain and improve riparian vegetation corridors; <input checked="" type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	Short: 1-2 years

Action no.	Management Action	Cost (Capital)	Annual Cost (Operational & Maintenance)	Responsibility	Funding & Cost Distribution	Benefits (Management Objective)	Timeframe for implementation
5	Stormwater Management Assets	\$75,000 (to engage external consultant)	\$0	Primary: Council Secondary: N/A	Council-DPIE 2:1 Coastal and Estuary Grants Program Floodplain Management Grants	<input checked="" type="checkbox"/> Improve and maintain water quality;	Short: 1-2 years
31	Environmental Protection Works	N/A	Varies	Primary: Council Secondary: N/A	Environment Levy Ordinary Rates	<input checked="" type="checkbox"/> Improve and maintain water quality; <input checked="" type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input checked="" type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	Ongoing annual basis

5.3 Schedule of Implementation

The schedule of implementation of the CMP is provided in **Appendix G**. It has been developed based on the assumption the CMP would be certified by the Minister in early 2021.

6 Monitoring, Evaluation and Reporting Program

As part of the adaptive management process and in accordance with State policy Council has a number of obligations to report on its ongoing activities in coastal management. Section 18 of the CM Act sets out the requirements for the review, amendment and replacement of a CMP as follows:

- > Council must review the CMP at least once every 10 years;
- > Council may amend the CMP or replace the CMP at any time; and
- > Council may repeal a CMP following a review by publishing a notice in the Gazette.

The monitoring, evaluation and reporting on the implementation of a CMP is to be aligned with the review and reporting requirements of Council's IP&R framework. The CMP and the Delivery Program of the IP&R framework should include measures of the outputs and outcomes of delivery of coastal management responses. Implementation of the proposed CMP (2021) actions is subject to significant funding pressures and limited Council resources. While the proposed implementation schedule (**Appendix G**) outlines a nominal implementation program Council's annual budgeting processes and the success of funding applications to Federal and State Agencies managing various schemes will largely dictate the funds available for implementation of proposed CMP (2021) actions in any given year. In addition, extreme events such as a major flood or east coast low-induced erosion may require a shift in the priority of CMP implementation.

6.1.1 **Reporting**

Under the CM Act, Councils are required to report:

- > **Annually**
 - Report on implementation of coastal management actions (as required for Operational Plans in IP&R) including, which actions have been implemented, progress of actions, cooperation with stakeholders, barriers and issues, funds allocated and source, update on timeline of implementation.
- > **At four yearly intervals**
 - What has been achieved from management of the coast (as input to updates of the Community Strategic Plan and Delivery Program)
 - To what extent the CMP (2021) management objectives are being met
 - Provide an overview of the CMP interim performance in terms of key indicators of the management objectives and recommend whether amendment of the CMP would benefit coastal management.
- > **At intervals of not more than 10 years**
 - On the performance of the CMP as an instrument for improving coastal management.
 - The strategic review of the CMP is to be conducted at least every 10 years and should include an evaluation of the effectiveness of the CMP in achieving its objectives and recommend items for inclusion in the new CMP document.

It is suggested that a CMP Actions register of activities be established and maintained to support the ongoing annual, four yearly and decadal reporting requirements. Ideally this would be linked to the Council GIS to facilitate the presentation of spatial locations and focus of activities as well as to support the community consultation and engagement. An example of the fields to be maintained within the register is presented in **Table 6-1**.

The Actions and Activities Register is to be updated and maintained by Council and forms the basis for Annual CMP reports that can then be rolled into the Four Yearly report and subsequently into the CMP review (**Figure 6-1**). The CMP Actions and Activities Register database should be set up as a formal controlled document under Council's Quality Control procedures to ensure its robustness as a long-term management and reporting tool that provides consistency through any potential organisation structure

realignments and/or personnel changes. It is important to note that the CMP is a living document and its amendment and update in future is to be expected as part of the adaptive management process.

Table 6-1 Example fields to be maintained in the CMP Actions and Activities register

CMP 2021			Implementation Planning					Actual Implementation				
Action Ref.	Action Priority	Year proposed to implement	Year Action Included in Council Annual Plan and Budget	Date Funding Application Submitted	Funding sought	Date Funding Approved	Amount of Funding Approved	Council Project Manager	Date Activity Started	Area of Focus	Reference to Activities Scope	Date Activities Complete

6.1.2 Overview of Risks and Monitoring reality

As indicated in the Coastal Management Manual (OEH, 2018) the ability to plan data collection to provide unequivocal evidence of a cause (such as land clearing) and effect (deteriorating estuarine water quality) is fraught by the complexity of the processes linking the activity (e.g. land clearing) to a response or impact (deteriorating water quality) that may involve a long time to generate a statistically resolvable signal in any collected data. For example, the processes linking land clearing to deteriorating water quality may involve several intermediate steps, and could potentially have a number of processes/pathways that eventually leads to the decline in water quality. These contributing processes could even vary for different sites across the catchment (with same effect), and may also take several years or even decades evolve into a measurable issue. So, even though specific processes could be identified which are likely contributing to the effect (eg decline of water quality) due to cause (land clearing), the design of a monitoring program to detect change and attribute that change to a particular cause is relatively difficult to plan, execute and usually expensive.

Therefore, a pragmatic approach to monitoring and evaluation is proposed at this stage in the CMP process.

6.1.3 Monitoring and evaluation

Monitoring is key to identifying whether implemented actions contribute to achieving the management objectives and the objects of the CM Act. To maintain focus, highlight successes and provide early warning of problems, it is important to monitor and review progress towards the outcomes at regular intervals. As part of the CMP an initial monitoring program has been developed which can form the basis for Stage 5 of the CMP process (Implement, monitor, evaluate and report).

A number of different forms of monitoring and existing programs is available to the CMP process. Two key components related to the CMP monitoring are:

- > The specific monitoring programs as proposed in this CMP, including:
 - EcoHealth Monitoring Program (Action ID 7) – 4-yearly, part of top 12 actions
 - Water Quality Monitoring Program (Action ID 8) – annually, not part of top 12 actions,
 - Coastal Inundation Monitoring (Action ID 23), and
- > Ongoing data collection programs managed and funded by State Government (DPIE Energy, Environment and Science group, Manly Hydraulics Laboratory), federal government (Bureau of Meteorology, CSIRO) and Internet Sites (Google Earth). This data can provide essential contextual information to inform the evaluation of the performance of CMP actions and activities.

It is suggested that these sources of information will provide input to an annual estuary conditions report, that would contain a summary of the year's key environmental forcing data and statistics to inform the annual review. The Annual Condition Report would aim to:

- > present results of analysis and interpretation of meteorological and oceanographic forcing conditions from the following data - MHL's Bonville Creek water levels, Coffs Harbour ocean water levels, Coffs Harbour ocean waves, BoM weather (rainfall, winds, air temperature, solar radiation, humidity) and OEH groundwater tables at various sites around the catchment to provide indication of potential change in the local climate and therefore estuary condition;
- > incorporate data and interpretation from the available CMP Actions Monitoring Programs; and
- > incorporate any other relevant data (e.g. NPWS monitoring of Bongil Bongil Wetlands) that could be beneficial to describe the conditions of the estuary.

An annual condition report, allows for Council to accumulate relevant information on a yearly basis. This contextual information enables interpretation of the natural variability and potential change associated with implementation CMP actions. It is also critical to start the process of determining criteria for the thresholds and triggers.

An opportunity to perform this exercise efficiently is to combine it with conditions reports of other estuaries in the Coffs Harbour Council LGA. Involvement from DPIE – Coasts and Estuaries is strongly recommended in the development of this report, by either leading it or facilitating provision of time series data. It is suggested that a vacation work experience student (with appropriate GIS, time series and event analysis and report writing skills) and under direction could be considered to collate, analyse and provide report on current year's conditions to inform the CMP Annual report.

At this stage, it is suggested that key indicators and benchmarks will be defined as part of the ongoing activities once specific information becomes available through the Action implementation. For example, the proposed investigation of the entrance management protocols will determine thresholds and critical water levels at which management actions (e.g. artificially opening the entrance to minimise flooding or to minimise impacts on wetland habitats are to be determined).

6.1.4 Summary CMP evaluation process

The CMP implemented Actions evaluation process would involve the interpretation of the year's activities and rolling up into the four yearly and decadal reporting. The evaluation would be undertaken by Council and its DPIE – Coasts and Estuaries partner and the CEMAC.

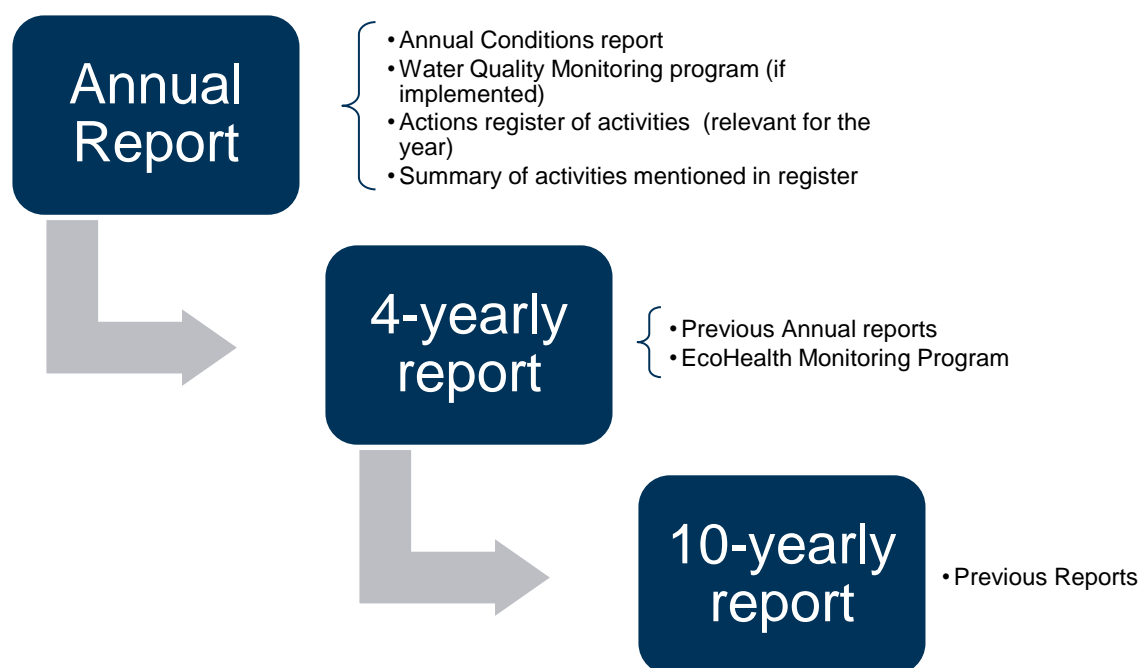


Figure 6-1 Summary CMP evaluation process

6.2 Implementation

Sections 22 and 23 of the CM Act set out the obligations of local councils and public authorities for the implementation of a CMP:

- > A council is to give effect to its CMP through the IP&R framework and land use planning system;
- > When exercising their functions, public authorities are to have regard to a CMP, the coastal management manual and the objects of the CM Act.

As discussed in **Section 4.2**, any capital works would be subject to further feasibility assessment. More detailed investigation may identify constraints that could result in modification of the project or impact the project budget or timeline. Each proposal would require environmental impact assessment under the EP&A Act, and may be subject to other environmental permits, licences or approvals (such as landowner consent

from DoI - Crown Lands under the *Crown Lands Management Act 2016* or a permit from DPI - Fisheries under the *Fisheries Management Act 1994*).

Appropriate stakeholder consultation should be undertaken, not only to meet the requirements of the EP&A Act and/or other legislation, but also to manage risk through project delivery.

Due to the potential to encounter Aboriginal cultural heritage sites and artefacts, it is recommended that consultation with the CH&D LALC be undertaken in relation to any works proposed within the estuary, or along the estuary banks or riparian zones.

