



Manning River Estuary
COASTAL MANAGEMENT PROGRAM
2022-2032

Acknowledgement of country

We acknowledge the traditional custodians of the land on which we work and live, the Gathang-speaking people and pay our respects to all Aboriginal and Torres Strait Islander people who now reside in the MidCoast Council area. We extend our respect to elders past and present, and to all future cultural-knowledge holders.

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Thank you

Thank you to the many stakeholders who assisted Council to prepare this program. Special thanks go to the members of the Manning River ECMP Reference Group, the Technical Advisory Group, the Biripi community and our colleagues at Hunter Local Land Services.

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OUR VISION

"The Manning River, its tributaries and the estuary give life to our community connecting the mountains to the sea. Together we manage the catchment holistically and respond to a changing climate - safeguarding environmental, social, cultural and economic values."

Executive Summary

The Manning estuary is a single channel from the tidal extent up-river of Wingham to Taree. From there it spills over an extensive floodplain with a complex of intertidal tributaries and inter-connecting channels approximately 115 km in length. Six islands lie between the north and south entrances. The estuary is fed by the Manning River, with its vast catchment covering approximately 8,420 km².

Much of the estuary is rural land with a population of approximately 34,000 people living in small towns and villages. The Manning estuary is important for oyster-growing, fishing, tourism and recreation. Our community loves swimming, boating and the beautiful scenery of this mighty waterway. These values all depend on healthy ecosystems and clean water.

The local Biripi Aboriginal people are known as the *guyiawan*, the shark people. They are connected to the Manning estuary (*Djarri bila*) through their tribal totem and see water as the life source for *Country* and all living things. It is important for culture, identity and healing.

Estuaries are the "nurseries of the sea." Their sheltered waters provide vital nesting, breeding and feeding habitats for many species of fish, shellfish, aquatic plants and birds. Saltmarsh, mangroves and seagrass sequester carbon, contribute to good water quality, and provide protection against flood and storm surge. The Manning floodplain is rich with fertile topsoil from centuries of deposition, beneath which lies some of the highest risk Acid Sulfate Soils in NSW.

Our most valuable natural assets are coastal wetlands and riparian and littoral vegetation. Together these habitats work hard to keep our waterways clean and healthy. They provide ecosystem services which have a social and economic value for our community. Protecting and restoring these assets will pay real dividends for resilience and prosperity.

The Manning River Estuary Coastal Management Program (Manning Estuary CMP) has been developed to sustain the environmental, social and economic values of the estuary. It

is a ten-year action program that primarily addresses the impact of land-use on water quality and ecosystem health.

The Manning Estuary CMP is a subsidiary of the Manning River Estuary and Catchment Management Program (Manning River ECMP), which was adopted by Council on the 28th of July 2021. The Manning River ECMP was prepared in response to the NSW Coastal Management Act and therefore focused on the estuary, but took a whole-of-catchment approach, recognising that the fresh and saltwater systems are connected and what happens upstream impacts on the estuary and marine receiving waters. This approach followed the guidance of our Technical Working Group and Community Reference Group.

The Planning Area for the Manning River ECMP commences 2 km inland from the open coast and extends to the top of the catchment. It covers the four Coastal Management Areas mapped in the State Environmental Planning Policy - Resilience and Hazards 2021 (the CM SEPP – formerly the Coastal Management SEPP 2018) and adds two additional management areas: the floodplain and the freshwater catchment.

By contrast, the Manning Estuary Coastal Management Program (Manning Estuary CMP) is an edited extract of the broader catchment management program. Its Planning Area commences 2 km inland from the open coast at both entrances and relates only to the Coastal Zone mapped in the CM SEPP.

The Manning Estuary CMP has been prepared following a legal review and advice from the NSW Government, as a requirement for certification under the Coastal Management Act. The Manning River ECMP can be considered as the parent program that manages catchment inputs to the estuary, while the Manning Estuary CMP is its subsidiary, focusing exclusively on the estuarine component of the marine estate.

The Manning River ECMP was prepared under the Coastal Management Act and had a strong focus on the estuary. Its vision, values, treats and risks, objectives and actions therefore remain relevant and those actions relating to the Coastal Zone planning area have been carried across with only minor changes. This will ensure integration between the two programs.

Over 300 people were involved in development of these programs. Stakeholders consulted included a Community Reference Group formally appointed by Council, and a Technical Advisory Group, with members from key state agencies including the Department of Planning, Industry and Environment and the Department of Primary Industry – Fisheries.

Our community told us that what they value most in the Manning estuary is healthy aquatic ecosystems, which underpin all other values. This was closely followed by visual amenity and then cultural and spiritual values. To protect these and other values, we developed a series of themes and objectives:

1. **Stewardship:** Engage with the community, build capacity and support partnerships to promote understanding, connection and stewardship.
2. **Water Quality and Ecosystem Health:** Manage the Manning River Catchment and its Estuary holistically to maintain and improve water quality and ecosystem services.
3. **Climate Change:** Understand, mitigate, adapt and build resilience to current and future hazards including the impacts of climate change.
4. **Biodiversity:** Protect and enhance natural character and biological diversity.

5. **Aboriginal Custodianship:** Acknowledge and support Aboriginal peoples' spiritual, social, customary and economic connection to the Manning River Catchment and its Estuary.
6. **Social and Economic Values:** Manage the Manning River Catchment and its Estuary to maintain and improve social, cultural, and economic opportunities and benefits.
7. **Land Use Planning:** Facilitate ecologically sustainable development and promote sustainable land use planning decision-making.
8. **Governance:** Build stakeholder partnerships for good governance and integrated management.

The project team conducted a risk assessment to identify which threats occurring in the catchment have the highest likelihood of impacting on the values identified. The top threats are:

- Lack of stewardship
- Failure to account for long term impacts of climate change
- Clearing and degradation of coastal wetlands
- Floodplain drainage Acid Sulfate Soil
- Clearing and degradation of (littoral) riparian vegetation and adjacent habitat
- Agricultural diffuse source run-off.

Through a series of issue papers and discussion groups, we analysed the activities, stressors and impacts for key issues driving these threats. This issue analysis was used to inform the CMP Action Program set out in this document.

Four actions have not been carried forward from the catchment program into the CMP. Two of these are outside the Coastal Management Area: restoration of drought refuge pools and remediation of unsealed roads. Another two actions relating to proposed entrance modifications have been removed because they are outside the Planning Area. These actions are well underway. All other actions remain relevant. The CMP Action Program therefore brings together 32 management actions to be implemented over ten-years in a format that is measurable and targeted. It sets the direction for Council, our community and partner organisations to improve the health of the Manning estuary.

At its heart this program involves working in partnership with landholders to manage impacts and improve the health of our waterways. The top priority actions are:

- Engaging our community to promote understanding and commitment to stewardship of the catchment
- Supporting landholders and land managers to implement regenerative practices that contribute to improved estuarine health
- Implementing key priority acid sulfate soil management actions from the draft Manning River Floodplain Prioritisation Study 2021

- Protecting and/or rehabilitating coastal wetlands
- Improving the condition and extent of riparian and estuarine shoreline vegetation.

A business plan presents the financial framework for the program. It includes co-contributions from Hunter Local Land Services, our key delivery partner, and grant funding to be sought through the NSW Government's Coast and Estuary Program. The total implementation budget is \$10,953,500 over ten-years.

As with its parent document, the Manning Estuary CMP will be implemented through Council's Integrated Planning and Reporting Framework and Land Use Planning program, and through the activity of our partner agencies. A governance structure is in place to facilitate collaboration between Council, our partners and community stakeholder groups.

The Manning Estuary CMP includes a program to monitor and evaluate both the water quality and ecosystem health of the estuary, and progress against the targets set out in the actions. Reporting will take place annually via Council's Water Quality Report Card and an annual report for the CMP. Evaluation of our results will guide continuous improvement, which will be captured in a 5-year review of the document.

Working together with partners, stakeholders and our community to implement the Manning Estuary CMP will help us protect and improve the ecological health of this vital natural asset and support the social, cultural and economic values of the region.



Photo: Our River – Our Future by Mark Gutterson

Acronyms

AEP	Annual Exceedance Probability for floods (1% AEP means 1 % chance of a flood of that magnitude occurring in any given year, roughly equivalent to a 1 in 100-year event)
AHD	Australian Height Datum (essentially mean sea level is zero)
CM	Coastal Management
CMM	Coastal Management Manual
CZMP	Coastal Zone Management Plan
CSP	Community Strategic Plan
DCP	Development Control Plan
DPE	Department of Planning and Environment (formerly DPIE – see below)
DPIE	Department of Planning, Industry and Environment
ECMP	Estuary and Catchment Management Program
FAWNA	For Australian Wildlife Needing Aid
FRMS	Floodplain Risk Management Study
Hunter LLS	Hunter Local Land Services
LEP	Local Environmental Plan
LG	Local Government
LGA	Local Government Area
M&E	Monitoring and evaluation
MC2T	Mid Coast 2 Tops Landcare
MCC	MidCoast Council
MERI	Monitoring, evaluation, reporting and improvement
NRAR	Natural Resources Access Regulator
OBMP CMP	Old Bar - Manning Point Coastal Management Program
PASS	Potential Acid Sulfate Soil
SEPP	State Environmental Planning Policy
S.M.A.R.T	Specific, Measurable, Attainable, Realistic, Timely
SQID	Stormwater Quality Improvement Device
TARA	Threat and Risk Assessment
TAG	Technical Advisory Group
TIDE	Taree Indigenous Development and Employment
WSUD	Water Sensitive Urban Design
WQ	Water Quality



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1. Introduction and strategic direction

Throughout history human settlement has hugged waterways. Middens on the Manning estuary speak of ancient Biripi Aboriginal campsites and shellfish banquets. For European settlers, the waterways provided fish and oysters, fertile floodplains for farming, transport routes for milk and timber, and places to enjoy recreation and restore wellbeing. Today, the town of Taree and villages such as Tinonee and Wingham are located on the tidal reaches of the Manning estuary.

1.1 Purpose of the Manning Estuary CMP

MidCoast Council has worked together with stakeholders including the Department of Planning and Environment to develop the Manning River Estuary Coastal Management Program (Manning Estuary CMP). The purpose of the Manning Estuary CMP is to set the long-term strategy for coordinated land management within the coastal zone, while responding to local stakeholder input and evidence-based science. It has been prepared to meet the mandatory requirements for a CMP set out in the Coastal Management Manual (OEH 2018). There is no preceding Coastal Zone Management Plan for the Manning estuary.

The Manning Estuary CMP aims to achieve the objects of the Coastal Management Act (2016) by protecting the environmental, social and economic values of the estuary. It identifies community values and objectives, issues and a ten-year action program to address them. The Manning Estuary CMP sets out the governance structure and implementation through Council's Integrated Planning and Reporting Framework, a business plan with budgets and funding mechanisms, and the Monitoring, Evaluation and Reporting framework.

The Manning Estuary CMP can be seen as a subsidiary of the Manning River Estuary and Catchment Management Program adopted by Council on the 28th July 2021. Continued implementation of the over-arching Catchment Management Program will help manage catchment inputs that influence water quality and ecosystem health in the estuary. Once certified by the NSW Government, Council will seek grant funds through the NSW Coast and Estuary program to implement the CMP.

In the Manning Estuary CMP, the words “river” and “estuary” are used interchangeably, referring to the estuarine reaches of the system corresponding to the Coastal Environment Area mapped in the State Environmental Planning Policy - Resilience and Hazards 2021 (the CM SEPP – formerly the Coastal Management SEPP 2018).

The Manning Estuary CMP is supported by several complementary programs of MidCoast Council. These include the strategic land use planning framework for the Local Government Area and the Manning River Floodplain Risk Management Study and Plan 2019. Together these programs will safeguard the environmental, social and economic values of the Manning estuary.