7 Concluding Remarks

This CMP for the Bonville and Pine Creeks Estuary has been prepared by Cardno on behalf of Coffs Harbour City Council in accordance with the requirements of the Coastal Management Act 2016 and the Coastal Management Manual (2018).

This CMP has built upon the Scoping Study (Cardno, 2017a), the Estuary Processes and Community Uses Study (Cardno, 2017c), and the Business Plan (Cardno, 2017d) which have been prepared throughout the coastal management process for the Bonville and Pine Creeks Estuary. Throughout the process, Cardno has reviewed existing literature and undertaken community and stakeholder consultation to identify the values and significance of the estuary to the community, and their desired outcomes for ongoing management. The CMP summarises the management issues and risks, and presents a series of management options to mitigate these risks.

Thirty options were identified, assessed, and ranked in accordance with a multi-criteria analysis that assessed the feasibility and viability of each option. The management options have been prioritised to assist in the allocation of resources when carrying out the plan, however, it is acknowledged that a flexible approach to undertaking works should be adopted as grants and funding opportunities arise from time to time that may allow some options to be progressed ahead of others.

This CMP should be viewed as a 'living document' that is reviewed and updated over time. A strategic review of the CMP should occur at least once every ten years to assess the effectiveness of the CMP in achieving its objectives.

The draft Bonville and Pine Creek CMP (RevA, Oct 2017) was presented to the CEMAC in 2017. The draft has been updated in accordance with CEMAC's feedback and requirements of the new Coastal Management legislation, gazetted in April 2018, resulting preparation of the Final Draft CMP (RevD, Feb 2019).

The Final Draft CMP was subject to public exhibition from 27 March to 25 April 2019 in accordance with the requirements of the CM Act. No submissions were received during the public exhibition period; however, the CEMAC members and relevant agencies undertook a final review of the CMP and provided some further feedback. This feedback has been assessed and where appropriate incorporated into the Final CMP.

This document, the Final CMP will now be presented for formal adoption by Council and submitted to the responsible NSW State Minister for certification.

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Bonville and Pine Creek

APPENDIX

A

COASTAL MANAGEMENT MANUAL: MANDATORY REQUIREMENTS

Mandatory Requirements for Preparing a CMP

CMPs are developed through a staged process as set out in the NSW Coastal Management Manual (OEH, 2018). The five stages are:

- > Stage 1: Identify the scope of a CMP;
- > Stage 2: Determine risks, vulnerabilities and opportunities;
- > Stage 3: Identify and evaluate options;
- > Stage 4: Prepare, exhibit, certify and adopt the CMP; and
- > Stage 5: Implement, monitor, evaluate and report.

The essential elements of the CMP process as set out in the Manual (OEH, 2018) are provided in **Table A-1**. The full details of each of these essential elements can be reviewed in the Manual.

Table A-1 Mandatory requirements for preparing CMPs

Mandatory requirement	Where Addressed
Mandatory requirements and guidance in this manual	
1. In this manual: <ul style="list-style-type: none"> i. the numbered paragraphs of Part A are mandatory requirements within the meaning of section 21(2) of the CM Act; ii. the numbered paragraphs addressing consultation in Part A are also mandatory requirements within the meaning of section 21(2) of the CM Act and are the relevant provisions for the purpose of section 16(2) of that Act; and iii. all other content in Parts A and B provide guidance within the meaning of section 21(2) of the CM Act. 	Compliance with mandatory requirements addressed in this particular section.
The purpose, scope and focus of a CMP	
2. A CMP is to consider a range of timeframes and planning horizons including immediate, 20 years, 50 years, 100 years and (if council considers it relevant based on expert advice) beyond.	Chapter 2 (More specifically Section 2.6 and Appendix D)
3. A CMP is to consider a broad range of coastal management issues and management actions with a focus on achieving the objects and objectives of the CM Act.	Stage 1 – Scoping Study (Cardno 2017a) Stage 2 – Estuary Conditions and Community uses Study (Cardno 2017c)
The area that a CMP covers	
4. A CMP must include the rationale for selecting the area to be covered by a CMP and identify whether it applies to: <ul style="list-style-type: none"> i. all or part of the coastal zone of one local government area; or ii. all or part of the coastal zone of adjoining local government areas that share a coastal sediment compartment or estuary (where adjoining local government areas share a coastal sediment compartment or estuary - refer to Schedule 1 of the CM Act - a CMP that addresses an area comprising that coastal sediment compartment or estuary must reflect this regional context). 	Stage 1 – Scoping Study (Cardno, 2017a) Section 1.1
5. A CMP must identify: <ul style="list-style-type: none"> i. any proposed amendments to mapping of the relevant coastal management areas; ii. evidence to support any proposed amendments or additions to the area of the four coastal management areas in the relevant area; and iii. information about these proposed amendments that can support the preparation of a planning proposal and, in particular, that could be forwarded along with a planning proposal to the Greater Sydney Commission (if the planning proposal relates to the Greater Sydney Region) or the 	Not identified and therefore not relevant for this CMP

Mandatory requirement	Where Addressed
Minister (for elsewhere) to inform a Gateway determination under section 3.34 of the EP&A Act.	
Preparing a CMP	
<p>6. During preparation of a CMP, a council is to:</p> <ul style="list-style-type: none"> i. identify the scope of the CMP; ii. determine and assess coastal risks, vulnerabilities and opportunities (including without limitation risks to environmental, social and economic values and benefits); and iii. evaluate and select coastal management options. 	<ul style="list-style-type: none"> i. Stage 1 – Scoping Study (Cardno 2017a) ii. Stage 2 – Estuary Conditions and Community uses Study (Cardno 2017c) iii. Stage 3 – Business Plan (Cardno, 2017d)
<p>7. A council may choose not to repeat steps (or parts of steps) in subparagraphs (ii) or (iii) of mandatory requirement 6 for the area the subject of the proposed CMP (or parts of that area) if those tasks have already been undertaken for the coastal management of that area, provided that council first considers:</p> <ul style="list-style-type: none"> i. whether the existing assessment of coastal risks, vulnerabilities and opportunities, or the existing evaluation of coastal management options, that council proposes to rely on enables council to prepare the CMP in accordance with mandatory requirement 8 below and sections 14 and 15 of the CM Act; ii. the effectiveness of the existing coastal management of that area; and iii. whether any circumstances concerning the coastal management of that area have changed. 	<p>Stage 1 – Scoping Study (Cardno 2017a)</p> <p>This applies to:</p> <ul style="list-style-type: none"> – Coastal Vulnerability Area (Coffs Harbour CZMP, BMT WBM 2013a) – Bongil Bongil National Park (Bongil Bongil National Park Management Plan) <p>Coffs Harbour CZMP will be transitioned to CMP separately according to new legislation.</p>
Key issues to be identified	
<p>8. A CMP must:</p> <ul style="list-style-type: none"> i. provide a description of how the objects of the CM Act have been considered and promoted in preparing the CMP; ii. provide a description of how the objectives of the coastal management areas covered by the CMP have been given effect to in preparing the CMP; iii. identify the key coastal management issues affecting the areas to which the CMP is to apply and how these have been considered; iv. identify any coastal management actions required to address those key coastal management issues in an integrated and strategic manner; v. identify how the coastal management actions in (iv) have been considered and evaluated (including, without limitation, how council has evaluated the coastal management actions in light of the functions and responsibilities council has under legislation other than the CM Act); vi. identify any environmental protection works, on land identified as 'coastal wetlands' or 'littoral rainforests' on the Coastal Wetlands and Littoral Rainforests Area Map under the CM SEPP, that are proposed to be carried out by or on behalf of a public authority; vii. identify any coastal protection works that are proposed to be carried out by or on behalf of a public authority; viii. set out the recommended timing for the proposed coastal management actions; ix. identify a proposed monitoring, evaluation and reporting program in relation to the CMP, including by identifying key indicators, trigger points and thresholds relevant to the CMP; and x. include a business plan. 	<ul style="list-style-type: none"> i. Section 1.5 ii. Section 1.5 iii. Section 2.3 and 2.4 iv. Chapter 4 v. Section 4.1 vi. Not relevant for this CMP vii. Not relevant for this CMP viii. Section 4.2 ix. Chapter 6 x. Chapter 5

Mandatory requirement	Where Addressed
Requirements for the business plan in the CMP	
<p>9. The business plan included in the CMP must identify:</p> <ul style="list-style-type: none"> i. all proposed coastal management actions identified elsewhere in the CMP; ii. the full proposed capital, operational and maintenance costs, and recommended timing, of proposed coastal management actions; iii. any proposed cost-sharing arrangements and any other viable funding mechanisms for the proposed coastal management actions to ensure delivery of those actions is consistent with the timing for their implementation under the CMP; and iv. the distribution of costs and benefits of all proposed coastal management actions. 	<p>Chapter 5 and Appendix F</p>
Requirements for preparing a CMP which includes a proposed or mapped coastal vulnerability area	
<p>10. Where coastal hazards have been identified in a coastal management area, a CMP must identify proposed coastal management actions for those hazards.</p>	<p>The coastal vulnerability areas have been identified in CZMP (BMT, 2013).</p> <p>A number of management actions in this CMP (refer Section 4.2, Action 16, 23, 21 and 17) contribute to mitigation measures against coastal hazards.</p>
<p>11. If the CM Act requires that a coastal zone emergency action subplan be prepared, it must identify any requirements for how emergency coastal protection works, within the meaning of the CM SEPP, are to be carried out.</p>	<p>The coastal zone emergency action subplan has been developed as part of the CZMP (BMT, 2013)</p>
Requirements for taking coastal change into account when preparing a CMP	
<p>12. A CMP must demonstrate how a council has considered:</p> <ul style="list-style-type: none"> i. projected population growth and demographic changes; and ii. projected use of coastal land for infrastructure, housing, commercial, recreational and conservation purposes. 	<p>Section 2.4</p>
<p>13. A CMP must demonstrate how a council has considered:</p> <ul style="list-style-type: none"> i. current and future risks, at timeframes of immediate, 20 years, 50 years, 100 years and (if council considers it relevant based on expert advice) beyond; ii. (if council considers it relevant) current and future risks of potentially high consequence, low probability events that may affect the relevant area; iii. the effects of projected climate change and how it may affect the relevant area; iv. the local and regional scale effects of coastal processes; and v. the ambulatory and dynamic nature of the shoreline and how it may affect the relevant area. 	<ul style="list-style-type: none"> i. Section 2.6 and Appendix D ii. Not relevant to this CMP iii. Section 2.3 iv. Section 2.1 v. Section 2.1
Format and content required for a CMP	
<p>14. A CMP is to include the following sections:</p> <ul style="list-style-type: none"> i. Executive summary ii. Introduction iii. A snapshot of issues iv. Actions to be implemented by the council or by public authorities v. Whether the CMP identifies recommended changes to the relevant planning controls, including any proposed maps vi. A business plan 	<ul style="list-style-type: none"> i. Page iv ii. Chapter 1 iii. Chapter 2 iv. Chapter 4 v. Not relevant for this CMP vi. Chapter 5

Mandatory requirement		Where Addressed
vii.	Coastal zone emergency action subplan, if the CM Act requires that subplan to be prepared	vii. Not relevant for this CMP
viii.	Monitoring, evaluation and reporting program	viii. Chapter 6
ix.	Maps	ix. Section 1.2
x.	Reference list	x. Chapter 8
Community engagement and consultation		
15. A draft CMP must be exhibited for public inspection at the main offices of the councils of all local government areas within the area to which the CMP applies, during the ordinary hours of those offices, for a period of not less than 28 calendar days before it is adopted. This mandatory requirement does not prevent community consultation, or other consultation, in other ways.		This will be done when Draft CMP is approved by CHCC and DPIE – Coasts and Estuaries.