1.2 Supporting Documents

A set of supporting documents was prepared as annexures to the Manning River Estuary and Catchment Management Program and were adopted by Council in July 2021. The supporting documents provide the results of more detailed investigations relevant to the Manning Estuary CMP. They are referred to throughout this document and include:

- Annexure A: The Manning River ECMP Scoping Study (MCC 2020)
- Annexure B: The Manning River ECMP Stakeholder Consultation Report (MCC 2021)
- Annexure C: Birrbay Voices - Aboriginal Consultation Report (Lawler 2021)
- Annexure D: The Manning River ECMP Farmers Consultation (NBA Consulting 2019)
- Annexure E: The Manning River Estuary ECMP Community Values Report (MCC 2020)
- Annexure F: The Manning River ECMP Coastal Wetlands Mapping Report (Ecological 2019)
- Annexure G: Manning River Estuary ECMP Spatial Risk Assessment (EES 2020)
- Annexure H: Manning Rapid Site Assessment Report (EES 2020)
- Annexure I: The Manning River Estuary ECMP Issue Analysis Report (2021)
- Annexure J: The Manning River ECMP Management Actions – Practice Notes (MCC 2021)
- Annexure K: The Manning River ECMP Management Options Evaluation Report (Salients 2021)
- Annexure L: The Manning River ECMP Monitoring, Evaluation and Reporting Program: Water Quality and Ecosystem Health (MCC 2021)
- Annexure M: Evidence for a future Planning Proposal to amend the CM SEPP – Coastal Wetlands (Locale Consulting 2021)

1.3 The Legislative Framework

This Coastal Management Program (CMP) has been prepared under the NSW Government's Coastal Management Framework shown in Figure 1.



Figure 1: The NSW Coastal Management Program

Its scope is to manage Coastal Management Areas within the Manning River Estuary, fulfilling the objectives of:

- The Coastal Management (CM) Act 2016
- The Coastal Management State Environmental Planning Policy (CM SEPP) 2018
- The Marine Estate Management (MEM) Act 2014

These Acts along with the Environmental Planning and Assessment Act are the key legislative tools to manage the interaction of coastal processes and hazards, population growth, coastal lifestyles and sensitive natural environments of the open coast and estuaries.

1.3.1 The Coastal Management Act and CM SEPP

The CM Act recognises that the NSW coast is one of our greatest assets, with unique natural features, values and resources that support our way of life. It requires all Councils to prepare Coastal Management Programs that will sustainably manage this dynamic and diverse landscape for the people of New South Wales.

The associated State Environmental Planning Policy - Resilience and Hazards 2021 (CM SEPP) establishes a framework to manage development and land use planning in the coastal zone.

The CM SEPP defines the coastal zone as four (sometimes overlapping) coastal management areas, which are mapped in the SEPP. The four areas are:

Coastal wetlands and littoral rainforest area –coastal wetlands or littoral rainforests that were previously protected by SEPP 14 and SEPP 26, plus a 100-metre buffer for each.

Coastal environment area – areas with natural features such as beaches and headlands, coastal lagoons and estuarine waters.

Coastal use area – land adjacent to coastal waters, estuaries and coastal lakes and lagoons, where urban coastal development may be found.

Coastal vulnerability area – areas subject to coastal hazards such as coastal erosion and tidal inundation. Coastal Vulnerability Area mapping has not been completed in the Planning Area.

1.3.2 The Marine Estate Management Act

As shown in Figure 1, the Marine Estate Management Act sits side-by-side with the Coastal Management Act to protect our marine estate. The marine estate includes the estuaries, coastal wetlands, coastline and receiving waters of the Pacific. This Act aims to achieve “a healthy coast and sea, managed for the greatest well-being of the community, now and into the future.”

1.3.3 The Environmental Planning and Assessment Act

The EP&A Act 1979 was amended in 2017. Its objects are concerned with facilitating ecologically sustainable development that conserves natural heritage while promoting development of land for economic and social outcomes.

A Ministerial Planning Direction under Section 9.1 of the *Environmental Planning and Assessment Act 1979* accompanies the Coastal Management SEPP. It requires that planning proposals within the coastal zone need to be consistent with Coastal Management Programs.

Management Actions in Section 3.7 will be implemented under the EP&A Act.

1.3.4 The Local Government Act

The Local Government (LG) Act 1993 provides a legal framework for local government in NSW, setting out responsibilities and powers of councils and facilitating engagement with, and accountability to the community.

Chapter 13 of the LG Act requires Council to prepare a Community Strategic Plan, Delivery Program and Operational Plan as part of the Integrated Planning and Reporting (IP&R) Framework.

Management Actions in Sections 3.1 – 3.6 and 3.8 will be implemented through the Local Government Act.



Photo: Sunset in paradise by Megan Gavenlock

1.4 Our Planning and Management Areas

1.4.1 The Planning Area

A Coastal Management Program may be made in relation to the whole, or any part, of an area included within the coastal zone. MidCoast Council is preparing three Coastal Management Programs to manage the Manning estuary and coastal zone. These are:

1. The Manning River Estuary Coastal Management Program (Manning Estuary CMP)
2. The Old Bar-Manning Point Coastal Management Program (OBMP CMP)
3. The Open Coast Coastal Management Program (OC CMP)

The three CMP Planning Areas and their relationship to the Manning River and Estuary Catchment Management Program are shown in Figure 2 overleaf.

The Manning Estuary CMP commences 2 km inland from the Manning coast and covers only the Coastal Management Areas mapped in the CM SEPP (ie. the Coastal Zone). It includes the lower Manning River and its tributaries below the tidal limit. The entire Planning Area is within the MidCoast Council Local Government Area.

The Old Bar -Manning Point Coastal Management Program (OBMP CMP) Planning Area covers the highly erosive open coast to 2 km inland, including Farquhar Inlet and the river entrance at Old Bar.

Following completion of the OBMP CMP, an Open Coast CMP will be prepared to replace the certified and gazetted Manning Valley CZMP 2018. It will include Harrington and the north entrance of the Manning River.

The rationale for developing three CMPs to cover the Manning River Estuary and coastal zone is that the threats, risks and issues affecting each of these Planning Areas are different and require detailed attention that will be better handled in separate programs.

The Manning estuary is a relatively low energy environment and its CMP is primarily concerned with the impact of land on water.

The NSW Government identified some 15 open coast hazard sites along the NSW coastline where the impact of coastal hazards and the risk to assets are particularly high. Beaches between Old Bar and Manning Point are identified as high-risk open coast hazard sites. Hence Council is developing the Old Bar Manning Point CMP as a high priority and conducting detailed investigations to develop the best options to manage these risks.

We have distinguished between the Old Bar-Manning CMP and the Open Coast CMP northward from the entrance at Harrington because these Planning Areas represent separate secondary sediment compartments: the Manning river sediment compartment for the former, and the Tacking Point – Crowdy Head for the latter.

The Manning River ECMP and three Coastal Management Programs are inter-related and there will be ongoing communication between the programs, including integration through Council's IP & R Framework.



Figure 2: Map of the Planning Areas for the three CMPs and Manning River ECMP

1.4.2 The CMP Management Areas

Features of the Coastal Management Areas within this document's Planning Area are outlined below and shown in Figure 3 overleaf.

Coastal wetlands and littoral rainforest areas (CWLRA) – Coastal wetlands play a crucial role in attenuating pollutants, storing carbon, providing habitat for fish and shorebirds and mitigating the impact of flood on the estuary. There are significant areas of coastal wetland covered by the Manning Estuary CMP, including Big Swamp, Cattai Wetlands, Crowdy Lagoon, Dawson Wetlands and Coopernook Wetlands. There are no areas of littoral rainforest within our Planning Area.

Coastal Environment Area (CEA) – The CEA for the Manning Estuary CMP covers estuarine waters from the tidal limit at Abbotts Falls upstream of Wingham to the edge of our Planning Area, 2 km inland from the dual entrances at Harrington and Farquhar Inlets. It includes tidal waterways such as the Lansdowne River, Dawson River, Cattai Creek, Ghinni Creek and Browns Creek. The estuary is shown in Figure 4.

Coastal Use Area (CUA) – this is land adjacent to the estuary, where urban coastal development may be found, such as the estuarine foreshores of Wingham, Taree and Cundletown. The Coastal Use Area was mapped in the MidCoast LGA as a 500 metres landward extent from the open ocean boundary and a 250 metres landward extent from the boundaries of estuaries.

Coastal Vulnerability Area (CVA) – these are areas subject to seven coastal hazards defined by the CM Act: beach erosion, shoreline recession, entrance instability, coastal inundation, coastal cliff or slope instability, tidal inundation, erosion and inundation of foreshores caused by tidal waters and wave action.

The Coastal Vulnerability Area has not yet been mapped for the Manning Planning Area. Mapping the CVA is action 7.02 in this CMP.

Council uses coastal hazard lines, foreshore set-backs and flood zones to control development in areas subject to hazards. Within the Manning Estuary CMP Planning Area there is a coastal setback line on the foreshore in Cundletown (Figure 5).

The location of the Manning River Estuary within the wider catchment managed through the Estuary and Catchment Management program is shown in Figure 6.