Bonville and Pine Creek

APPENDIX

B

COASTAL STRATEGY STATEMENT

Coastal Strategy Statement

This coastal strategy statement provides the context and objectives for the Bonville and Pine Creek Estuary. It establishes the strategic direction for the management of the coast. It sets out the long-term strategy for the integrated and coordinated management of the coastal zone.

B.1 Strategic Context for the Bonville and Pine Creeks Estuary

Legislative Context

The Bonville and Pine Creeks Estuary CMP has been prepared in accordance with the CM Act, the SEPP CM, and the Coastal Management Manual (OEH, 2018).

This CMP has been prepared for all coastal management zones within the Bonville and Pine Creeks Estuary study area and includes:

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

The strategies and actions identified as part of this CMP has been developed with due regard to the management objectives for each of these coastal management areas as set out in the CM Act.

Management Context

The IP&R) Framework requires Council to produce a set of documents that articulate where Coffs Harbour wants to be in ten years and how Council will achieve these aspirations through details of its budgets, activities and performance measures. The framework allows NSW councils to draw their various plans together, understand how they interact and get the maximum leverage from their efforts by planning holistically and sustainably for the future. This CMP has been developed to feed into the IP&R framework.

B.2 Vision for the Bonville and Pine Creeks Estuary

A vision statement has been prepared for the Bonville and Pine Creek Estuary to guide the management actions and represents the “desired outcome” for the ongoing management of the estuary. Key stakeholders and the community were provided with the opportunity to comment on the vision statement during its development. The vision statement for the Bonville and Pine Creeks Estuary is:

To provide for the holistic and coordinated management of the Bonville and Pine Creeks estuary for ecosystem health and the sustainable use and enjoyment of the natural environment by the community.

B.3 Management Objectives for the Bonville and Pine Creeks Estuary

The management objectives for the Bonville and Pine Creek Estuary have been developed throughout the CMP process. Key stakeholders and the community were provided with the opportunity to comment on the management objectives during their development. The management objectives for the Bonville and Pine Creeks Estuary are:

- > To improve and maintain water quality;
- > To reduce estuary sedimentation and bank erosion;
- > To improve community amenity and facilities (resident and tourist);
- > To preserve / protect the natural environment and cultural heritage;
- > To maintain and improve riparian vegetation corridors;
- > To understand and improve fish stocks; and
- > To support the ongoing use of the estuary as an educational resource and for research.

B.4 Coastal Processes and Values for the Bonville and Pine Creeks Estuary

The Coastal processes, socio-economic context, and coastal environment processes and values that frame the coastal decision making for this CMP has been identified in detail in the Estuary Conditions and Community Uses report (Cardno, 2017c) and summarised in **Section 2** of this CMP.

B.5 Key Stakeholders for the Bonville and Pine Creeks Estuary

Key stakeholders, including the local community, have been consulted throughout this coastal management process. A Stakeholder and Community Engagement Plan (Cardno, 2017b) was prepared during Stage 1 of the coastal management process. The Engagement Plan set out the details of the consultation activities undertaken to inform the development of the CMP and was prepared in accordance with Council's Community Engagement Policy and the requirements of the CM Act.

One of the overarching objectives for the preparation of the Bonville and Pine Creeks Estuary CMP was to "involve the community in the preparation of the CMP, including making information relating to the plan publicly available". The Stakeholder Community Engagement Plan has been designed to ensure that the views of the community and key stakeholders were heard and that opportunities were provided to allow for input into the CMP.

Outcomes of the consultation have been summarised in the Estuary Conditions and Community Uses report (Cardno, 2017c), and in **Section 3** of this CMP.

B.6 Issues and Opportunities for the Bonville and Pine Creeks Estuary

Key risks, issues and opportunities were identified in the Estuary Conditions and Community Uses report (Cardno, 2017c). Key threats identified as resulting in high risks include for the existing or future planning horizon included:

- > Land use changes;
- > Vegetation clearing;
- > Declining fish population due to overfishing;
- > Lack of knowledge on fish population leading to unrecorded decline in stocks;
- > Sea level rise; and
- > Increased storm intensity and frequency plus increased population.

Opportunities identified to manage these key risks were developed into management options and assessed during Stage 3 of the coastal management process. The Business Plan (Cardno, 2017d) sets out the options development and assessment process.

B.7 Strategies and Actions for the Bonville and Pine Creeks Estuary

Strategies and actions for the Bonville and Pine Creeks Estuary are detailed in this CMP. A total of 29 options were assessed and developed into the CMP. These strategies and actions will be implemented throughout a 10 year implementation period as part of the IP&R framework.

This CMP will be reviewed at least once every 10 years and should include an evaluation of the effectiveness of the CMP in achieving its objectives.

Bonville and Pine Creek

APPENDIX

C

RISK ASSESSMENT

Risk Assessment

C.1 Risk Assessment Methodology

This report adopts a risk management approach to characterise the vulnerability of the project to natural hazards in both the present day and under climate change conditions. The risk assessment was conducted in accordance with:

- > AS/NZS ISO 31000:2009, Risk management – Principles and guidelines; and
- > AS 5334-2013 Climate change adaptation for settlements and infrastructure – A risk based approach.

These standards provide a framework for managing risk, and can be used by any organization regardless of its size, activity or sector.

In accordance with the standards, the risk assessment presented in this report adopted the following steps:

- > Understanding which coastal management areas may be at risk from identified threats, and how this will impact achievement of the estuary management objectives;
- > Establishing success criteria to assist in the evaluation of the significance of the risks;
- > Characterising the risk to the coastal management areas from the identified threats;
- > Identifying potential management measures; and
- > Re-evaluation of the residual risk following adoption of the management measures.

Risk is assessed by considering both the likelihood and consequences of an event occurring. Likelihood is used as a general description of probability or frequency; that is, how likely it is that something will occur. A consequence is the outcome or impact of an event (AS/NZS ISO 31000:2009).

A qualitative risk assessment assesses the likelihood of a hazard (**Table C-1**). For this preliminary risk assessment, likelihoods have been assigned based on consideration of the historical occurrence for the key hazards.

Table C-1 Likelihood of Risk

Likelihood	Description	Recurrent or Event Risks
Almost Certain (L1)	Expected to occur in most circumstances.	Could occur several times per year.
Likely (L2)	Will probably occur in most circumstances.	May occur once every year.
Possible (L3)	May occur at some time.	May arise once in 5 years.
Unlikely (L4)	May occur at some time, but is considered unlikely.	May arise once in 5 to 50 years.
Rare (L5)	Could occur in exceptional circumstances.	Unlikely during the next 50 years.

The potential consequences of the hazard are defined as per the criteria in **Table C-2**. The consequence criteria consider the potential for the success criteria estuary (management objectives) to not be realised.

C.1.1 Success criteria

The success criteria for the risk assessment have been developed based on the management objectives for the Bonville and Pine Creek estuary, as presented in the *Scoping Study* (Cardno, 2017a), with some minor modifications as a result of the findings of Stage 2 and a review of the stakeholder and community consultation outcomes. Improve and maintain water quality;

- > Reduce estuary sedimentation and bank erosion;
- > Improve community amenity and facilities (resident and tourist);
- > Preserve / protect the natural environment and cultural heritage;
- > Maintain and improve riparian vegetation corridors; and
- > Understand and improve fish stocks.

Table C-2 Consequence of Risk

Rating	Water quality	Estuary sedimentation and erosion	Community amenity and facilities	Natural Environment and Cultural Heritage	Riparian vegetation corridors	Fish stocks
Extreme (C5)	Irreversible change in multiple water quality parameters over a large area. Little to no potential for recovery or restoration.	Significant increase in bank erosion and sedimentation over extensive sections of all three tributaries. Nuisance shoaling in the entrance. Extensive bank structural protection works present / required.	No facilities to support community uses. Little or no public access. Very high levels of conflict between users with risk of death to members of the public.	Irreversible deterioration in the extent and condition of conservation significant natural areas. No potential for recovery. Loss of cultural heritage assets.	Loss of riparian vegetation. Complete loss of habitat connectivity. No potential for unassisted recovery. Significant investment in restoration required.	Loss of key commercial and recreational species from the estuary. Significant decline in biodiversity with flow on effects for other fauna.
Major (C4)	Significant degradation or deterioration of multiple water quality parameters over a large area. Limited potential for recovery and restoration. Some clean up and remediation required.	Major increase in bank erosion and sedimentation / entrance shoaling. Large bank structural protection measures present / required.	Insufficient recreational facilities. Damage or decline in condition of facilities requiring extended closures. Public access to open space very limited. High levels of conflict between users with risk of major injury to member of the public.	Major decline in extent and condition over a large area of natural environment. Limited potential for recovery. Irreversible damage to cultural heritage assets.	Significant net loss of riparian vegetation over a large area. Major fragmentation. Limited potential for unassisted recovery. Restoration works required.	Very small stocks of commercial and recreational species in the estuary. Several species overfished. Major decline in biodiversity and population size / biomass. Limited potential for recovery.
Moderate (C3)	Degradation or deterioration of a limited number of parameters throughout estuary, or for several parameters in specific location. Potential for recovery by restoration works or longer term natural processes.	Some bank erosion and sedimentation throughout the estuary and creeks. Some entrance shoaling on occasion. Some bank structural protection works present / required.	Sufficient recreational facilities. Some require improved maintenance or repairs. Good public access to some areas but lacking in others. Moderate levels of conflict with risk of injury to member of the public.	Moderate decline in extent and condition over part of natural environment. Some potential for recovery. Damage to cultural heritage assets with potential for recovery.	Complete loss of small area of riparian vegetation, or degradation of a large area. Some fragmentation. Some potential for natural recovery. Restoration work required.	Moderate stocks of key commercial and recreational species. Some species overfished. Moderate decline in population sizes / biomass. Good potential for recovery.
Minor (C2)	Deterioration of 1-2 water quality parameters in a particular location. Good potential for recovery by restoration works or short term natural processes.	Bank erosion and sedimentation in excess of natural rates of variation; minor erosion and sedimentation. Very few bank structural protection works present / required.	Sufficient recreational facilities. Good public access to most of the study area. Minor levels of conflict with low risk of injury to member of the public.	Minor decline in extent and condition over part of natural environment in excess of natural variation. Good potential for recovery. Minor damage to cultural heritage assets.	Some degradation in riparian vegetation condition. Good potential for recovery. No restoration works required.	Low levels of pressure on stocks of key commercial and recreational species. Minor decline in population sizes / biomass. Excellent potential for recovery.
Negligible (C1)	No or negligible change or deterioration in water quality.	Very few bank structural protection works present / required. No dredging required.	Sufficient recreational facilities with active management and maintenance. Great public access to most of the study area, including for those with limited mobility. Low levels of conflict between users.	No or negligible loss of natural environment values, communities or species. No restoration works required. No or negligible damage to cultural heritage assets.	No or negligible change or damage to riparian vegetation.	No overfishing and fishers observe regulations. Generally healthy and diverse fish stocks occur in the estuary.

Each risk event was assigned an overall level of risk determined as a function of the probability (or likelihood) of the event occurring and the consequence if the event occurred (**Table C-3**).

Table C-3 Risk Assessment Matrix

Likelihood	Consequence				
	C1	C2	C3	C4	C5
	L1	Low	Moderate	High	Extreme
	L2	Low	Moderate	High	Extreme
	L3	Low	Low	Moderate	High
	L4	Low	Low	Moderate	High
	L5	Low	Low	Moderate	Moderate

The risk assessment findings are documented **Table C-5 for Existing Risk (2017) and Future Risk (2050)**. The risk statements were formulated based on the success criteria and identified threats.

To get an understanding of how the risk would develop over longer timeframes (50 to even 100 years), an assessment has been made whether it's likely that the identified future risk in 2050 is likely to increase, stay the same or decrease at according extended timeframes (2070 and 2120). This assessment has been added to **Table C-5** using symbols from **Table C-4**. This information is used to see which elements require a review when CMP is up for renew or review within 10 years.