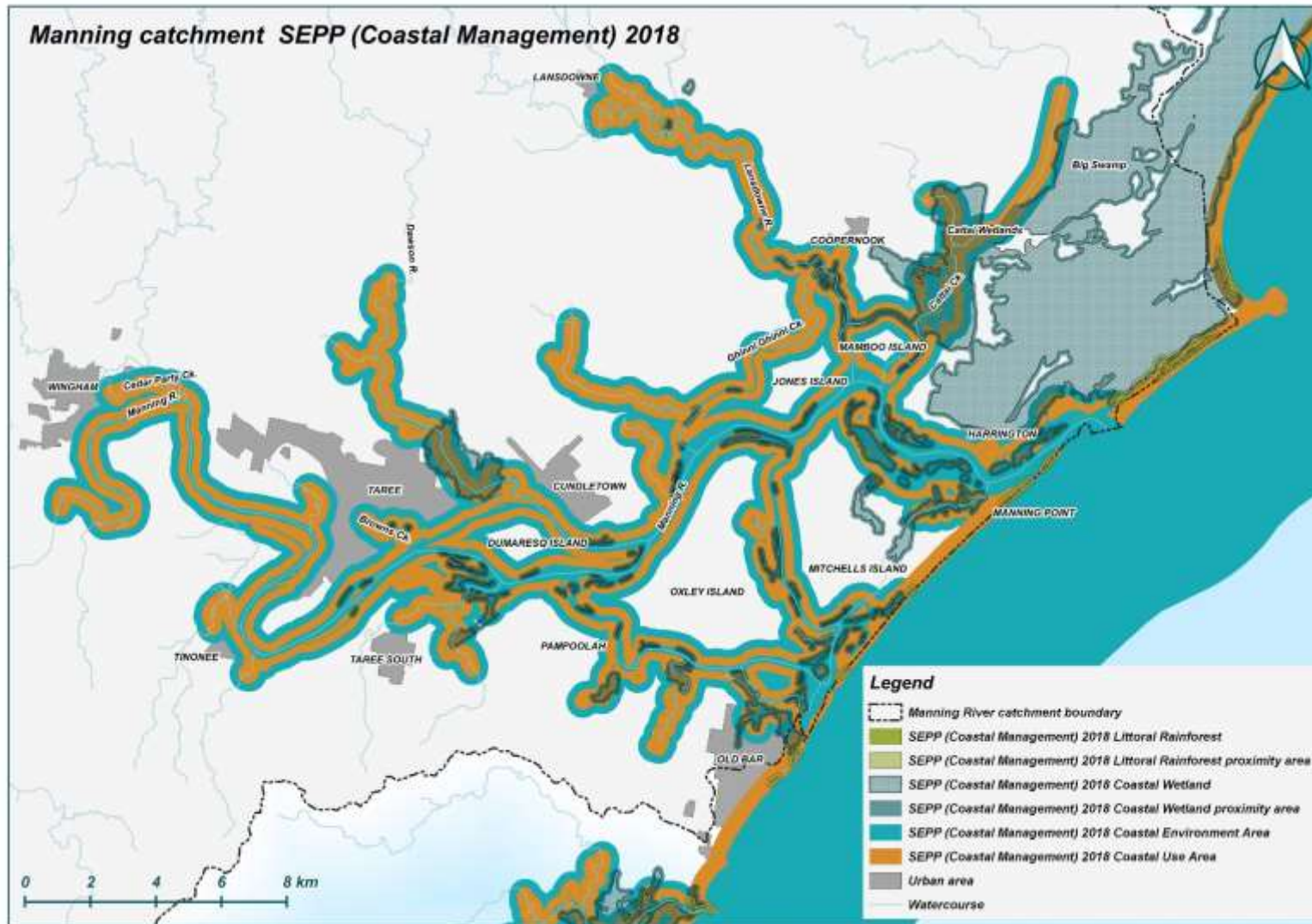


Figure 3: Map of the Manning River Estuary Coastal Management Areas

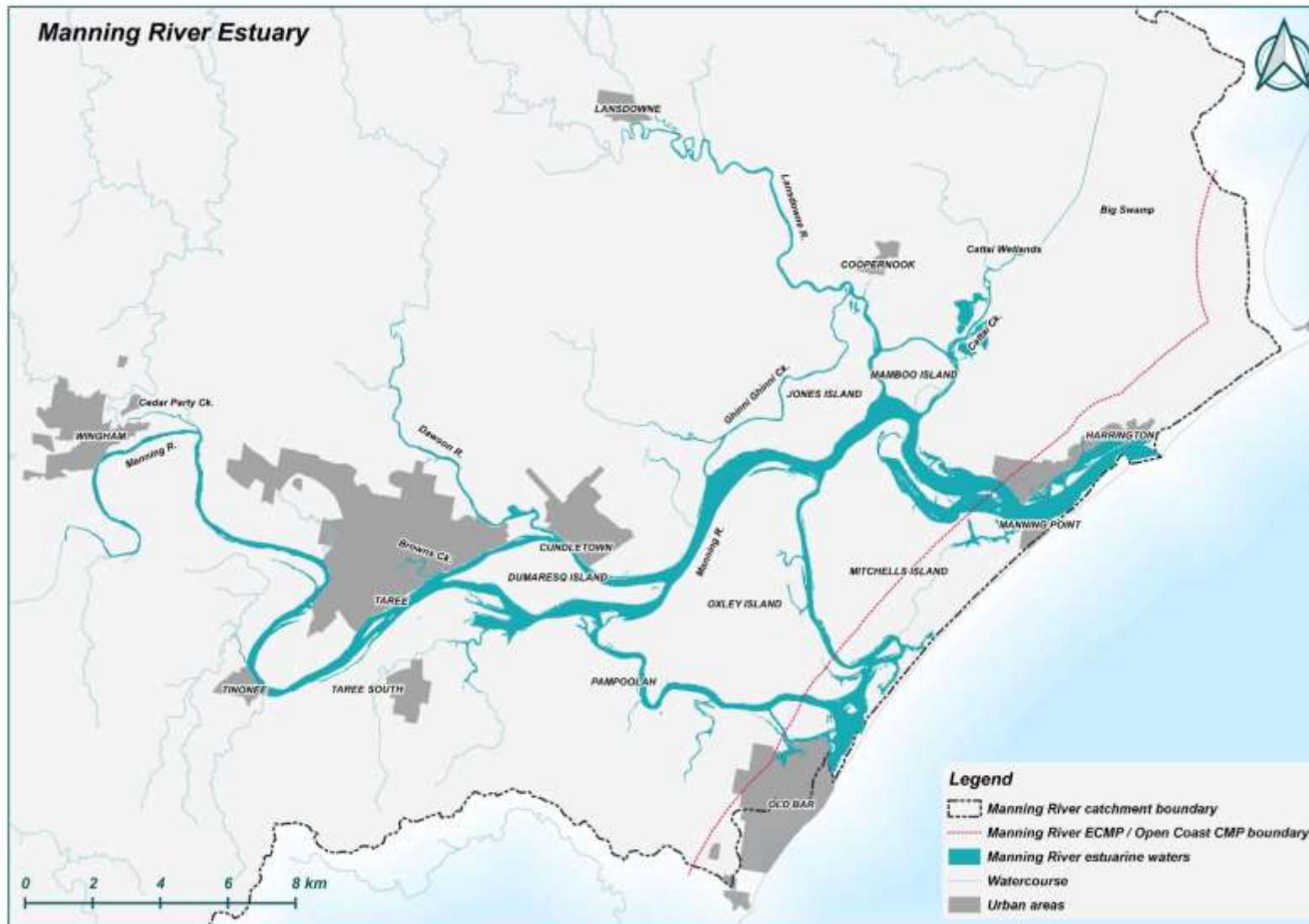


Figure 4: Map of the Manning River Estuary

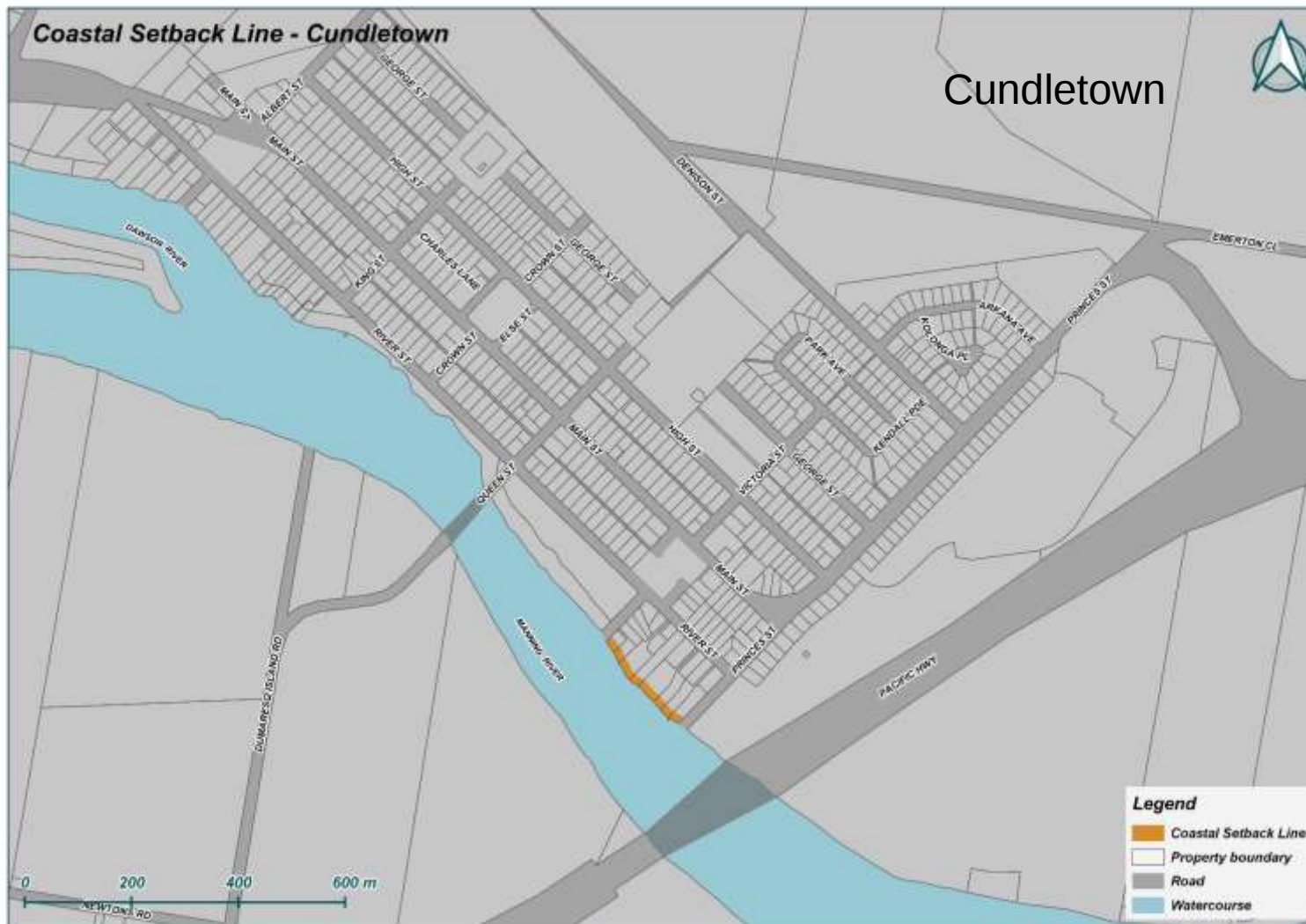


Figure 5: Map of the Coastal Setback line at Cundletown



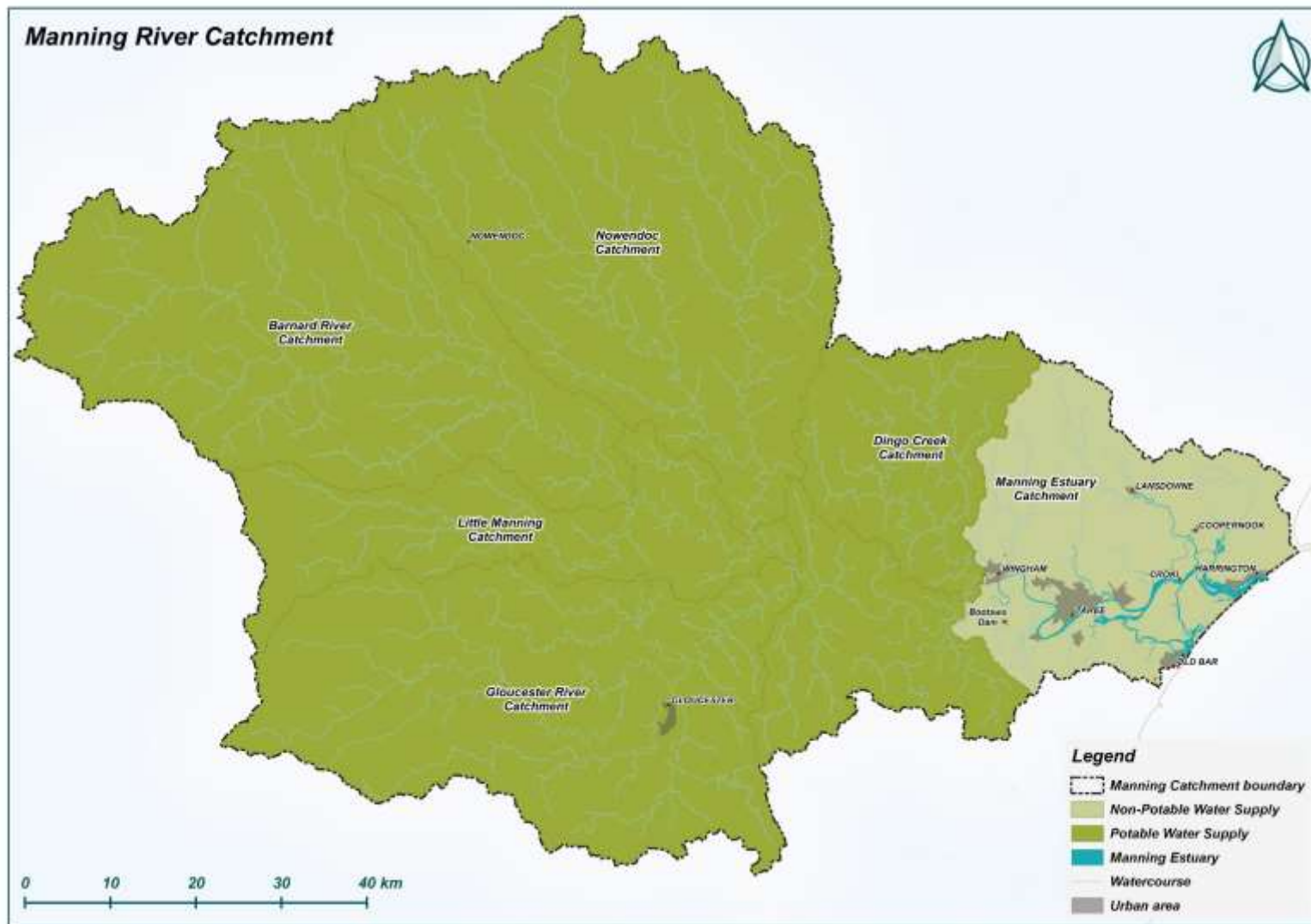


Figure 6: Map of the Manning estuary and its catchment

1.5 Natural features of the Manning Estuary

The Manning estuary is a mature wave dominated barrier estuary covering an area of approximately 32.3 km² (Roy *et al* 2001). From the tidal extent at Abbotts Falls up-river of Wingham, the estuary is a single channel to Taree then spills over an extensive floodplain with a complex of river intertidal tributaries and inter-connecting channels approximately 115 km in length. Six islands lie between the north and south entrances, the largest of which are Dumaresq, Oxley and Mitchell's islands.

The estuary's average flushing time is 31.6 days, compared to a State-wide median of 9 days (Roper *et al.* 2011). The long residence time of fresh water makes the estuary particularly sensitive to the accumulation of catchment inputs (Roper *et al.* 2011). The Manning River estuary has been rated as having medium sensitivity to freshwater inflows (NSW Govt. 2016 p. 10).

There is a moderately significant tidal pool in the main channel of the river directly downstream of Wingham. Despite being affected by daily tidal movements, the tidal pool is primarily fresh and sustains some commercial water extraction.¹

Estuaries are highly productive water bodies where freshwater and saltwater meet. They are the “nurseries of the sea,” where sheltered waters provide vital nesting, breeding and feeding habitats for many species of fish, shellfish, aquatic plants and birds. Most commercially valuable fish species depend on estuaries at some point during their development.²

The estuary is fed by the Manning River, which originates at 1570 m above sea level in the Gondwana World Heritage Area of the Barrington Tops and flows 261 km to the Tasman Sea on the mid-north coast of NSW.³ Its catchment covers an area of approximately 8,420 km² with 16 major tributaries, of which 11 are freshwater and 5 are estuarine.

Tributaries of the Manning within the tidal limit of the estuary include Cattai Creek, the Lansdowne River, Ghinni Ghinni Creek, Dawson River, Brown's Creek and Cedar Party Creek entering from the north, and Oyster Creek, Varwiba creek, Berady Creek, Halls Creek, Carters Creek, Peg leg Creek and Mondrook Creek entering from the south.

Coastal wetlands are known as the kidneys of the landscape, filtering and attenuating pollutants to keep the estuary water clean. They are like sponges, soaking up floodwater and releasing it slowly, mitigating the impact of floods on the estuary. Mangroves stabilise shorelines. Coastal wetlands store carbon, helping to mitigate greenhouse gas emissions. Wetlands also provide opportunities for nature-based tourism and have Aboriginal cultural significance, historical significance and importance for science and education.

While the majority of coastal wetlands in the Manning have been drained and modified, wetlands of considerable conservation significance still occur.⁴ These include:

- Large areas of mangrove forest and brackish wetlands in areas such as Cattai Wetlands, Big Swamp and Coopernook Swamp

¹ (Betteridge & Rabbidge, 2016)

² (NSW Government, Why estuaries are important, 2020)

³ (Betteridge & Rabbidge, 2016)

⁴ (Eco Logical Australia Pty Ltd, 2019)

- Large wetlands at Dawson wetlands, Kundle Kundle and Manning Point
- Forested wetlands with swamp mahogany, broadleaved paperbark and swamp oak⁵
- Estuarine and near-shore marine systems made up of coastal mangroves, salt marshes and sea-grass beds which rely on the submarine discharge of groundwater⁶
- Seagrass meadows.



Photo: Coastal wetlands are the kidneys of the landscape

A study conducted for the Manning Estuary CMP mapped 13 types of coastal wetlands in the Manning including broad-leaved paperbark swamps, freshwater wetlands, reedlands, saltmarsh and grey mangrove forest (Annexure F: The Manning River ECMP Coastal Wetlands Mapping Report, Ecological 2019). The study found that:

- 69% of the remaining coastal wetlands are in good condition
- 19% are in fair condition
- 12% are in poor/very poor condition.
- The majority (86%) of all wetland types mapped are identified and protected under State or Commonwealth legislation

⁵ (MidCoast Council, 2020)

⁶ (Geosciences Australia, undated)

Groundwater aquifers are found throughout the Manning catchment⁷. Groundwater “commonly provides an important and reliable source of water to many ecosystems and can be the main factor controlling the distribution of ecosystem types” (Geoscience Australia). Coastal sand aquifers have significant connectivity to surface water⁸. Understanding the connection between groundwater and surface water is important when regulating groundwater use, recognising that draw-down of the aquifer influences surface water flows.

Groundwater Dependent Ecosystems are ecosystems that depend on groundwater for some or all their water requirements. Coastal wetlands and estuarine and near-shore marine systems such as coastal mangroves, salt marshes and sea-grass beds in the Manning River Estuary are classified as Groundwater Dependent Ecosystems, as they rely on the submarine discharge of groundwater (Geoscience Australia).

Healthy in-stream condition of estuarine creeks and rivers contributes to conservation of aquatic fauna and the productivity of fisheries including commercial species.

Riparian and littoral vegetation including mangroves and swamp oak forests plays a central role in stabilising waterways, reducing channel boundary erosion, filtering diffuse-source run-off and providing habitat. Riparian vegetation helps maintain water quality by reducing the amount of pollutants entering the waterway. It serves as a physical buffer, slowing down overland flow and mitigating the negative impacts of flooding.⁹ All of these ecosystem services benefit the estuary.

“The remaining native vegetation remnants are very important – we need to improve and maintain them.”

Noel Piercy, Member, Community Reference group

Estuaries are exceptionally biodiverse because they form transition zones between fresh and saltwater systems, aquatic and terrestrial ecosystems. The focus for the Manning Estuary CMP is on estuarine aquatic and riparian fauna, particularly listed threatened species within the Planning Area. These include:

- A maternity camp of vulnerable grey-headed flying fox in a patch of Sub-tropical Lowland Rainforest (EEC) on the estuary at Wingham Brush.
- At least twenty-five species of fish that migrate throughout the Manning system including the Australian Bass.¹⁰

⁷ (Commonwealth of Australia, 2017-18)

⁸ (Betteridge & Rabbidge, 2016)

⁹ (Swanson, 2020)

¹⁰ (Bishop, 2016)

1.6 Water Quality

1.6.1 Community Values and Uses

The National Water Quality Management Strategy aims to manage waterways according to community environmental values and uses. These are the values and uses people want protected to support livability, amenity, recreational and primary industry uses. The NSW government adopted this principle and developed Water Quality Objectives (WQO) in 1999 (EPA 2000) to help state and local authorities assess whether waterways are being managed in-line with the community uses and values. The Objectives consist of three components: the community environmental value or use, water quality indicators to maintain those values and numerical trigger values that indicate when water quality meets the desired state.

Social science research conducted by the NSW Government was used to develop a map of community environmental values and uses for the Manning Estuary. The values and uses identified are:

- Aquatic ecosystems
- Visual amenity
- Secondary contact recreation
- Primary contact recreation
- Aquatic food production

New research was planned to revise the community environmental values and uses but due to the global pandemic the project was postponed, and the results were not available when developing the Manning River Estuary and Catchment Management Program.

MidCoast Council therefore conducted our own community values consultation. Full details are provided in Annexure E: The Manning River ECMP Community Values Report (MCC 2020). We found that the top 3 values at the catchment scale were aquatic ecosystems, visual amenity and cultural use. For the estuary our research matched the values above, with the addition of cultural values.

The Monitoring, Evaluation and Reporting program for the Manning Estuary CMP is set out in section 7 of this document, with full details provided in Annexure L: The Manning River ECMP Monitoring, Evaluation and Reporting Program (MCC 2021). This program establishes the level of protection, water quality indicators, trigger levels, and monitoring regime for each of the community values.

In the event a water quality guideline 'Trigger Value' is reached and the cause is not determined to be due to natural variability, further monitoring and investigation will be undertaken to provide increased understanding of the possible cause and whether the relevant WQO is likely to be achieved. Where a WQO is considered likely to be at risk, or the risk is uncertain, management response options based on scientific advice will be evaluated in consultation with CMP Stakeholders.

1.6.1 Water Quality Monitoring Results

MidCoast Council engages the Department of Planning and Environment (DPE) to undertake annual water quality monitoring in the estuary, which is made public in the annual Water Quality Report Card.

A healthy waterway can generally be characterised by low turbidity and low levels of algae and provides habitat for a wide range of plants and animals. Therefore, two key indicators of estuary health are monitored independently by DPE – Chlorophyll-a (the amount of algae in a water sample) and turbidity (water clarity).

- 5 sites in the Manning River estuary are monitored annually from Tinonee southwest of Taree to Farquhar Inlet, as shown in Figure 7 below.
- 3 of the 5 sites have been sampled each year since 2014 over the spring/summer period, with Dawson River estuary and Farquhar Inlet added to the monitoring in 2019.
- The data collected in the Manning are compared to reference sites in NSW for similar types of estuaries to grade the condition of the estuary.



Figure 7: Water quality monitoring sites in the Manning estuary

The overall ecological condition of the Manning River estuary has been good since monitoring commenced in 2014, scoring a B-grade on most occasions. However, there is a trend towards increased algal growth throughout the estuary. In the 2020 Report Card it was noted that apart from the Lower Manning estuary, algal levels continued to be much higher than desired; this was particularly noticeable in the Dawson River and Upper Manning estuaries.

- **Lower Manning estuary** - There is a trend towards increasing algal levels in the Lower Manning Estuary since sampling began in 2014.
- **Mid Manning estuary** - Apart from periods of drought where there are lower catchment inputs there is a trend towards increasing algal levels.
- **Upper Manning estuary** - Trend towards algae increasing each year (apart from periods of drought) leading to a drop in overall grade from a B to a C (good to fair) in 2020.

These results suggest that the Manning estuary is influenced by diffuse source runoff from the catchment, indicated by the response of algal levels to changes from nutrient inputs. The estuary is acting as a nutrient sink, and elevated algae concentrations will continue unless nutrient inputs are managed.

Water quality monitoring results show that water clarity in the estuary is strongly influenced by catchment runoff. There is improved clarity during times of drought and high turbidity during high rainfall events, especially at the Middle and Upper Manning estuary sites.

Freshwater inputs to the estuary have elevated levels of nutrients, sediment and algae, recorded through long-term water quality monitoring at the Bootawa offtake by MidCoast Council's Water Services team.

Monitoring across 6 sites in the freshwater system shows that:

- Nutrients are elevated. Total nitrogen exceeded the ANZECC total nitrogen trigger of 350 ug/L approximately twice a year with three results for the period exceeding 800 ug/L. Total phosphorus levels exceeded the ANZECC trigger of 25 ug/L in a similar manner.
- Higher chlorophyll-a levels generally occurred during low flow events. This may align with variables such as higher water temperature. Low flow conditions may also present less of a physical threat to algal growth.
- For turbidity, only one event exceeded the ANZECC trigger from 2015-2018. Turbidity is a measure of sediment inputs from erosion.

1.7 Land use and regional economy

Development for infrastructure, housing and commercial use is managed by Council's Land Use Planning team under the Environmental Planning & Assessment Act 1979. For more information on land use planning see section 3.11. Documents currently being developed (2021) include the:

- Urban Land Monitor Review
- Housing Strategy
- Rural Strategy
- Local Environmental Plan and Development Control Plan.

The Manning regional economy is intrinsically linked to the natural values of the catchment and estuary. Industries directly dependent on environmental values include agriculture, aquaculture, fishing, forestry and tourism. These industries contribute combined gross revenue of \$817 million per annum to the wider MidCoast Region, with agriculture and tourism each injecting over \$210 million per annum. The dependence of these sectors on healthy land and water is recognised in the MidCoast Regional Economic Development Strategy (Saphere Group 2018).