Table C-4 Assessment of risk development during extended future timeframe

Risk development in 2090 or 2120 compared to 2070	
↑	Threat risk is likely to increase
–	Threat risk is not likely to change
↓	Threat risk is likely to decrease
?	Threat risk evolution is unknown

Table C-5 Risk Assessment Findings

Threat / Hazard	Risk Statement	Relevant Coastal Management Area(s):				Existing Risk (2017)			Future Risk (2050)			Future Risk assessment		Opportunities / Proposed Risk Mitigation Measures
		CWLR	CVA	CEA	CUA	L	C	R	L	C	R	2070	2120	
Community education	The public has a poor appreciation of habitat values and undertakes activities that lead to negative impacts on habitat condition and/or extent.	Y	-	-	-	L3	C3	M	L3	C3	M	-	-	Community education and community projects to engage the community directly with the estuary.
	A lack of understanding about the importance of the coastal wetlands and littoral rainforests to Aboriginal people can mean that the social and cultural significance of the area is not appreciated.	Y	-	Y	-	L3	C3	M	L3	C3	M	-	-	Community education of the social and cultural importance of coastal wetlands and littoral rainforests (e.g. signage) in partnership with Aboriginal stakeholders.
Unrecorded Aboriginal cultural heritage	There is a potential for unrecorded Aboriginal heritage sites, items and objects in the area. Proposals can have a negative impact on these areas if not considered appropriately.	Y	Y	Y	Y	L3	C3	M	L3	C3	M	-	?	Any proposal in the study area with potential to negatively impact on Aboriginal cultural heritage requires an assessment to determine if a Aboriginal heritage site, object or item exists.
Invasion of mangroves	Mangrove invasions of saltmarsh resulting in net loss of saltmarsh.	Y	-	-	-	L2	C2	M	L3	C2	M	-	↑	Future activity: Consider opportunities to remove boundaries for landward migration of intertidal estuarine macrophytes.
Acid sulfate soils	Disturbance of acid sulfate soils resulting in poor water quality and the degradation of vegetation.	Y	-	-	-	L3	C3	M	L3	C3	M	-	?	Existing management in place: all works in PASS locations to consider ASS as per the LEP.
Land use change	Increasing urbanisation of the catchment modifies stormwater runoff,	Y	-	Y	Y	L4	C3	M	L3	C3	M	-	↑	Planning controls.

Threat / Hazard	Risk Statement	Relevant Coastal Management Area(s):				Existing Risk (2017)			Future Risk (2050)			Future Risk assessment		Opportunities / Proposed Risk Mitigation Measures
		CWLR	CVA	CEA	CUA	L	C	R	L	C	R	2070	2120	
	negatively impacting coastal wetlands and littoral rainforest. There is a decline in estuarine water quality, and consequently negative impacts on estuarine biota, and can also negatively impact aquatic recreation.													Adequate consideration of stormwater management controls when in the planning phases for urban and agricultural areas. Consider need for additional GPTs prior to discharge to the estuary or tributaries. Undertake outreach program and/or encourage Landcare participation by farmers.
	Increase land use change to intensive plant agriculture farming increases nutrient loads in catchment runoff, resulting in poor water quality in the estuary and its tributaries. This negatively impacts on coastal wetlands, littoral rainforest and estuarine biota.	Y	-	Y	-	L4	C3	M	L3	C3	M	-	↑	Monitoring programs or compliance reporting for agricultural enterprises and urban growth areas. Estuarine water quality monitoring.
	Increased urbanisation reduces the visual amenity / rural character of the estuary and its catchment.	-	-	Y	Y	L3	C2	L	L3	C3	M	-	↑	
	Increased intensive plant agriculture, in particular the presence of blueberry netting, reduces the visual amenity.	-	-	Y	Y	L3	C3	M	L2	C3	M	-	↑	Planning controls assessing visual impacts of development.
Vegetation clearing	Clearing of catchment vegetation for agricultural land uses such as cropping; net loss of vegetation and decline in water quality.	-	-	Y	Y	L3	C3	M	L2	C4	H	-	↑	Planning controls. Undertake outreach program and/or encourage Landcare participation by farmers.

Threat / Hazard	Risk Statement	Relevant Coastal Management Area(s):				Existing Risk (2017)			Future Risk (2050)			Future Risk assessment		Opportunities / Proposed Risk Mitigation Measures
		CWLR	CVA	CEA	CUA	L	C	R	L	C	R	2070	2120	
	Intensification of agriculture in the upper catchment resulting in vegetation clearing and degradation of water quality and erosion.	-	-	Y	Y	L3	C3	M	L2	C3	M	-	↑	Monitoring programs or compliance reporting for agricultural enterprises. Encourage / undertake riparian vegetation restoration.
	Unrestricted cattle access causes bank erosion, loss of riparian vegetation and sedimentation of creeks.	-	-	Y	-	L2	C3	M	L2	C4	H	-	↑	Fencing of riparian zones.
	The illegal clearing of vegetation for public recreation pursuits or agriculture results in the degradation of coastal wetlands and littoral rainforest.	Y	-	Y	Y	L3	C2	L	L2	C2	M	-	↑	Community education of the importance of coastal wetlands and littoral rainforests (e.g. signage). Fencing where appropriate (e.g. Sawtell Beach dunes). Encourage / undertake riparian vegetation restoration.
Weeds	Establishment of weeds along banks and in riparian vegetation displaces native species resulting in degradation of the natural environment and riparian corridors.	Y	-	Y	-	L3	C3	M	L3	C3	M	-	↑	Weeding programs. Community programs such as Bushcare / Landcare. Community education of noxious weeds.
Edge effects	Vegetation clearing and fragmentation results in edge effects, and the degradation of vegetation quality through weed invasion and/or pollution.	Y	-	-	-	L3	C3	M	L2	C3	M	-	↑	Encourage / undertake riparian vegetation restoration. Weed management through community projects such as Bushcare / Landcare.

Threat / Hazard	Risk Statement	Relevant Coastal Management Area(s):				Existing Risk (2017)			Future Risk (2050)			Future Risk assessment		Opportunities / Proposed Risk Mitigation Measures
		CWLR	CVA	CEA	CUA	L	C	R	L	C	R	2070	2120	
Decline in fish population	There is a lack of knowledge as to the cause of observed (anecdotal) declines in fish stocks in the estuary. Any changes in population may go unnoticed.	-	-	Y	-	L2	C4	H	L2	C4	H	-	-	Study of fish stocks and species. Review restrictions on commercial and recreational fishing. Estuarine fish stocking.
	If overfishing occurs it can result in a decline in key recreational or commercial fish stocks.	-	-	Y	Y	L4	C4	M	L3	C4	H	-	?	
Boating impacts	Boating activities cause bank erosion and sedimentation and/or damage to habitat, negatively impacting on estuarine biota.	-	-	Y	Y	L3	C2	L	L2	C2	M	-	↑	Enforcement of boating speed limits. Navigation aids.
	Boat wake causes bank erosion and sedimentation resulting in reduced amenity or access for the community, or damage to facilities.	-	-	Y	Y	L3	C2	L	L2	C2	M	-	↑	
	There are conflicts due to the large number of users of watercraft leading to public safety issues and reduced recreational amenity.	-	-	-	Y	L3	C2	L	L2	C3	M	-	↑	Boating Management Plan to consider options for eliminating conflict between powered and other waterway users, such as, designation of areas for different activities and/or additional facilities.
Conflict between estuary users	Commercial and recreational fishing in the estuary can create conflict between estuary users.	-	-	-	Y	L3	C2	L	L2	C3	M	-	↑	Review restrictions on commercial and recreational fishing.

Threat / Hazard	Risk Statement	Relevant Coastal Management Area(s):				Existing Risk (2017)			Future Risk (2050)			Future Risk assessment		Opportunities / Proposed Risk Mitigation Measures
		CWLR	CVA	CEA	CUA	L	C	R	L	C	R	2070	2120	
Sedimentation	Erosion and sedimentation negatively impact on community access (e.g. navigation) and/or recreational facilities, leading to reduced amenity.	-	-	-	Y	L3	C3	M	L2	C3	M	-	-	Review need for dredging of the estuary entrance. Encourage / undertake bank restoration works. Consider need for more controlled access under future scenario of more intensive usage.
Population increase	Population increases may lead to user conflict and/or lack of adequate access.	-	-	-	Y	L3	C3	M	L2	C3	M	-	↑	Public access management plan with consideration given to projected population increases and tourism.
Tourism	Tourism leads overcrowding of public infrastructure and recreational assets leading to user conflict.	-	-	Y	Y	L3	C3	M	L2	C3	M	-	↑	Public access management plan with consideration given to projected population increases and tourism.
	Seasonal influx of tourists places pressure on the estuary and on facilities.	-	-	Y	Y	L2	C2	M	L2	C3	M	-	↑	
Elevated water levels (e.g. due to flooding or storm surge)	Elevated water levels cause bank erosion and sedimentation, resulting in loss of riparian vegetation and impacts on estuarine biota.	-	-	Y	-	L2	C2	M	L2	C2	M	-	↑	Bank and riparian restoration including planting in riparian zones and other measures (e.g. jute mats)
	Elevated water levels cause bank erosion and sedimentation, resulting in negative impacts on public infrastructure and/or recreational amenity.	-	-	-	Y	L3	C3	M	L2	C3	M	-	↑	
Ocean waves, tidal currents	Ocean waves and storm surge introduce marine sediment into the estuary mouth resulting in	-	Y	-	Y	L2	C2	M	L2	C2	M	-	↑	

Threat / Hazard	Risk Statement	Relevant Coastal Management Area(s):				Existing Risk (2017)			Future Risk (2050)			Future Risk assessment		Opportunities / Proposed Risk Mitigation Measures
		CWLR	CVA	CEA	CUA	L	C	R	L	C	R	2070	2120	
and/or storm surge	shoaling of the entrance and restricting navigation.													
	Storm surge propagates up the estuary, causing bank erosion and sedimentation, and degradation of riparian habitats.	-	Y	Y	-	L2	C3	M	L2	C3	M	-	↑	Bank stabilisation and riparian restoration.
	Existing coastal protection works provide insufficient protection from coastal hazards such as storm surge, resulting in damage to public infrastructure.	-	Y	-	Y	L3	C3	M	L2	C3	M	-	↑	Consideration of where coastal protection works may need to be extended or retrofitted to manage ongoing and future risk.
	Some existing coastal protection works are failing, resulting in damage to public infrastructure.	-	Y	-	Y	L2	C3	M	L3	C3	M	-	↑	Remediation of existing coastal protection works as required. Ongoing maintenance of coastal protection works.
Climate Change:	General opportunities: Ongoing support for and implementation of the Renewable Energy and Emissions Reduction Plan. Reduce emissions reductions targets periodically. Review new information on climate change projections as they become available, and consider implications for Council's policies and plans as required. Review local monitoring data identify climate change impacts. Undertake climate change risk assessment and develop adaptation plan for Council's operations and assets.													
Sea level rise	Sea level rise results in modification of entrance behaviour, with resultant impacts on a range of estuarine processes (incl. water quality and ecology).	-	Y	Y	-	L3	C2	L	L2	C3	M	-	↑	
	Sea level rise results in inundation of some areas riparian vegetation,	Y	-	Y	-	L4	C3	M	L3	C4	H	-	↑	Assess potential for landward migration of intertidal vegetation and identify barriers.