Primary production is a widespread land-use throughout the Manning River estuary, contributing to our regional economy, identity and cultural way of life. Dairy dominates in the estuary with high stock intensity (6000 – 10,000 head of stock per subcatchment) in the Lansdowne River and moderate stock intensity in the Cedar Party Creek, Dawson River and lower Manning River subcatchments as shown in Figure 8. There are localised areas of intensive poultry farming, with the highest intensities (52,000 – 72,500 birds) in the Lansdowne River and Cedar Party Creek subcatchments.

The oyster industry was established in the Manning in 1871 and produced 66,414 dozen oysters in 2019-20.

Primary industries play an important role in food security and exports. They are the sixth biggest employer in the region but make a significantly higher contribution to Gross Regional Product when compared to the healthcare, retail and hospitality sectors (Saphere Group 2018).

The tourism industry across the whole MidCoast region is valued at more than \$211.4 million each year and employs up to 1500 full-time equivalent employees. Visitors spend about \$31 million per year. Our community and tourism industries benefit from the healthy food produced locally, with farmer's markets and farm-to-fridge programs gaining in popularity.

Industry	Gross Revenue (per annum)
Agriculture (dairy, beef, sheep)	\$217.048 million (MCC area)
Forestry	\$10.134 million (MCC area)
Tourism	\$211.4 million (Manning Catchment 2014) \$570.4 million (MCC area)
Aquaculture & fishing	\$19.816 million (MCC area)
Total	\$817.398 million (MCC area)

Table 1: Gross revenue of major industries in the MidCoast region (Saphere 2018)



Photo: Rowing regattas are held annually attracting visitors to the Manning River Estuary

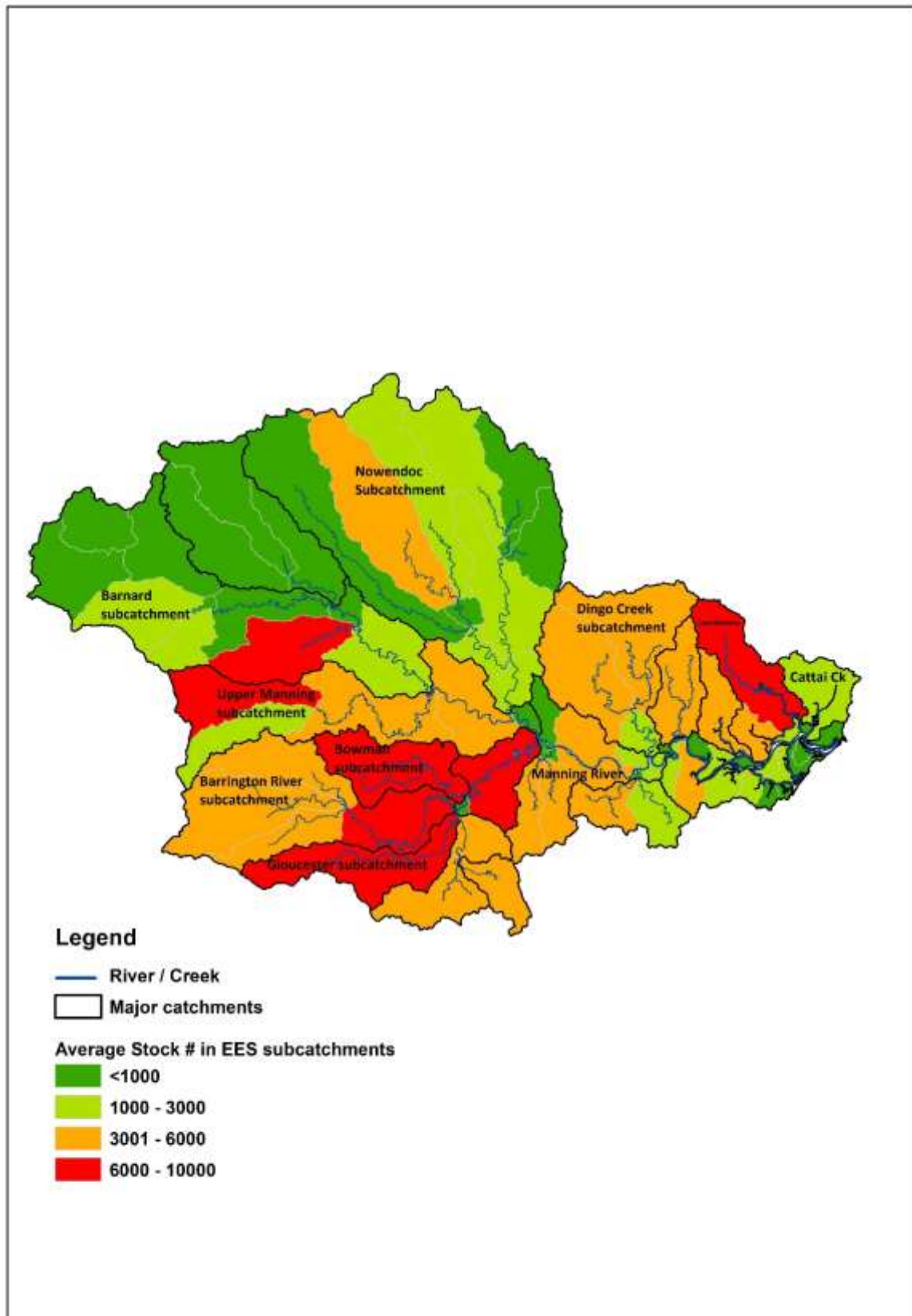


Figure 8: Stock intensity in the catchment (cattle, sheep, horses)



Photo: Clem Collier

“Sustain and support the fishing industry. The fish co-op in Taree is all local – prawns and fish from our river, sold to our local community.”

Noel Piercy, ECMP Reference Group

1.8 Stakeholder consultation

There is a diverse range of stakeholders in the Manning region sharing management responsibilities for the estuary. These include multiple government agencies, community stakeholders and private landowners. Similarly, within Council there are numerous teams whose programs and interests influenced development of the Manning Estuary CMP.

Representatives from the community, environmental, agricultural and government sectors were consulted throughout development of the Manning Estuary CMP. Our project team considered local, cultural and scientific knowledge contributed by our stakeholders.

1.8.1 The Manning community

Approximately 50,000 people live in the Manning River Catchment, of which 34,000 people reside within the estuary and coastal zone. Towns in the CMP planning area include Taree and Wingham and villages include Cundle Town, Tinonee, Coopernook, Croki and Lansdowne.

The MidCoast 2030 Community Strategic Plan (CSP) is a roadmap for the future of the MidCoast Council area. The Vision of the CSP is:

“We strive to be recognised as a place of unique environmental and cultural significance. Our strong community connection, coupled with our innovative development and growing economy, builds the quality of life we value.”

Approximately 7% of the community are Aboriginal/Torres Strait Islanders. The estuary is Biripi land, with Kamilaroi, Worimi and Geawegal represented in the wider catchment (Horton 2018). Water is an intrinsic and inseparable element in the physical, cultural, economic and spiritual existence of Aboriginal people. Aboriginal people refer to their tribal areas as *Country*.

“Country is important for identity. It is important for culture, cultural practices and our own healing.

Building strong partnerships to share knowledge and care for Country will assist in healing our people.”
(Lawler 2021)



1.8.2 Our stakeholder consultation program

Council undertook comprehensive stakeholder consultation for the Manning River ECMP which remains relevant for the Manning Estuary CMP. The project team used the Public Participation Spectrum (IAP2 2018) to assign participation levels for stakeholder and community engagement. The spectrum sets out the level of consultation for each target group from *inform* to *consult*, *collaborate* and *empower*. A diagram of the spectrum and full list of stakeholders consulted are provided in Appendix 2. Unless otherwise shown below, formal consultation is documented in Annexure B: The Manning River Estuary CMP Stakeholder Consultation Report (MCC 2021) available on Council's website. Groups we consulted are described below.

The Community Reference Group: a formally appointed committee of Council with 15 members made up of 10 community representatives, four government agency representatives and the CEO of the Purfleet-Taree Local Aboriginal Land Council (LALC). Community members recruited via an advertising campaign represented beef, dairy and oyster farmers, Landcare, Coastcare, recreational fishing and broad community interests.

The Technical Advisory Group: an informal group with meetings held as needed. Members represented a range of Council teams, government agencies and academic institutions. The Group met four times between November 2018 and May 2020. Members also participated in workshops held for issue analysis and management options.

Delivery Partners: The CMP project team consulted numerous Council teams with programs aligned to the objectives of the Manning Estuary CMP. Hunter LLS and DPE – Environment and Energy Services are major partners in the program and were consulted throughout the planning process. Other State government agencies involved in CMP development included DPE – Crown Lands, Transport for NSW, Department of Primary Industries – Fisheries, National Parks and Wildlife Service and the Biodiversity Conservation Trust, all of which provided letters of support for the program. Industry groups and non-government organisations such as Mid Coast 2 Tops Landcare were also consulted as delivery partners.

Aboriginal Consultation: the Purfleet-Taree Local Aboriginal Land Council (LALC) was engaged to consult with the Biripi community. The consultation project was led by LALC CEO Joedie Lawler.

Public consultation: Council conducted a range of public consultation events during the planning process attracting 251 participants.

The Manning River Estuary and Catchment Management Program, containing all CMP issues, actions and associated budget went on public exhibition for 6-weeks from 3 June 2021 to seek community feedback.

A total of 25 submissions were received from members of the MidCoast community and several community groups, with 19 expressing broad support for Council's approach. The Manning River ECMP was amended to reflect this feedback. The draft Manning Estuary CMP will go on public exhibition for 4 weeks and feedback will be incorporated prior to adoption.

An overview of the consultation program is shown in Figure 9 overleaf. Full membership details for each group are provided in Appendix 3 of the Manning River Estuary and Catchment Management Program.

Supporting Documents:

- Annexure B: The Manning River ECMP Stakeholder Consultation Report (MCC 2021)
- Annexure C: Birrbay Voices: Aboriginal Consultation Report (PTLALC 2021)
- Annexure D: The Manning River ECMP Farmers Consultation (NBA Consulting 2019)
- Annexure E: The Manning River ECMP Community Values Report (MCC 2020)



Photo: extensive community consultation was conducted for development of this program



Figure 9: The consultation program

1.9 Vision, objectives and strategic direction for Coastal Management Areas

The Manning Estuary CMP retains the vision of the whole-of-catchment management program to ensure integration between the two programs



OUR VISION:

"The Manning River, its tributaries and the estuary give life to our community connecting the mountains to the sea. Together we manage the catchment holistically and respond to a changing climate - safeguarding environmental, social, cultural and economic values."

1.9.1 Our Objectives

The Manning Estuary CMP focuses on achieving the objects of the Coastal Management Act and giving effect to the objectives of the Coastal Management Areas as set out in the CM SEPP. The objects of the Coastal Management Act relate to:

- ecosystem integrity and resilience
- supporting social, cultural and Aboriginal values and access
- maintaining a vibrant economy
- ecologically sustainable development and land use planning
- mitigating current and future risks from climate change
- supporting the objects of the Marine Estate Management Act 2014.

Within this framework, local objectives were developed to suit our conditions and context through consultation with stakeholders. The objectives for the Manning Estuary CMP are shown in Figure 10 overleaf.



Figure 10: Local objectives for the Manning River Estuary CMP

1.9.2 Alignment between the Manning River Estuary CMP Objectives and the Coastal Management Act

Table 2 below explains how the objects of the Coastal Management Act have been considered and promoted through the Manning Estuary CMP. For more information see Appendix 2.

Manning Estuary CMP Objective	Coastal Management Act Objects addressed	Alignment between Manning Estuary CMP Objectives and CM Act Objects	Actions
Objective 1: Stewardship Engage with the community, build capacity and support partnerships to promote understanding, connection and stewardship	Object (k) To support public participation in coastal management and planning and greater public awareness, education and understanding of coastal processes and management actions Object (m) To support the objects of the Marine Estate Management Act 2015	Actions to achieve Objective 1 will contribute to delivery of Object (k) in the CM Act by using a range of education and communication methods to build awareness and understanding of coastal processes, build capacity and promote sustainable behaviours to protect the values of SEPP-listed Coastal Management Areas. It will develop knowledge to enable informed input to decision making. Target groups include floodplain farmers, landowners, oyster growers and fishers, recreational users, tourists, developers and Council staff. Actions to achieve Objective 1 will also help implement Marine Estate Management (MEM) Act Object (ai) and (aia) by engaging the community to promote stewardship and on-ground action to restore biological diversity, productivity and ecosystem integrity.	1.01-1.06
Objective 2: Water Quality and Ecosystem Health Manage the Manning River catchment and its estuary holistically to maintain and improve water quality and ecosystem services	Object (a) To protect and enhance natural coastal processes and coastal environmental values including natural character, scenic value, biological diversity and ecosystem integrity and resilience Object (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 Object (m) To support the objects of the Marine Estate Management Act 2015	Actions to achieve Objective 2 will contribute to delivery of Object (a) by remediating Acid Sulfate Spoils, restoring coastal wetlands, improving the condition and extent of riparian and littoral vegetation on estuarine waterways, managing the impacts of urban stormwater, and sedimentation from estuarine riverbanks and unsealed roads. Actions in the Water Quality and Ecosystem Health theme will also contribute to Object (i) by identifying SEPP-listed Coastal management Areas for purchase and remediation, such as Acid Sulfate Soils and priority coastal wetlands. Actions to achieve Objective 2 will also help implement MEM Act Object (ai) and (aia) through on-ground action to restore biological diversity, productivity and ecosystem integrity.	2.01-2.14
Objective 3: Climate Change Understand, mitigate, adapt and build resilience to current and future hazards including the impacts of climate change.	Object (f) To mitigate current and future risks from coastal hazards, considering the effects of climate change Object (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	Actions to achieve Objective 3 will contribute to delivery of Object (f) by identifying and protecting migration pathways for coastal wetlands under climate change scenarios, and developing an action plan to protect Council assets including roads and stormwater assets from coastal hazards such as coastal inundation and extreme weather events. Objective 3 also includes actions aligned to Object (i). Stakeholders will develop a long-term strategy to manage the agricultural production and ecosystem values of the Manning floodplain, considering transitions required to adapt to climate change impacts including coastal inundation in the 50-100 year timeframe.	3.01-3.03
Objective 4: Biodiversity Protect and conserve natural character and biological diversity	Object (a) To protect and enhance natural coastal processes and coastal environmental values including natural character, scenic value, biological diversity and ecosystem integrity and resilience	Actions to achieve Objective 4 will contribute to Object (a) by restoring fish passage and protecting Coastal Environment Areas and Coastal Wetlands from the impact of invasive weeds and predators.	4.01, 4.02

Manning Estuary CMP Objective	Coastal Management Act Objects addressed	Alignment between Manning Estuary CMP Objectives and CM Act Objects	Actions
Objective 5: Aboriginal Custodianship Acknowledge and support Aboriginal people's spiritual, social, customary and economic connection to the Manning River catchment and its estuary	Object (c) Acknowledge Aboriginal peoples' spiritual, social, customary and economic use of the coastal zone Object (k) To support public participation in coastal management and planning and greater public awareness, education and understanding of coastal processes and management actions	Actions to achieve Objective 5 are aligned to Object (c) by training and engaging Aboriginal people in Natural Resource Management and water quality monitoring, communicating Aboriginal cultural connections to the wider community, and improving Aboriginal representation in governance. Action 5.04 will improve Aboriginal participation in decision making.	5.01-5.05
Objective 6: Social and Economic Values Manage the Manning River catchment and its estuary to maintain and improve social, cultural and economic opportunities and benefits	Object (d) Recognise the coastal zone as a vital economic zone and to support sustainable coastal economies	Actions to achieve Objective 6 recognise the value of the estuary for oyster production and will achieve Object (d) by protecting fisheries from the impact of human pathogens.	6.01
Objective 7: Land Use Planning Facilitate ecologically sustainable development and promote sustainable land use planning decision-making	Object (e) To facilitate ecologically sustainable development in the coastal zone and promote sustainable land use planning decision-making Object (g) 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	Actions to achieve Objective 7 will implement Object (e) by improving development controls to protect water quality in the estuary and submitting a planning proposal to amend Coastal Wetlands in the SEPP, thereby expanding SEPP protections to these priority natural assets. Object (e) is also supported by Council's Land Use Planning program – see section 8.1.6. Mapping Coastal Vulnerability Areas to underpin development controls in Coastal Use Areas will implement Object (g), helping to manage coastal development in the estuary.	7.01, 7.03 7.03
Objective 8: Governance Build stakeholder partnerships for good governance and integrated management	Object (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 Object (h) To promote integrated and coordinated coastal planning, management and reporting Object (m) To support the objects of the Marine Estate Management Act 2015	Actions to achieve Objective 8 will meet Object (j) and Object (h) by establishing an interagency working group to improve integration coastal management including compliance activities. This group will report against the actions in the CMP, to the Community Reference group and via Council's IP&R framework. Actions to achieve Objective 8 will contribute to ME Act Object (b), by promoting coordination between public authorities in relation to the marine estate.	8.01, 8.02
	Object (b) To support the social and cultural values of the coastal zone and maintain public access, amenity, use and safety	CM Act Object (b) and the Marine Estate Management Act Object (aii) are met through Council's recreation management program, see section 3.11.	

Table 2: Alignment between the Manning Estuary CMP and objects of the CM Act 2016

1.9.3 Strategic Direction for the Coastal Management Areas

Council's strategic approach to land-use planning in the SEPP-listed Coastal Management Areas is to manage development in accordance with the objectives and controls of the CM SEPP. The MidCoast Local Strategic Planning Statement sets out Council's planning priorities to protect and improve the coastal environment, improve landscape resilience, manage our land and water assets and maintain social and cultural values of the coastal zone. These planning priorities give effect to the Coastal Management Act and CM SEPP objectives

MidCoast Council's planning decisions are guided by the Local Environmental Plans (LEPs) through zoning and development controls, which provide a framework for the way land can be used. LEPs are the main planning tool to shape the future of communities and ensure local development is done appropriately. Development controls identified in the CM SEPP are applied through Council's planning process.

Council is currently transitioning from three LEPs, for the Manning, Great Lakes and Gloucester Regions, to a single, consolidated LEP which will provide a consistent approach to land use planning in the LGA. This document will ensure that Council's land use planning and development controls implement the objects of the CM Act and Objectives consistently across each of the CM SEPP Management Areas.

An outline of Council's strategic approach for each of the Coastal Management Areas covered by this CMP is provided in Table 3 below.

Coastal Management Area	MidCoast Council's Strategic Direction
Coastal Wetlands and Littoral Rainforest	MidCoast Council has a commitment to protecting the ecosystem services of coastal wetlands, which include pollution assimilation, flood mitigation, carbon storage and biodiversity. We will continue our strong track record of rehabilitating and restoring degraded coastal wetlands, as a priority action of this CMP. This will include identifying and protecting migration pathways under climate change scenarios. Coastal wetlands mapped in the CM SEPP will be transitioned to E2 Environmental Conservation. Land-use zones under this zoning will continue to enable cultural and social uses to occur where appropriate in the future MidCoast planning controls. If land is purchased through the NSW Government's coastal protection scheme for rehabilitation, restoration and ongoing protection, requirements for re-zoning will be identified through the CMP reviews. The CM SEPP requires development consent for clearing native vegetation on land mapped as coastal wetlands or littoral rainforests, even if the clearing is not associated with any other development. The development controls for land mapped as coastal wetlands and littoral rainforests apply to all land use zones in MidCoast Council's LEPs. Clearing of native vegetation on land mapped as a coastal wetland or littoral rainforest is a 'designated development' and triggers a requirement for an assessment under the Biodiversity Conservation Act 2016.
Coastal Environment Area	The current LEP applies environmental or waterway zones as appropriate to waters up to the tidal extent. MidCoast Council's Guidelines for Water Sensitive Design Strategies (2019) sets out our commitment to minimising development impacts on water quality in creeks, rivers, wetlands, lakes, estuaries and beaches throughout the local government area (LGA). Part C (3.5) of the Subdivision Section of the Greater Taree DCP requires that drainage from subdivision sites should be consistent in both water quality and quantity with the predevelopment storm water patterns. WSUD guidelines will be incorporated into the future consolidated MidCoast DCP. With regards to coastal vulnerability, Action 7.02 in this CMP is to map the Coastal Vulnerability Area. This will inform future planning controls in the Coastal Environment Area. Foreshore setbacks will be reviewed in line with CVA mapping in the consolidation of DCPs for the MidCoast LGA. Identification and protection of priority drinking water catchments and coastal groundwater aquifer resources in the MidCoast Region will be incorporated into the MidCoast DCP and LEP, which will benefit the quality of freshwater inputs into the estuary. In the future MidCoast planning controls, land-use zones (e.g. rural zones, environmental zones) will continue to enable cultural and social uses to occur where appropriate.
Coastal Use Area	The focus of development in the Coastal Use Area is predominantly consolidation within the existing urban footprint. Consolidation of the MidCoast LEP and DCP will apply a consistent approach to continue encouraging urban consolidation within the defined urban footprint. Limited urban development is expected to occur within the Planning Area of the Manning Estuary CMP and where it is proposed, it will be undertaken in compliance with the objectives of the CM SEPP, noting that development controls identified in the CM SEPP are applied through our planning process. In consolidating MidCoast planning controls these objectives will continue to be considered and implemented.
Coastal Vulnerability Area	There is no CVA at present and coastal hazard areas identified under the DCP are outside the Manning CMP Planning Area. A coastal setback line at Cundletown controls development to mitigate to erosion risks. Mapping the Coastal Vulnerability Area is an action of this CMP and its counterparts the Old Bar- Manning Point CMP and Open Coast CMP. Once completed a planning proposal will be submitted to incorporate this mapping into the CM SEPP and MidCoast Council planning controls will be amended in accordance with the Act.

Table 3: Council's strategic direction for the Coastal Management Areas

1.10 Coastal Vulnerability

There are seven types of coastal hazard defined by the Coastal Management Act. Of these, the potential hazards in the Planning Area for the Manning Estuary CMP could include:

- coastal inundation
- tidal inundation
- erosion and inundation of foreshores caused by tidal waters and the action of waves, including the interaction of those waters with catchment floodwaters

As has been mentioned, the Coastal Vulnerability Area has not yet been mapped for the Manning Planning Area. Mapping of the Coastal Vulnerability Area has been included as Action 7.02 in this CMP.

In the case of flood, coastal inundation and tidal inundation, the primary planning document is the Manning River Floodplain Risk Management Study and Plan (BMT WBM 2019). Its study area encompasses the low-lying floodplain area downstream of Wingham. The Manning River Floodplain Management Study (BMT WBM 2016) considers flood events driven by both catchment and oceanic processes, with the potential impact of climate change on flood behaviour within the catchment. The Manning River Floodplain Risk Management Study and Plan (2019) considers climate change scenarios as follows:

- Predicted increased rainfall intensity: modelled 10% and 30% increased rainfall
- Sea Level Rise (SLR): +0.28 m by 2050; and +0.98 m by 2100.

Storm surge is factored into tail-water levels. In general, coastal inundation causes more frequent nuisance flooding while riverine flooding is less frequent but causes more damage. Impacts include reduced efficiency of stormwater infrastructure and increased groundwater levels.

Additional analysis of threats associated with climate change were prepared for the Manning Estuary CMP. This analysis considers modeling for the years 2040, 2050 and 2100. Key threats assessed included sea level rise, more extreme rainfall events, an overall drier climate and increased water temperature. Under sea level rise modeling, the coastal hazard of tidal Inundation is expected to cause landward migration of coastal wetlands including mangroves and saltmarsh.

The Lower Manning River Drainage Remediation Plan (Glamore et. al. 2016) commissioned by Council assessed the impact of rising sea levels on the Manning estuary floodplain as predicted for 2050 and 2100. Forecasted increases in high tides will reduce drainage, cause overtopping of levees, impact on backswamp connectivity, and affect agricultural productivity in some regions. Glamore et al note that the greater issue for land management will be elevated low tides, which will reduce drainage from low-lying back swamps and increase the impact of blackwater events on pasture cover¹¹.