Threat / Hazard	Risk Statement	Relevant Coastal Management Area(s):				Existing Risk (2017)			Future Risk (2050)			Future Risk assessment		Opportunities / Proposed Risk Mitigation Measures
		CWLR	CVA	CEA	CUA	L	C	R	L	C	R	2070	2120	
	coastal wetland and littoral rainforest species, with potential for sub-lethal or lethal impacts. This negatively impacts biodiversity.													Consider options to provide for landward migration.
	Sea level rise increases estuarine water depths resulting in decreased light penetration to seagrasses.	-	-	Y	-	L4	C2	L	L2	C3	M	-	↑	
	Sea level rise resulting in increased bank erosion and sedimentation, and resulting in degradation of riparian vegetation.	-	Y	Y	-	L4	C3	M	L3	C4	H	-	↑	Ongoing bank restoration and revegetation works.
	Sea level rise resulting in increased bank erosion and sedimentation, and resulting in loss of public land.		Y			L4	C3	M	L2	C3	M	-	↑	
	Sea level rise inundation of foreshore land.	-	Y	-	Y	L4	C3	L	L3	C4	H	-	↑	Review how sea level rise is considered in asset management plans. Consider need to modify existing coastal protection works or construct additional works to minimise risk. Identify assets at risk and consider appropriate management options (e.g. progressive upgrades as part of regular maintenance/renewal).
	Sea level rise inundation of public infrastructure and recreational facilities resulting in damage to, or loss of facilities.	-	Y	-	Y	L4	C3	M	L3	C4	H	-	↑	
	Sea level rise resulting in inundation of the foreshore and degradation or loss of heritage sites.	-	Y	-	Y	L4	C3	M	L3	C4	H	-	↑	
Changed rainfall patterns	Changes in rainfall and flooding alter the hydrological regimes of wetlands resulting in die-	Y	-	-	-	L4	C3	M	L3	C3	M	-	↑	

Threat / Hazard	Risk Statement	Relevant Coastal Management Area(s):				Existing Risk (2017)			Future Risk (2050)			Future Risk assessment		Opportunities / Proposed Risk Mitigation Measures
		CWLR	CVA	CEA	CUA	L	C	R	L	C	R	2070	2120	
Changed rainfall patterns (cont.)	off or degradation of the wetland.													
	Changes in rainfall and flooding alter the water quality processes, leading to a decline in estuarine water quality.	-	-	Y	-	L4	C3	M	L3	C3	M	-	↑	
	Changes in rainfall and flooding alter entrance behaviour, with resultant impacts on a range of estuarine processes (incl. water quality and ecology).	-	-	Y	Y	L4	C3	M	L3	C3	M	-	↑	
Increased incidence of drought	Drought conditions and increased temperatures cause stress in coastal wetlands and littoral rainforest resulting in die-back or degradation.	Y	-	-	-	L4	C3	M	L3	C3	M	-	↑	
Increased temperatures	Increased water temperatures modify water quality processes in the estuary and increase potential for issues (e.g. algal blooms), with resultant impacts on estuarine biodiversity.	-	-	Y	-	L4	C3	M	L3	C3	M	↑	↑	
	Increased temperatures cause degradation of public infrastructure, increasing maintenance costs.	-	-	-	Y	L4	C2	L	L3	C3	M	-	?	Create "green" communities to reduce urban heat island effect. Standardise maintenance registers and monitor maintenance requirements to identify any potential increases in expenditures.
	Increased temperatures cause degradation of heritage assets,	-	-	-	Y	L4	C2	L	L3	C3	M	-	?	

Threat / Hazard	Risk Statement	Relevant Coastal Management Area(s):				Existing Risk (2017)			Future Risk (2050)			Future Risk assessment		Opportunities / Proposed Risk Mitigation Measures
		CWLR	CVA	CEA	CUA	L	C	R	L	C	R	2070	2120	
	increasing maintenance costs.													
	Increased temperatures cause drying of soils resulting in increased erosion and degradation of soil quality.	-	-	Y	-	L4	C3	M	L2	C3	M	-	↑	
Increased storm intensity and frequency	Increase storm surge levels and wave propagation up the estuary results in bank erosion and sediment, degrading riparian habitats	-	Y	Y	-	L4	C3	M	L2	C3	M	-	↑	Ongoing bank stabilisation and riparian restoration.
	Increase storm surge levels and wave propagation up the estuary results in damage to public infrastructure.	-	Y	-	Y	L4	C3	M	L2	C3	M	-	↑	Consider need to modify existing coastal protection works or construct additional works to minimise risk.
Increased storm intensity and frequency plus increased population	The combination on ongoing land use change and heavy rainfall significantly modifies stormwater runoff quality and quantity, causing erosion and sedimentation and negatively estuarine water quality.	Y	-	Y	Y	L4	C4	M	L3	C4	H	-	↑	Ensure adequate stormwater planning for urban release areas

Bonville and Pine Creek

APPENDIX

D

CONCURRENCE

Concurrence

The CMP process requires that public authorities are consulted about proposed actions that are their responsibility. As per the Coastal Management Manual (OEH, 2018), engaging with public authorities in should:

- > Support the integration of council and public authority delivery programs;
- > Allow the public authorities to commit to relevant actions the CMP; and
- > Refine opportunities for alignment of management actions of public authorities with the state's objectives and priorities.

The list of management options developed for the Bonville and Pine Creek estuary identified options that were the primary or secondary responsibility of several organisations. These organisations were given the opportunity to provide comment on the proposed management option, and provide concurrence (or otherwise).

Table D-1 summarises the responses and concurrence received for each management option that had a primary or secondary responsibility listed as an organisation other than Council.

Table D-1 Summary of Agency Concurrence

Agency	Action ID	Concurrence received?
Department of Primary Industries - Fisheries	10, 11, 14, 28	<p>Having initially supported these two actions subject to conditions, DPI Fisheries subsequently clarified that they do not accept primary responsibility for implementation, noting the following:</p> <ul style="list-style-type: none"> ▪ Action 14: DPI Fisheries notes that rehabilitating and resolving impacts on key fish habitats should be prioritised over fish stocking. DPI Fisheries undertakes restocking but this occurs on a case-by-case basis and is subject to need and funding. As funding of this action cannot be guaranteed, DPI Fisheries recommended the action either be removed or that DPI Fisheries is removed as action lead. Based on this feedback, Council has decided to remove this action from CMP. ▪ Action 11: DPI Fisheries contribution being subject to the specific external funding being made available to DPI Fisheries. Based on this feedback, Council has decided to remove this action from CMP. <p>No to secondary responsibility noting the following:</p> <ul style="list-style-type: none"> ▪ DPI Fisheries should be removed from having a role in Action 10 as Fisheries is not aware of any significant alien or pest fish or marine vegetation threat in Bonville Pine Creek CMP area requiring action from DPI Fisheries. This request was actioned. <p>Additional notes:</p> <ul style="list-style-type: none"> ▪ Action 7: If specific external funding is made available, DPI Fisheries supports the undertaking of fish community condition assessments being undertaken as part of the proposed Ecohealth assessments. ▪ Action 13 This is an action DPI Fisheries supports and aligns with actions 2.4 and 3.4 in the draft Marine Estate Management Strategy. ▪ Action 26: DPI Fisheries note that the existing boat ramp - and proposed improvements are in the immediate area of some seagrass and it is likely that the proposed ramp upgrade and/or use of the upgraded facilities will exacerbate existing impacts on seagrass. DPI Fisheries highlights that future direct impacts associated with upgrade works would need to be adequately offset. ▪ Action 28: DPI Fisheries note that this action is undertaken by DPI Fisheries as part of their routine compliance activities across NSW and that there will be no additional resources allocated to increasing the frequency or length of compliance activities that may occur within the Bonville Pine Creek area. As a result, Council decided to remove this action from the CMP.

Agency	Action ID	Concurrence received?
Environmental Protection Agency	8	<p>Yes, to secondary responsibility noting the following:</p> <ul style="list-style-type: none"> If Council decides to implement such a monitoring program the EPA is willing to provide technical support and advice in designing the program. However due to resourcing constraints the EPA is only in a position to fulfil this advisory role and would not be able to develop or undertake the proposed program.
Local Land Services	6, 10	<p>Yes, to secondary responsibility noting the following:</p> <ul style="list-style-type: none"> NCLLS has previously invested in weed control management actions in these areas and assists landholders with pest animal control. Future NCLLS involvement in weed control activities will be subject to availability of investment and resources.
National Parks and Wildlife Service	3, 10, 16	<p>Yes, to shared primary responsibility for Action 16</p> <p>Yes, to secondary responsibility noting the following:</p> <ul style="list-style-type: none"> Weed control programs are a primary operational function of local NPWS staff within the park. No hydraulic structures such as weirs or seawalls are present within Bongil Bongil National Park.
Office of Environment and Heritage (now DPIE)	7	<p>Yes, to secondary responsibility noting the following:</p> <ul style="list-style-type: none"> Under current arrangements DPIE (Coasts and Estuaries) will provide financial support for EcoHealth monitoring where it has been listed as an action in a certified plan with qualifiers on funding availability. Stakeholders should note: <ul style="list-style-type: none"> Both Environmental Trust and Estuary Program funding streams are contestable, and funding is not guaranteed. There is currently no funding source for long term waterway condition monitoring program available.
Roads and Maritime Services	15	<p>Having initially supported this proposed management action, RMS subsequently advised that they could not take primary responsibility for this management action (refer Section 4.1.3). Given Council does not have authority under the Marine Safety Act 1998 to regulate navigation, they have decided to remove this action from the CMP.</p>

Bonville and Pine Creek

APPENDIX

E

OPTIONS ASSESSMENT

Table E-1 Management objectives scoring system for the Bonville and Pine Creek Estuary

Criteria	Likely Outcome (Qualitative Assessment)						
	-3	-2	-1	0	+1	+2	+3
Water Quality	Decline in water quality throughout estuary over the medium-long term.	Decline in water quality over the short term at a limited number of locations.	Decline in water quality for only a limited number of parameters.	No net impact on water quality.	Improvement in water quality for a limited number of parameters.	Improvement in water quality over the short/medium term.	Improvement in water quality throughout estuary over the medium-long term.
Sedimentation and erosion	Results in direct negative impact on sedimentation and erosion throughout estuary.	Direct negative impact at limited number of locations or over the short/medium term.	Indirect negative impacts on erosion and sedimentation	No net impact on sedimentation and erosion.	Indirect positive impacts on erosion and sedimentation	Direct positive impact at limited number of locations or over the short/medium term.	Results in direct positive impact on sedimentation and erosion throughout estuary.
Riparian vegetation	Direct negative impacts on riparian vegetation over the long term; permanent loss of species or habitat.	Direct negative impacts on riparian vegetation over the short-medium; permanent loss of species or habitat for at least one site.	Indirect negative impacts on riparian vegetation; direct negative impact over the short term.	No net impacts on riparian vegetation	Indirect positive impacts on riparian vegetation; direct positive impact over the short term.	Direct positive impacts over the short-medium term; provides for the conservation, management and rehabilitation of a number of sites, species or habitats.	Results in a more strategic approach to the protection of riparian vegetation; provides for the long term conservation, management and rehabilitation of the estuary.
Fish stocks	Net reduction in fish population size / biomass for multiple species. Significant decline in biodiversity with flow on effects for other fauna.	Net reduction in fish population size / biomass for several species.	Indirect negative impacts on fish species and fish stocks.	No net impacts on fish stocks or no change in understanding of fish stocks	Indirect positive impacts on fish species and fish stocks. Some understanding of fish species and stocks in the estuary.	Improved understanding of fish species and fish stocks in the estuary. Net increase in fish population size / biomass for several species.	Strong understanding of fish species and fish stocks in the estuary. Net increase in fish population size / biomass for multiple species. Significant increase in biodiversity with flow on effects for other fauna.
Natural environment and cultural heritage	Direct decline in natural environment and/or cultural heritage protection / understanding throughout the estuary / community	Direct decline in natural environment and/or cultural heritage protection / understanding at some locations	Indirect decline in natural environment and/or cultural heritage protection / understanding at one or two locations.	No net impact on natural environment or cultural heritage.	Indirect improvement in natural environment and/or cultural heritage protection / understanding at one or two locations.	Direct improvement in natural environment and/or cultural heritage protection / understanding at some locations	Direct improvement in natural environment and/or cultural heritage protection / understanding throughout the estuary / community
Community amenity and facilities	Reduction in the community uses (recreation, cultural or heritage) of the estuary over the long term.	Reduction in the community uses of the estuary over the medium term.	Minor reduction in community uses; option negatively impacts limited number of user groups.	No net impact on community uses.	Minor improvements to community uses; option improves uses for a limited number of user groups.	Improvement in community uses of the estuary over the medium term.	Community uses of the estuary are positively affected across the estuary for all user groups over the long term.