For more information on coastal inundation and tidal inundation see the Issue Snapshot sections 2.3.3 (Climate Change), 2.3.4 (Coastal Wetlands), 2.3.5 (Floodplain Management

¹¹ (Glamore, Ruprecht, & and Rayner, Lower Manning River Drainage Remediation Action Plan, 2016)

and ASS) and 2.3.10 (Flood, Tidal Inundation and Coastal inundation). A more detailed analysis is provided in Annexure I: The Manning River ECMP Issue Analysis Report (MCC 2021).

Table 4 below shows management actions in the Manning Estuary CMP developed to address coastal hazards and vulnerability.

Action #	Action Description	Coastal Hazard
2.01	Implement key priority acid sulfate soil management actions from the draft Manning River Floodplain Prioritisation Study 2021. This action will reduce risk of acid exposure exacerbated by sea level rise.	Coastal inundation Tidal inundation
2.02	Work with landholders to restore coastal wetlands. This action will improve resilience to the impacts of sea level rise for existing coastal wetlands including mangroves and protect foreshores from storm surge	Coastal inundation Tidal inundation Foreshore erosion
2.05	Should the preliminary business case for the proposed Manning River Entrance Project lead to progression of this proposal, the more rigorous environmental impact assessment should consider potential impacts on coastal inundation, tidal inundation and foreshore erosion.	Coastal inundation Tidal inundation Foreshore erosion
2.09	Revise the Greater Taree Capital Urban Stormwater Management Plan. This revised plan should address forecast impacts of sea level rise, coastal inundation, tidal inundation and extreme weather events on stormwater infrastructure.	Coastal inundation Tidal inundation
2.10	Complete a study to identify and prioritize foreshore erosion , follow by bank stabilisation works.	Foreshore erosion
3.01	Identify coastal wetland migration zones under seal-level rise scenarios, develop a foreword plan to retain suitable buffers	Coastal inundation Tidal inundation
3.02	Develop forward plans in Council's Asset Management program for upgrades and replacement of Council assets at risk from sea level rise and extreme storm events	Coastal inundation Tidal inundation

Action #	Action Description	Coastal Hazard
	(e.g. roads, stormwater systems, river access facilities)	
7.02	Prepare mapping of Tidal Inundation Coastal Vulnerability Area and undertake stakeholder consultation to inform a future planning proposal recommending amendments to the CM SEPP.	Coastal inundation Tidal inundation

Table 4: CMP actions to address coastal hazards and vulnerability

1.11 How will the CMP be implemented?

1.11.1 CMP Timeframes

The Manning Estuary CMP is a ten-year action program from January 2023 – December 2032. It will be reviewed after 5-years.

Population projections have been considered across a 20-year timeframe to 2042.

The Manning Threat and Risk Assessment (Section 2.2.2) assessed risks across a 20-year time horizon.

A detailed climate change risk assessment covered 20 year and 50-100 year timeframes, while the issue analysis for climate change used modeling by the Intergovernmental Panel on Climate Change (IPCC) for the years 2040, 2050 and 2100.

The Manning River Floodplain Risk Management Study and Plan (2019) considers the impacts of Sea Level Rise (SLR) on coastal inundation for +0.28 m by 2050 and +0.98 m by 2100.

The Lower Manning River Drainage Remediation Plan (Glamore et. al. 2016) commissioned by Council assessed the impact of rising sea levels on the Manning estuary floodplain as predicted for 2050 and 2100.

When the 5-year review of the CMP takes place, the Hunter Regional Plan 2041 will be complete. The Hunter Regional Plan is anticipated to present significant changes to urban planning in our region, including revised urban density targets which could affect population projections.

The IPCC's Sixth Assessment Report (AR6) will also be complete. A preliminary report, *Climate Change 2022: Impacts, Adaptation and Vulnerability* was released on 28 February 2022. It has found Australia will suffer greater impacts of climate change than any other advanced economy.

The 5-year review of the CMP will provide opportunity to reassess risk based on these forecasts and develop corresponding actions.

The Land-use Plan includes the Local Environmental Plan (LEP), Development Control Plans (DCPs) and a Local Strategic Planning Statement. The region-wide planning framework being developed to cover the entire LGA will be guided by the forthcoming Rural Strategy, which will set the strategic direction for all our rural, environmental and waterway zones. This is significant as rural and environmental lands cover around 95% of the MidCoast Local Government Area, including most of the land and water covered by the Coastal Management SEPP.

Manning Estuary CMP actions to be implemented through Council's Land-use Planning framework are shown in Theme 6: Land-use Planning.

The new Land-use Plan, when complete, will work together with the Manning Estuary CMP actions in the IP&R Framework to implement the objects of the Coastal Management Act.

1.11.3 The CMP Governance Structure

Implementation of the Manning Estuary CMP will be led by MidCoast Council's Natural Systems team. A governance structure with three groups will foster integration between agencies and Council teams, ongoing technical advice and community collaboration. The groups are described below, and the CMP governance structure is shown in Figure 12.

Community Reference Group: Community-based strategic input will continue to be provided through a Community Reference Group (CRG). The Manning River ECMP Community Reference Group was wound up following the Council election in September 2021. A new CRG will be established following certification of the CMP. It is an action of the CMP to increase Aboriginal representation by appointing a second person from the Gathang-speaking community.

Technical Advisory Group (TAG): Technical advice will continue to be provided by the Technical Advisory Group, which will be assisted by several multi-stakeholder *thematic groups* currently being established in the MidCoast Region. Representatives from these groups will advise and liaise with the proposed CMP Working Group to ensure adaptive program implementation is based on the best scientific evidence.

CMP Working Group: This group will focus on delivering CMP actions along with monitoring, evaluation and reporting. It will be made up of representatives from each agency designated as a lead in the action program, along with Council personnel from complementary programs leading actions that will contribute to delivery of the CMP. The Working Group will ensure projects are integrated across Council departments and other agencies and report to the Community Reference Group.

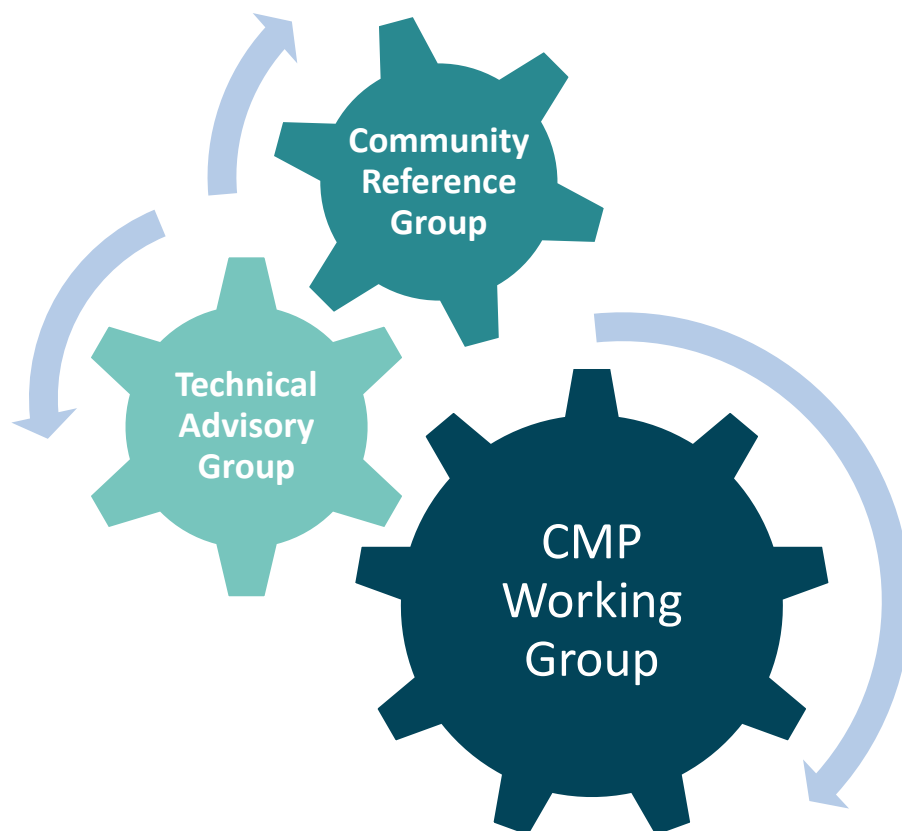


Figure 12: Option for the Manning Estuary CMP Governance Structure



Photo: The Community Reference Group provided valuable input to the CMP

2. Snapshot of issues

This snapshot provides a summary of the key threats to coastal ecosystems and the CMP objectives, outlining the planning horizons, scenarios and risk criteria that have been used. It then identifies the coastal management issues to be addressed in the CMP for each of the Coastal Management Areas and provides a brief analysis.

Detailed information is provided in the supporting documents (Annexure I – Manning River Estuary and Catchment Management Program Issue Analysis Report, MCC 2021).

2.1 Matters considered in the Threat Assessment and Issue Analysis

When undertaking the Threat and Risk Assessment and issue analysis for the program, the following matters were considered.

2.1.1 Population Projections

The latest population projections from the NSW Planning Portal (March 2021) state that the population of the MidCoast region is projected to rise from 91,800 in 2016 to 100,100 in 2041. In the Manning Estuary CMP Planning Area, Taree (including Cundletown) has a population growth of 0.33% per year and current undeveloped residential-zoned land could provide 652 dwellings. The demand for dwellings by 2036 was stated as being 536 at the current population projection and 643 under a high growth scenario (draft Urban Land Monitor review 2021). Council's Urban Land Monitor defines areas available for future development, which are subject to development controls that meet the objectives of the CM SEPP.

To find out more about Council's approach to land use planning and residential development see section 3.11.1

2.1.2 Climate change scenarios

The impacts of climate change have been considered throughout the issue analysis. A detailed risk assessment and issue analysis for climate change are provided in sections 2.2.2 Table 9, Section 2.3.3 and Annexure I – Manning River Estuary and Catchment Management Program Issue Analysis Report 2021).

Four different scenarios of future greenhouse gas emissions were adopted in the Intergovernmental Panel on Climate Change Assessment Report 5 (IPCC AR5 2013). These are referred to as *Representative Concentration Pathways* or RCPs. Characteristics of these are summarised in Table 5.

RCP (Radiative Forcing at 2100 (W/m ²))	Equivalent Peak CO ₂ Concentration	Description
8.5	>1370	Very high baseline scenario. Little effort to reduce emissions and warming not curbed by 2100
6.0	850	Medium Scenario. Stabilises soon after 2100.
4.5	650	Medium Scenario, Stabilises soon after 2100.
2.6	490	Very Low "Ambitious" scenario. Peaks early at 3.0 W/m ² then fall due to active removal CO ₂

Table 5: Representative Concentration Pathways used in IPCC's AR5

It is customary in Australian practice (e.g. Ball et al., 2019) to focus on RCPs 8.5 and 4.5.

Sea-level Rise and Increased Tidal Inundation

Following AR5, the National Climate Change Adaptation Research Facility (NCCARF) published corresponding, localised relative sea level rise projections for application at a local government area scale¹².

There is substantial difference between projections over the long term, however projections are similar over shorter timeframes (e.g. to 2040). While the CMP avoids actions that inhibit effective adaptation in the long term, the time frame over which the CMP adaptation actions are focused is the next 20 years or so.

By 2040, it seems very unlikely that mean sea level will have risen by more than 35cm (compared to what it was in the mid-1990s¹³). Considering other minor adjustments, it also seems very unlikely that mean sea level will exceed 0.4m above AHD, offshore of NSW, by 2040.

Three different scenarios of the impact of sea level rise inside the estuaries have been considered by the NSW Government (OEH, 2018) and concurrently published by Hanslow et al. (2018), these corresponded to a rise in sea level offshore of the Manning River by 0.5, 1.0 and 1.5m.