Criteria	Likely Outcome (Qualitative Assessment)						
	-3	-2	-1	0	+1	+2	+3
Educational resource and research	N/A	N/A	Limited consultation/lack of involvement of the community.	No net change in scientific understanding of the estuary. No net impact on community engagement / education.	Some additional understanding of the estuary. Improved educational outcomes for a small subset community. Short term information, communication or education engaging the community in a positive way.	Improved scientific understanding / research opportunities for the estuary. Medium term information, communication or education campaign resulting in improved educational outcomes for large subset of community. .	Strong scientific understanding / research opportunities for the estuary. Improved educational outcomes for the entire community. Long term, direct or broad scale information, communication or education promoting a positive community engagement
Community acceptability (as per workshop survey results)	N/A	Strongly against	Against	Neutral / no opinion	Support	Strongly support	N/A

E.1 Options Assessment Outcomes & Ranking

Table E-2 Ranked management options

Action ID	Option Description	Rank
16	Undertake an investigation of historic and potential future estuary entrance behaviour. Assess the interaction between the entrance condition, flooding and coastal processes, and how these impact on built and natural assets. Based on the outcomes of the assessment, consider the need to develop an entrance management plan and/or undertake stabilisation works.	1
11	Work with NSW Fisheries and/or local universities to undertake a study of fish populations in the Bonville and Pine Creek estuary. The study should seek to identify any historic changes in fish populations and any pressures on estuarine fish. The outcomes of the study should be used to inform adaptive management of estuarine fish population, as required (e.g. regulation of commercial and/or recreational fishing). Note: Subsequently re-prioritised as a lower priority action in consultation with NSW Fisheries.	2
4	Continue to implement DCP to support development and environmental protection, taking into account the biodiversity and coastal statutory reforms. Key issues for estuarine health include: <ul style="list-style-type: none"> Stormwater management from both urban and rural area Visual impacts and landscape character, to ensure maintenance of existing rural and bushland character Vegetation management and restrictions on clearing Landscaping in urban areas to reduce heat impacts and promote greening. 	3
1	Develop and implement a community education program on estuarine health and community uses of the estuary. This may include placement of educational signage promoting key features of the estuary such as littoral rainforests and important bird life and/or Aboriginal cultural heritage (e.g. at Pine Creek Way, Sawtell Beach dune and/or the boat ramp). N.B. this will be done in consultation with LALC and elders.)	4
2	Continue to work with key stakeholders to engage with, and involve, community members in environmental conservation and restoration projects (e.g. via Bushcare, Landcare and Coastcare) in the catchment.	5
24	Review Council's LEP and DCP with respect to regulation and control of development for intensive agriculture / horticulture. In particular, identify opportunities for regulation of certain activities as development requiring consent, and for additional development controls as required for monitoring the impacts of these types of development.	6
23	Monitor frequency, depth and spatial extents of coastal inundation events propagating up the estuary (see corresponding action in the CZMP). The information can be used to gain a greater appreciation of potential climate change impacts and inform adaptive management.	7
21	Review Council's Coastal Change Adaptation Plan (CCAP) and implement actions or update as appropriate.	8
6	Identify priority areas: <ul style="list-style-type: none"> For improved maintenance / conservation of riparian vegetation and/or protection of the riparian zone from livestock Subject to bank erosion or instability that may need stabilisation works, with due consideration of enhancing riverine / estuarine health and habitats. Work with Landcare to ensure priority areas are targeted.	9
17	Assess condition of existing coastal protection and bank stabilisation works at Boronia Park. This is to include consideration of where coastal protection works may need to be extended or retrofitted to manage ongoing and future risk, and consideration of environmentally friendly seawalls.	10
7	Continue financial support for the EcoHealth monitoring program to inform understanding of the estuarine health and facilitate adaptation management.	11
5	Review Council's stormwater management assets with a view to reducing impacts on estuarine water quality and hydrology. Issues for consideration include: <ul style="list-style-type: none"> The location and/or orientation of stormwater outlets in relation to sensitive ecosystems Scour and sedimentation around stormwater outlets. Opportunities to improve existing or implement new stormwater quality improvement devices. 	12

Action ID	Option Description	Rank
3	<p>Assess potential for landward migration of intertidal vegetation (mangroves and saltmarsh) and identify barriers. Consider opportunities to improve potential for landward migration of intertidal and riparian vegetation. Options to facilitate landward migration may include:</p> <ul style="list-style-type: none"> ▪ Land swaps / acquisition ▪ Removal of hydraulic structures such as weirs or seawall ▪ Support for "environmentally friendly" shoreline protection structures that incorporate habitat / vegetation ▪ Reserving parts of foreshore parks and reserves specifically for landward migration of intertidal and riparian vegetation ▪ Progressive, facilitated migration by translocation or planting of vegetation. 	13
8	Develop and undertake a water quality monitoring program for upper reaches of estuary targeting natural variation and multiple parameters (e.g. herbicides, pesticides, microbial parameters, nutrients, suspended solids etc.).	14
18	Develop guiding principles for recreational areas within the study area. The guiding principles should consider the existing and future recreational requirements of the community, and the role of tourism in the area. These guiding principles should be captured in the revision of the Sawtell Plan of Management and Council's Open Space Strategy.	15
20	Review updated climate change projections as they become available (i.e. NSW Government Climate Change projections), and consider implications for Council's policies and plans as required.	16
25	Provide for ongoing compliance monitoring of illegal dumping.	17
19	Provide ongoing support for Council's initiatives to reduce their greenhouse gas emissions, and to encourage the community to adopt low emissions practices.	18
12	Encourage landholders to consider the need and feasibility for bank stabilisation measures along Middle Creek to prevent continued bank erosion. All works are to be approved structures under the Coffs Harbour LEP.	19
10	Support regional pest and weed control activities, including those conducted by Council, NPWS, LLS and DPI (Fisheries).	20
9	Continue to support grant programs such as Environmental Levy Grants, Community Arts and Cultural Development Grants, Green Schools Sustainability Grants, Community Capital Infrastructure Grants Programme.	21
29	Support ongoing regulation of 'no dog' areas.	22
30	Conservation of unrecorded Aboriginal cultural heritage	23
22	Review Asset Management Plan and monitoring protocols to ensure potential climate change impacts are captured in the Asset Management Plan (refer to Coffs Harbour CZMP Action A.1).	24
13	Manage pedestrian access where it is impacting on Sawtell dunes and littoral rainforests.	25
27	Provide improved connectivity for cyclists to and from the study area.	26
26	Improve boat ramp at Micks Retreat by providing more parking and making it more accessible at low tide.	27

Bonville and Pine Creek

APPENDIX

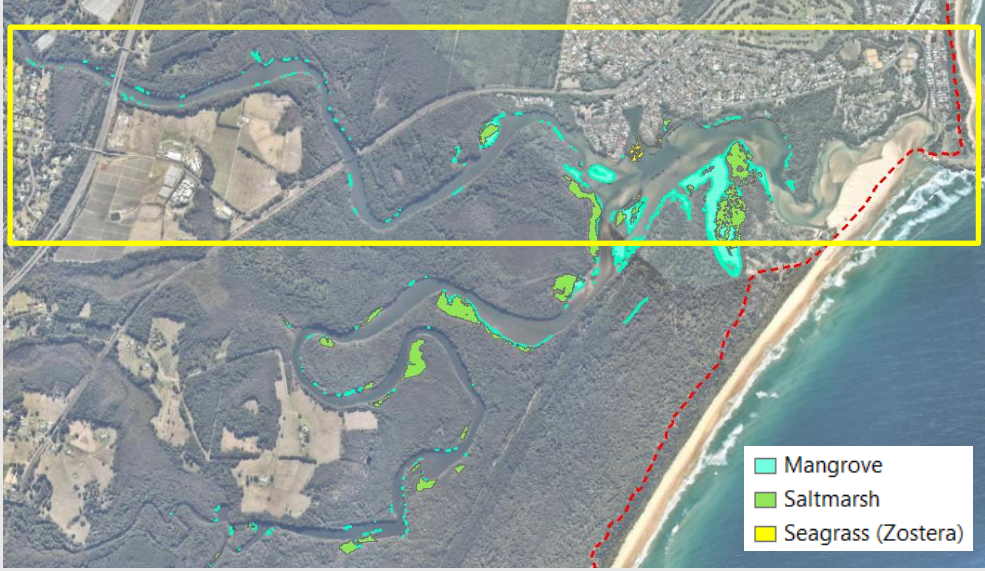
F

LOWER PRIORITY MANAGEMENT
ACTIONS

Lower Priority Management Actions

This section provides a description of the lower priority management actions, namely those that were ranked lower than the priority management action (refer **Section 4.2**) in the options assessment. They have been included here in order of their rank in the options assessment.

Action:	Landward migration of intertidal vegetation		Action ID: 3 Rank: 13
Description	<p>Assess potential for landward migration of intertidal vegetation (mangroves and saltmarsh) and identify barriers. Consider opportunities to improve potential for landward migration of intertidal and riparian vegetation. Options to facilitate landward migration may include:</p> <ul style="list-style-type: none">▪ Land swaps / acquisition;▪ Removal of hydraulic structures such as weirs or seawall;▪ Support for "environmentally friendly" shoreline protection structures that incorporate habitat / vegetation;▪ Reserving parts of foreshore parks and reserves specifically for landward migration of intertidal and riparian vegetation; and▪ Progressive, facilitated migration by translocation or planting of vegetation. <p>This action would involve a review of all estuarine foreshore areas to identify those areas with potential for landward migration of intertidal vegetation. Existing GIS data would be used identify the location of mapped estuarine vegetation and potential barriers such as road, Council assets or other infrastructure. Field assessments by either Council officers or external consultants could be used to ground-truth the location of estuarine vegetation and to identify barriers to vegetation.</p> <p>In addition, land use zoning could be mapped to identify potential for future migration barriers and identify those areas where zoning could be changed to facilitate landward migration. A review of land ownership would also assist in understanding the potential management options (e.g. land reservation, land swaps).</p> <p>Existing seawalls (such as at Boronia Park) could be replaced with environmentally seawalls to incorporate habitat and be more amenable to estuarine vegetation (see Action 17).</p> <p>It is recommended that this option is focussed on estuarine vegetation in Bonville Creek as much of the area around Pine Creek is within the National Park.</p> <p><u>Tasks:</u></p> <ul style="list-style-type: none">▪ Initiation▪ Data collection. Identify area of estuarine vegetation, land zoning, land ownership and potential barriers (council assets, other buildings etc.). Field ground-truthing of initial mapping and identify (with GPS) the location of any assets or potential barriers to migration.▪ Data analysis. Review of all data and identification of barriers.▪ Reporting: Identify options for improving potential for landward migration for the identified estuarine vegetation.		
Threat/Hazard Addressed and Risk Rating	Mangrove invasion of saltmarsh	Medium (existing and future)	
	Climate change impacts on estuarine biodiversity (sea level rise)	Medium (existing) High (future)	
Coastal management objective addressed	<input type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input checked="" type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research		
Cost	Capital cost: \$55,000 Annual cost: \$0		
Responsibility	Primary: Council Secondary: NPWS (for those areas within the Bongil Bongil National Park) and DPI Fisheries		
Timeframe for implementation	Long: 5-10 years		

Action:	Landward migration of intertidal vegetation	Action ID: 3 Rank: 13
Location Map		

Action:	Water Quality Monitoring Program	Action ID: 8 Rank: 14
Description	<p>Develop and undertake a water quality monitoring program for upper reaches of estuary targeting natural variation and multiple parameters (e.g. herbicides, pesticides, microbial parameters, nutrients, suspended solids etc.).</p> <p>The purpose of the water quality monitoring program would be to monitor and identify impacts to water quality as a result of urbanisation of the upper catchment. With continued urbanisation and increase in intensive agriculture / horticulture, it is important for Council to understand the impacts that these land use changes are having on the estuary. A long term, broad scale monitoring program will be able to identify changes in water quality and allow for intervention to limit and/or mitigate downstream impacts.</p> <p>The monitoring program has been costed to allow for six monitoring sites on a monthly basis incorporating both dry and wet weather sampling, as well as provision for database management, and brief reporting and data analysis.</p> <p><u>Tasks:</u></p> <ul style="list-style-type: none"> Develop water quality monitoring program to include several sites in Bonville Creek and several sites in Pine Creek. Sites are to be selected above the tidal limits and take into consideration the existing and future land uses to ensure that impacts of land use changes can be monitored (e.g. one site upstream and one site downstream of land release areas). Undertake monthly dry weather sampling for at least one year to establish baseline water quality. Undertake wet weather sampling after heavy rainfall (e.g. >50 mm in 24 hours). The aim of this is to identify impacts to water quality from surface runoff from rural/agricultural/horticultural areas of the catchment. Create water quality monitoring database to allow for comparison of results and review of trends. <p><u>Notes:</u></p> <ul style="list-style-type: none"> Establishment of baseline water quality would ideally take place over several years to understand trends in water quality with weather and seasons. This option would be ideally suited to collaboration with the university and could be conducted by a student(s) undertaking a thesis in land management, agriculture, water resource or similar. This option provides for a more comprehensive water quality monitoring program than is currently undertaken as part of EcoHealth. The purpose of this program would be to understand the impacts of intensive agriculture on the creeks and would enable Council to mitigate impacts if negative trends are seen to be emerging. 	

Action: Water Quality Monitoring Program		Action ID: 8 Rank: 14
Threat/Hazard Addressed and Risk Rating	Vegetation clearing and fragmentation resulting from agricultural land uses, and/or recreational pursuits. Impacts to riparian areas and water quality.	Medium (existing) Medium to high (future)
	Land use changes (increasing urbanisation, intensive agriculture) altering runoff and nutrients	Medium (existing and future)
	Climate change (increased storm intensity and frequency, changing rainfall patterns, storm surge, sea level rise) resulting changes in water quality	Medium (existing and future)
	Flooding, ocean waves, tidal currents and storm surge resulting in bank instability and erosion	Medium (existing and future)
Coastal management objective addressed	<input checked="" type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input checked="" type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
Cost	Capital cost: \$25,000 (initial development of water quality monitoring program and database set up) Annual cost: \$150,000	
Responsibility	Primary: Council Secondary: Environmental Protection Authority	
Timeframe for implementation	Medium: 2-5 years Trigger: Land use changes in the upper catchment and/or development of urban release areas. A review of EcoHealth monitoring results may assist in the development of the scope and extent of a larger and/or more intensive or targeted monitoring program.	
Location Map	N/A	

Action: Guiding Principles for Recreational Areas		Action ID: 18 Rank: 15
Description	As part of the update of the Sawtell Plan of Management and Open Space Strategy, Council should develop guiding principles for recreational areas within the study area. The guiding principles should consider the existing and future recreational requirements of the community, and the role of tourism in the area. This option allows for the Council officer time to develop guiding principles and to update the relevant documents. The guiding principles would ensure that recreational projects conducted by Council or community groups are targeted and a holistic approach is adopted to suit the community's needs. Council may also consider gathering community feedback on the guiding principles.	
Threat/Hazard Addressed and Risk Rating	Boating impacts including conflicts between estuary users.	Low (existing) Medium (future)
	Tourism and increased population leading to user conflict and/or overcrowding	Medium (existing and future)
Coastal management objective addressed	<input type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and	

Action:	Guiding Principles for Recreational Areas	Action ID: 18 Rank: 15
	<input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
Cost	Capital cost: \$5,000 (for Council officer to develop principles and update documents) Annual cost: \$0	
Responsibility	Primary: Council Secondary: N/A	
Timeframe for implementation	Medium: 2-5 years	
Location Map	N/A	


Action	Update Climate Change Projections	Action ID: 20 Rank: 16
Description	Review updated climate change projections as they become available (i.e. NSW Government Climate Change projections), and consider implications for Council's policies and plans as required.	
Threat/Hazard Addressed and Risk Rating	Climate change impacts to coastal management areas	Low to medium (existing) Medium to high (future)
Coastal management objective addressed	<input type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input checked="" type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
Cost	Capital cost: \$0 Annual cost: \$1,500 (Council officer time)	
Responsibility	Primary: Council Secondary: N/A	
Timeframe for implementation	Long: 5-10 years Concurrent with Action 19: Support for Greenhouse Gas Emissions Reduction Initiatives and Action 21: Climate Change Risk and Vulnerability Assessment	
Location Map	N/A	

Action:	Compliance Monitoring for Illegal Dumping	Action ID: 25 Rank: 17
Description	Provide for ongoing compliance monitoring of illegal dumping. Currently undertaken by Council however, illegal dumping was identified as an issue in the community survey.	
Threat/Hazard Addressed and Risk Rating	Land uses changes (increased urbanisation) in the catchment and population increases	Medium (existing and future)
Coastal management objective addressed	<input type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors;	

Action:	Compliance Monitoring for Illegal Dumping	Action ID: 25 Rank: 17
	<input type="checkbox"/> Understand and improve fish stocks; and <input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
Cost	Capital cost: \$0 Annual cost: \$10,000 (Council officer time)	
Responsibility	Primary: Council Secondary: N/A	
Timeframe for implementation	Short: 1-2 years	
Location Map	N/A	

Action:	Support for Greenhouse Gas Emissions Reduction Initiatives	Action ID: 19 Rank: 19
Description	Provide ongoing support for Council's initiatives to reduce their greenhouse gas emissions, and to encourage the community to adopt low emissions practices.	
Threat/Hazard Addressed and Risk Rating	Climate change impacts to coastal management areas	Low to medium (existing) Medium to high (future)
Coastal management objective addressed	<input type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input checked="" type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
Cost	Capital cost: \$0 Annual cost: \$25,000	
Responsibility	Primary: Council Secondary: N/A	
Timeframe for implementation	Long: 5-10 years Concurrent with Option 20: Update Climate Change Projections	
Location Map	N/A	

Action:	Bank Stabilisation on Middle Creek	Action ID: 12 Rank: 20
Description	<p>Encourage landholders to consider feasibility and implementation for bank stabilisation measures along Middle Creek to prevent continued bank erosion. All works are to be approved structures under the Coffs Harbour LEP. Refer to Section 4.2.1 for any approvals and/or requirements if it involves any capital works.</p> <p>This action was part of the estuary management plan developed in 2004 (Patterson Britton and Partners, 2004) and reviewed in 2008 (CHCC, 2008). Erosion is still evident along Middle Creek and is expected to become more pronounced with climate change impacts from storm surge, increased water levels and increased storminess.</p> <p>It is noted that the bank stabilisation works would meet the definition of "coastal protection works" under the <i>Coastal Management Act 2016</i>.</p> <p>This action should only be initiated following completion of Actions 16 and 17 which will provide information relating to coastal hazards and the adequacy requirements of coastal protection works for existing and future hazards.</p>	

Action: Bank Stabilisation on Middle Creek		Action ID: 12 Rank: 20
Threat/Hazard Addressed and Risk Rating	Climate change (increased storm intensity and frequency, storm surge, sea level rise) resulting in bank erosion and degradation of habitat	Medium (existing) Medium to high (future)
	Flooding, ocean waves, tidal currents and storm surge resulting in bank instability and erosion	Medium (existing and future)
Coastal management objective addressed	<input type="checkbox"/> Improve and maintain water quality; <input checked="" type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
Cost	Capital cost: \$5,000 (provision of Council advice to landholders) Annual cost: \$0	
Responsibility	Primary: Landholders Secondary: Council	
Timeframe for implementation	Medium: 2-5 years Trigger: Completion of Action 16: Estuary Entrance Behaviour Investigation, and Action 17: Condition Assessment of Coastal Protection Works, to inform adequacy requirements for bank stabilisation / coastal protection measures for existing and future hazards	
Location Map		

Action: Pest and Weed Control		Action ID: 10 Rank: 21
Description	Support regional pest and weed control activities, including those conducted by Council, NPWS and LLS.	
Threat/Hazard Addressed and Risk Rating	Vegetation clearing and edge effects (intensification of agriculture, water quality impacts, degradation of habitat, informal access to waterways, bank stability)	Medium (existing) Medium to high (future)
	Weed invasion (degradation of habitat)	Medium (existing and future)
Coastal management	<input type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion;	

Action: Pest and Weed Control		Action ID: 10 Rank: 21
objective addressed	<input type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input checked="" type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
Cost	Capital cost: \$0 Annual cost: \$65,000	
Responsibility	Primary: Council Secondary: National Parks and Wildlife Service and Local Land Services	
Timeframe for implementation	Medium: 2-5 years Trigger: Review of Action 6 Bank Stability Projects: For those projects requiring more input than a local community group. This option should be undertaken concurrently with Action 2. Liaison with Bushcare, Landcare and Coastcare groups within the study area will allow for coordination of activities.	
Location Map	N/A	

Action: Support of Grant Programs		Action ID: 9 Rank: 23
Description	Continue to support grant programs such as Environmental Levy Grants, Community Arts and Cultural Development Grants, Green Schools Sustainability Grants, Community Capital Infrastructure Grants Programme. Additional information relating to these grant programs, including how to apply for grants, is available on Councils website. <ul style="list-style-type: none"> The Environmental Levy raises approximately \$1 million / year for the LGA Arts and Cultural Development Grant Program: \$2,000 to \$5,000 grants available, up to \$35,000 available for 2017/18 for the LGA Green Schools Grants: \$20,000 available for 2016/17 for the LGA Community Capital Infrastructure Grants: \$300,000 for 2017/18 for the LGA 	
Threat/Hazard Addressed and Risk Rating	Lack of understanding by community with regards: to habitat values, activities impacting habitat condition, importance of coastal wetlands and littoral rainforests to Aboriginal people and the social and cultural significance.	Medium (existing and future)
	Vegetation clearing and edge effects (intensification of agriculture, water quality impacts, degradation of habitat, informal access to waterways, bank stability)	Medium (existing) Medium to high (future)
	Weed invasion (degradation of habitat)	Medium (existing and future)
	Boating impacts (bank erosion, habitat damage, community access, safety, recreational amenity)	Low (existing) Medium (future)
	Tourism and population increases	Medium (existing and future)
Coastal management objective addressed	<input checked="" type="checkbox"/> Improve and maintain water quality; <input checked="" type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input checked="" type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input checked="" type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
Cost	Capital cost: \$0 Annual cost: \$25,000	


Action:	Support of Grant Programs	Action ID: 9 Rank: 23
Responsibility	Primary: Council Secondary: N/A	
Timeframe for implementation	Short: 1-2 years Grant programs are already funded by Council	
Location Map	N/A	

Action:	Regulation of No Dog Areas	Action ID: 29 Rank: 24
Description	Support ongoing regulation of 'no dog' areas. The community survey undertaken as part of the Community Uses Assessment identified a lack of enforcement of no dog areas as an issue particularly during peak holiday times.	
Threat/Hazard Addressed and Risk Rating	Population increase leading to user conflicts and lack of adequate public access	Medium (existing and future)
Coastal management objective addressed	<input type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
Cost	Capital cost: \$0 Annual cost: \$5,000	
Responsibility	Primary: Council Secondary: N/A	
Timeframe for implementation	Short: 1-2 years	
Location Map	N/A	

Action:	Conservation of unrecorded Aboriginal cultural heritage	Action ID: 30 Rank: 25
Description	<p>Identify opportunities to preserve unknown Aboriginal cultural heritage sites, for example by reviewing Council's LEP and DCP to identify potential Aboriginal cultural heritage that is unrecorded or unknown. Identify opportunities for regulation of certain activities as development requiring consent, and for additional development controls as required for monitoring the impacts.</p> <p>During the Estuary Conditions and Community Uses Study, it has been recognised that there is potential for previously unrecorded Aboriginal heritage items to occur in the study area, and that this should be considered in any proposals in the study area.</p> <p>Currently, most developments require a DA which would include consideration of cultural heritage and a review of potential cultural heritage. However, in cases where it is unknown if a site has potential Aboriginal cultural heritage, additional activities may be required to avoid potential decline of heritage.</p> <p><u>Tasks</u></p> <ul style="list-style-type: none"> Investigate potential actions in cases where it's unknown if a site could potentially contain Aboriginal heritage site, object or item Review consent provisions in DCP / LEP Introduce consent provisions in DCP / LEP (if required) 	


Action: Conservation of unrecorded Aboriginal cultural heritage		Action ID: 30 Rank: 25
Threat/Hazard Addressed and Risk Rating	There is a potential for unrecorded Aboriginal heritage sites, items and objects in the area. Proposals can have a negative impact on these areas if not considered appropriately.	Medium (existing) Medium (future)
Coastal management objective addressed	<input type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input checked="" type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
Cost	Capital cost: \$5,000 (Council officer time) Annual cost: \$2,500	
Responsibility	Primary: Council Secondary: N/A	
Timeframe for implementation	Short: 1-2 years	
Location Map	N/A	

Action: Standardisation of Asset Monitoring		Action ID: 22 Rank: 25
Description	Review Asset Management Plan and monitoring protocols to ensure potential climate change impacts are captured in the Asset Management Plan (refer to Coffs Harbour CZMP Action A.1 (BMT WBM, 2013).	
Threat/Hazard Addressed and Risk Rating	Climate change impacts to infrastructure and development	Low to medium (existing) Medium to high (future)
Coastal management objective addressed	<input type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
Cost	Capital cost: \$5,000 (Council officer time) Annual cost: \$0	
Responsibility	Primary: Council Secondary: N/A	
Timeframe for implementation	Long: 5-10 years	
Location Map	N/A	

Action: Manage Access to Sawtell Dunes and Littoral Rainforests		Action ID: 13 Rank: 26
Description	<p>Manage pedestrian access where it is impacting on Sawtell dunes and littoral rainforests.</p> <p>As the population of the study area increases and during high tourism times, there is the potential that informal access tracks will be established through the Sawtell dunes as has happened at other beaches along the east coast. The dunes are ecologically and culturally important and are an important resource to protect. This option is to involve the development of a management plan to consider the appropriate management of the dunes. Some alternatives for consideration include permanent fencing, temporary fencing, signage and education.</p>	
Threat/Hazard Addressed and Risk Rating	Unmanaged pedestrian access with potential for increased demand for access from tourism and population increases,	Low (existing) Medium (future)
	Edge effects to littoral rainforests (including weed invasion and habitat degradation)	Medium (existing and future)
Coastal management objective addressed	<input type="checkbox"/> Improve and maintain water quality; <input checked="" type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
Cost	<p>Capital cost: \$25,000 (development of management plan)</p> <p>Annual cost: \$0</p>	
Responsibility	<p>Primary: Coffs State Park (under care and control of Council)</p> <p>Secondary: N/A</p>	
Timeframe for implementation	<p>Short: 1-2 years</p> <p>Action 1: Community Education can be used as an additional resource to promote the natural and cultural heritage values of the littoral rainforests to try and limit access through the dunes.</p>	
Location Map		

Action:	Shared User Path Connectivity		Action ID: 27 Rank: 28
Description	Provide improved connectivity for cyclists to and from the study area. The community survey undertaken as part of the Community Uses Assessment (Stage 2 of this CMP) identified a lack of cyclist friendly infrastructure and a lack of pram friendly access to the estuary waterway.		
Threat/Hazard Addressed and Risk Rating	Population increase leading to user conflicts and lack of adequate access	Medium (existing and future)	
	Tourism leading to overcrowding of public infrastructure and recreational assets	Medium (existing and future)	
Coastal management objective addressed	<input type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research		
Cost	Capital cost: \$250,000 Annual cost: \$2,500		
Responsibility	Primary: Council Secondary: N/A		
Timeframe for implementation	Medium: 2-5 years		
Location Map	N/A		

Action:		Boat Ramp Improvements	Action ID: 26 Rank: 29
Description	<p>Improve boat ramp at Micks Retreat by providing more parking and making it more accessible at low tide.</p> <p>The community survey undertaken as part of the Community Uses Assessment identified that the boat ramp requires an upgrade. It was noted that parking is difficult at the boat ramp particularly during peak holiday times. Security was also identified as a problem as the boat ramp is within bushland and thefts have been known to occur at this location. Security measures such as surveillance should be considered.</p> <p>The existing boat ramp – and potential proposed improvements - are in the immediate area of seagrass and it is likely that the proposed ramp upgrade and/or use of the upgraded facilities will exacerbate existing impacts on seagrass. This should be considered in process of boat ramp improvements.</p> <p>Improvement of the boat ramp is to be done in consultation with RMS. It is also recommended that this action is captured in any plan of management prepared for this particular Crown Land Reserve (R81703). Refer to Section 4.2.1 for any approvals and/or requirements if it involves any capital works.</p>		
Threat/Hazard Addressed and Risk Rating	User conflicts (powered craft, unpowered craft, swimmers) resulting in public safety issues	Low (existing) Medium (future)	
	Population increase leading to user conflicts and lack of adequate access	Medium (existing and future)	
	Tourism leading to overcrowding of public infrastructure and recreational assets	Medium (existing and future)	
Coastal management objective addressed	<input type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist);		

Action:	Boat Ramp Improvements	Action ID: 26 Rank: 29
	<input type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
Cost	Capital cost: \$200,000 Annual cost: \$2,000	
Responsibility	Primary: Council Secondary: Roads and Maritime Services (Maritime)	
Timeframe for implementation	Medium: 2-5 years	
Location Map		

Business Case – Lower Priority Management Actions

Action no.	Management Action	Cost (Capital)	Annual Cost (Operational & Maintenance)	Responsibility	Funding & Cost Distribution	Benefits (Management Objective)	Timeframe for implementation
3	Landward migration of intertidal vegetation	\$55,000	\$0	Primary: Council Secondary: NPWS (for those areas within Bongil Bongil National Park) and DPI Fisheries	Coastal & Estuary Grant program: 66% DPIE 33% Council & NPWS (equal split)	<input type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input checked="" type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	Long: 5-10 years
8	Water Quality Monitoring Program	\$25,000	\$150,000	Primary: Council Secondary: Environment Protection Authority	Council DPIE 2:1 through Coastal and Estuary Grants Program	<input checked="" type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input checked="" type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	Medium: 2-5 years
18	Guiding principles for recreational areas	\$5,000	\$0	Primary: Council Secondary: N/A	100% Council Existing budgets / internal staff time	<input type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion;	Medium: 2-5 years

Action no.	Management Action	Cost (Capital)	Annual Cost (Operational & Maintenance)	Responsibility	Funding & Cost Distribution	Benefits (Management Objective)	Timeframe for implementation
						<input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input checked="" type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
20	Update climate change projections	\$0	\$1,500	Primary: Council Secondary: N/A	100% Council Existing budgets / internal staff time	<input type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input checked="" type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	Long: 5-10 years
25	Compliance monitoring of illegal dumping	\$0	\$10,000	Primary: Council Secondary: N/A	100% Council Existing budgets / internal staff time	<input type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage;	Short: 1-2 years

Action no.	Management Action	Cost (Capital)	Annual Cost (Operational & Maintenance)	Responsibility	Funding & Cost Distribution	Benefits (Management Objective)	Timeframe for implementation
						<input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
19	Support for greenhouse gas emissions reduction initiatives	\$0	\$25,000	Primary: Council Secondary: N/A	100% Council Existing budgets / internal staff time	<input type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input checked="" type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	Long: 5-10 years
12	Bank stabilisation works on Middle Creek	\$5,000	\$0	Primary: Landholders Secondary: Council	100% Council Existing budgets / internal staff time	<input type="checkbox"/> Improve and maintain water quality; <input checked="" type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and	Medium: 2-5 years

Action no.	Management Action	Cost (Capital)	Annual Cost (Operational & Maintenance)	Responsibility	Funding & Cost Distribution	Benefits (Management Objective)	Timeframe for implementation
						<input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
10	Pest and weed control	\$0	\$65,000	Primary: Council Secondary: NPWS and LLS	Council 50% NPWS and LLS 50% (equal split) Potentially Crown Reserves Improvement Fund Program grant (for works on Crown Reserves)	<input type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input checked="" type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	Medium: 2-5 years
9	Support of grant programs	\$0	\$25,000	Primary: Council Secondary: N/A	100% Council Existing budgets (e.g. Ordinary Rates, Environment Levy)	<input checked="" type="checkbox"/> Improve and maintain water quality; <input checked="" type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input checked="" type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input checked="" type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	Short: 1-2 years
29	Regulation of no dog areas	\$0	\$5,000	Primary: Council Secondary: N/A	100% Council	<input checked="" type="checkbox"/> Improve and maintain water quality;	Short: 1-2 years

Action no.	Management Action	Cost (Capital)	Annual Cost (Operational & Maintenance)	Responsibility	Funding & Cost Distribution	Benefits (Management Objective)	Timeframe for implementation
					Existing budgets / internal staff time	<input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
30	Conservation of unrecorded Aboriginal cultural heritage	\$5,000	\$2,500	Primary: Council Secondary: N/A	100% Council Existing budgets / internal staff time	<input type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input checked="" type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	Short: 1-2 years
22	Standardisation of asset monitoring	\$5,000	\$0	Primary: Council Secondary: N/A	100% Council Existing budgets / internal staff time	<input type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist);	Long: 5-10 years

Action no.	Management Action	Cost (Capital)	Annual Cost (Operational & Maintenance)	Responsibility	Funding & Cost Distribution	Benefits (Management Objective)	Timeframe for implementation
						<input type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
13	Manage access to Sawtell dunes and littoral rainforest	\$25,000	\$0	Primary: Coffs State Park (under care and control of Council) Secondary: N/A	100% Council Existing budgets / internal staff time	<input type="checkbox"/> Improve and maintain water quality; <input checked="" type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input checked="" type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	Short: 1-2 years
27	Shared user path connectivity	\$250,000	\$2,500	Primary: Council Secondary: N/A	100% Council Capital works budget	<input type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors;	Medium: 2-5 years

Action no.	Management Action	Cost (Capital)	Annual Cost (Operational & Maintenance)	Responsibility	Funding & Cost Distribution	Benefits (Management Objective)	Timeframe for implementation
						<input type="checkbox"/> Understand and improve fish stocks; and <input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	
26	Boat ramp improvements	\$200,000	\$2,000	Primary: Council Secondary: TfNSW (Maritime)	Council 75% MIDO 25% (see grant programs)	<input type="checkbox"/> Improve and maintain water quality; <input type="checkbox"/> Reduce estuary sedimentation and bank erosion; <input checked="" type="checkbox"/> Improve community amenity and facilities (resident and tourist); <input type="checkbox"/> Preserve / protect the natural environment and cultural heritage; <input type="checkbox"/> Maintain and improve riparian vegetation corridors; <input type="checkbox"/> Understand and improve fish stocks; and <input type="checkbox"/> To support the ongoing use of the estuary as an educational resource and for research	Medium: 2-5 years

Bonville and Pine Creek

APPENDIX

G

IMPLEMENTATION TIMEFRAME