In addition to the work completed by the NSW Government, pure tidal inundation simulations, adopting a boundary representing King tides (HHWSS) and allowances for sea-level rise (+0.28m, reported as '2050'; and +0.98m, reported as '2100'), were also completed as part of the Manning River Flood Study (BMT WBM, 2016). While that flood study used different analysis techniques, results for the simulation of a 0.98m sea level rise are very similar to those reported by NSW Government (OEH, 2018) for 1.0m of sea-level rise.

¹² https://coastadapt.com.au/sea-level-rise-information-all-australian-coastal-councils#NSW_GREATER_TAREE_MID_COAST-, accessed 4/03/2021.

¹³ Projections presented in AR5 are all referenced to the average mean sea level between 1986 and 2005. Accordingly, this is the mean sea level rise that would have occurred since around the mid 1990's.

Increases in extreme rainfall events

The most recent update to Australian Rainfall and Runoff (Ball et al., 2019; hereafter ARR) includes guidance on allowing for an increase in rainfall intensities as the climate warms.

ARR argues that, if the planning horizon being considered is relatively short (<20 years), then climate change will have negligible impact on design rainfall intensities. For longer periods, the guidance provided by ARR outlines a process which involves several strategies for assessment by considering:

- the purpose and nature of the asset or activity
- the consequences of failure
- whether climate change enhanced flooding will impair performance
- testing against more extreme events than would normally be used.

If this step demonstrates a level of concerning vulnerability, ARR recommends examining the outputs of a range of GCMs as made available through the *Climate Futures* online web service¹⁴.

The process outlined by ARR is for a 60-year time frame (e.g. the end of life of a facility or structure at 2080). To account for climate change in this instance, the design rainfall would need to be increased by 11.6% if RCP4.5 were assumed, and 19.2% if RCP8.5 were assumed. These calculated values are broadly consistent with published guidance specific to NSW¹⁵.

ARR recommends that, as a minimum RCP 4.5 should be adopted but, if additional expense can be justified on “socioeconomic and environmental grounds”, that RCP 8.5 should be used.

A flood study of the Manning River has been prepared (BMT WBM, 2016). As that study preceded the advice provided in ARR, a coarser approach, consistent with NSW Government guidance available at the time, was taken to the impact of climate change on rainfall intensities, with increases of 10% and 30% applied to the design values.

2.2 Threat and risk assessment

Threats and risks to our coastal management objectives were assessed in two ways during development of the Manning River ECMP.

- **A spatial risk assessment** was conducted by the DPE’s Environment Energy and Science (EES) branch. This included a calibrated Estuary Health Risk Model that rated the risk of sediment and nutrient loading from each subcatchment. The spatial risk assessment informed the priority areas shown in the CMP Action Program.
- **A Threat and Risk Assessment** was conducted by Council’s project team, with input from the Technical Advisory Group. The Threat and Risk Assessment informed selection of issues for the Manning River ECMP.

¹⁴ <https://www.climatechangeinaustralia.gov.au/en/climate-projections/climate-futures-tool/introduction-climate-futures/>, accessed 3/03/2021.

¹⁵ <https://www.environment.nsw.gov.au/research-and-publications/publications-search/floodplain-risk-management-guide>, accessed 4/03/2021.

2.2.1 Spatial Risk Assessment

DPE-EES have developed Estuary Health Risk Maps for NSW estuaries (Dela-Cruz et al. 2019). The maps are based on a risk assessment to identify subcatchments that pose the highest risk to water quality in the estuary, and subsequently where land use intensification is best avoided, and more stringent management controls are needed. The risk maps facilitate identification of strategic priorities for managing nutrient and sediment runoff in the catchment.

MidCoast Council (MCC) engaged EES to produce an updated and more specific Estuary Health Risk Model for the Manning River estuary and to assess risk of additional pressures in the catchment that may impact on ecological and community values of the estuary. The impact of stock on water quality and riparian zones, pathogens from animal and human waste, hill-slope and streambank/bed erosion, and acid run-off from acid sulphate soils are additional pressures in the Manning catchment that impact on the values of the river and estuary. Specifically, the following risks were assessed in this report (Swanson 2020a):

- The Estuary Health Risk Model mapped the risk of total nitrogen (TN), total phosphorous (TP) and total suspended solids (TSS) exports from land use on water quality in the estuary
- The risk of impact of pathogens from stock on water quality required for the community values of drinking water, aquaculture (oyster farming) and secondary recreation
- The risk of hillslope erosion and streambank erosion to riparian vegetation

The report also includes results from two stand-alone risk assessments of additional pressures on estuary health done by other investigators:

- On-site sewage management system risk assessment (DWC 2018b)
- Acidic run-off from acid sulfate soils risk assessment (Glamore et al. 2016)

The risk assessments are spatial prioritisation tools which identify areas in the catchment where investment of resources for on-ground actions would achieve the best benefits for managing estuary health. Relative spatial trends were used to prioritise higher risk subcatchments. Further field assessments / investigations need to occur in the high risk subcatchments to quantify the threat to the estuary, and to determine appropriate on-ground works that will mitigate threats to estuary health.

Spatial Risk Assessment Results

A summary of high and moderate-high risk subcatchments is provided in Table 6 below. Targeted on-ground works in these subcatchments will have the best chance of improving the health of the Manning estuary by mitigating threats using a holistic approach. The highest risk of impacts from nutrient and sediment inputs, acidic runoff from acid sulfate soil, and pathogen inputs from stock on ecological and community values of the Manning estuary comes from the Lansdowne River catchment.

The numbers in brackets (Column 2) relate to numeric identifier codes used for drainage units within each subcatchment shown in Figure 13. There are 88 numbered drainage units in the catchment. There is considerable variation between and within individual

subcatchments, meaning the results cannot necessarily be applied to an entire subcatchment but should be used as a guide to further field investigations.

Risk Assessment	High risk subcatchments
Estuary Health Risk Model (Figure 14)	Very High Risk: Lansdowne River (88, 223), Cedar Party Creek (95) High Risk (estuarine rivers): Manning (105, 108, 204, 219, 220) Dawson River (103), Cattai Creek (93) High Risk (freshwater catchment): Upper Manning (90), Dingo Creek (86, 89), Gloucester River (98, 122), Barrington River (115, 119), Avon River (123)
Stock pathogen a risk on Aquaculture	Oxley Island (203), Mamboo Island (204), Jones Island (205), Lansdowne River (88,223) Cattai Creek (93)
Stock pathogen a risk on Secondary Recreation	Cedar Party Creel (95), Oxley Island (203), Mamboo Island (204), Jones Island (205), Lansdowne River (88,223) Cattai Creek (93)
Erosion risk impacting riparian vegetation	Manning River (105,110), Upper Manning River (92, 96), Myall Creek (76), Barnard River (82)
Acidic runoff	Lansdowne River (88, 223), Cattai Creek (93)

Table 6: Subcatchments posing the highest risk to ecological and community values

The Estuary Health Risk Model

For the Estuary Health Risk Model (Figure 14), the generation rates for surface flow (SF – ML/ha/y) and TN, TP and TSS (kg/ha/y) from each subcatchment were used as likelihood criteria in the water quality risk assessment. In addition to the catchment runoff, the proximity of a subcatchment to the estuary was also considered to pose an additional likelihood of risk of impact on estuary health. Consequently, subcatchments that drain directly to the estuary were also attributed with a Likelihood Score of 4 to denote a high likelihood of risk of impacts on the ecosystem health of the estuary due to proximity. All other subcatchments were attributed with a very low Likelihood Score of 1.

Likelihood Scores for SF, TN, TP, TSS generation rates (kg/ha/y) and the proximity score for each subcatchment were averaged to get the Likelihood Score for the subcatchment, which was multiplied by the Consequence Score for that subcatchment to get the Risk level. That is, the Risk that each subcatchment poses to estuary health which are rated as Very High (16), High (12), Moderate (8, 9) or Low Risk (1-6).

Catchment model outputs (i.e. TN and TP pollutant loads) for the freshwater subcatchments were validated by comparison with water quality data collected at monitoring sites in the catchment by MidCoast Water from 2001 - 2019. For full details see Annexure G: Manning River Estuary ECMP Spatial Risk Assessment (EES 2020).



“It’s cool to see there is a lot of research and data being collected. There’s opportunity to use scientific research and data to improve management.”

Sam Nicholson

Dairy farmer and member of the CMP Community Reference Group

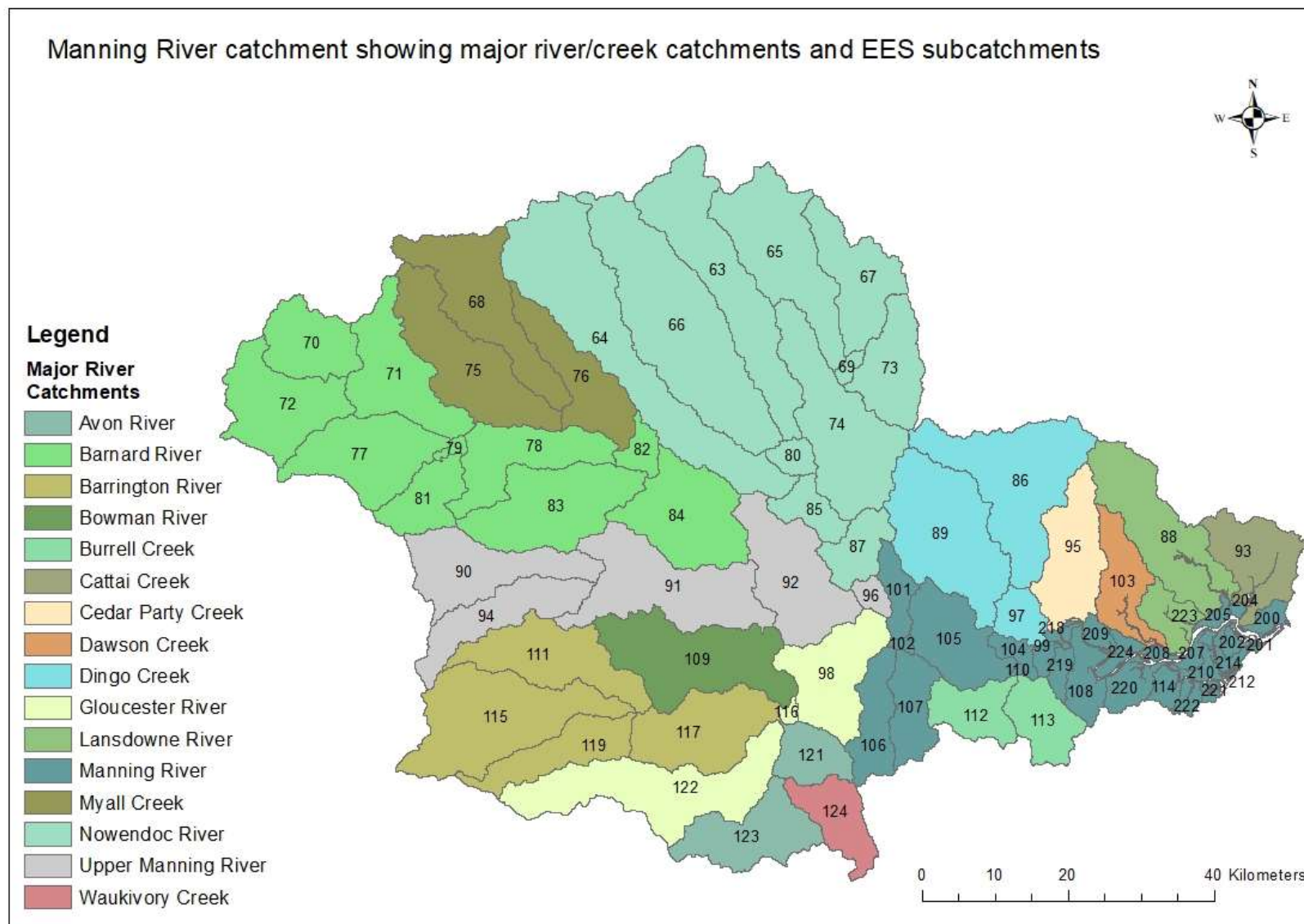


Figure 13: The numbered drainage units used to assess risk

Updated Estuary Health Risk Map (Water Quality Risk Assessment)

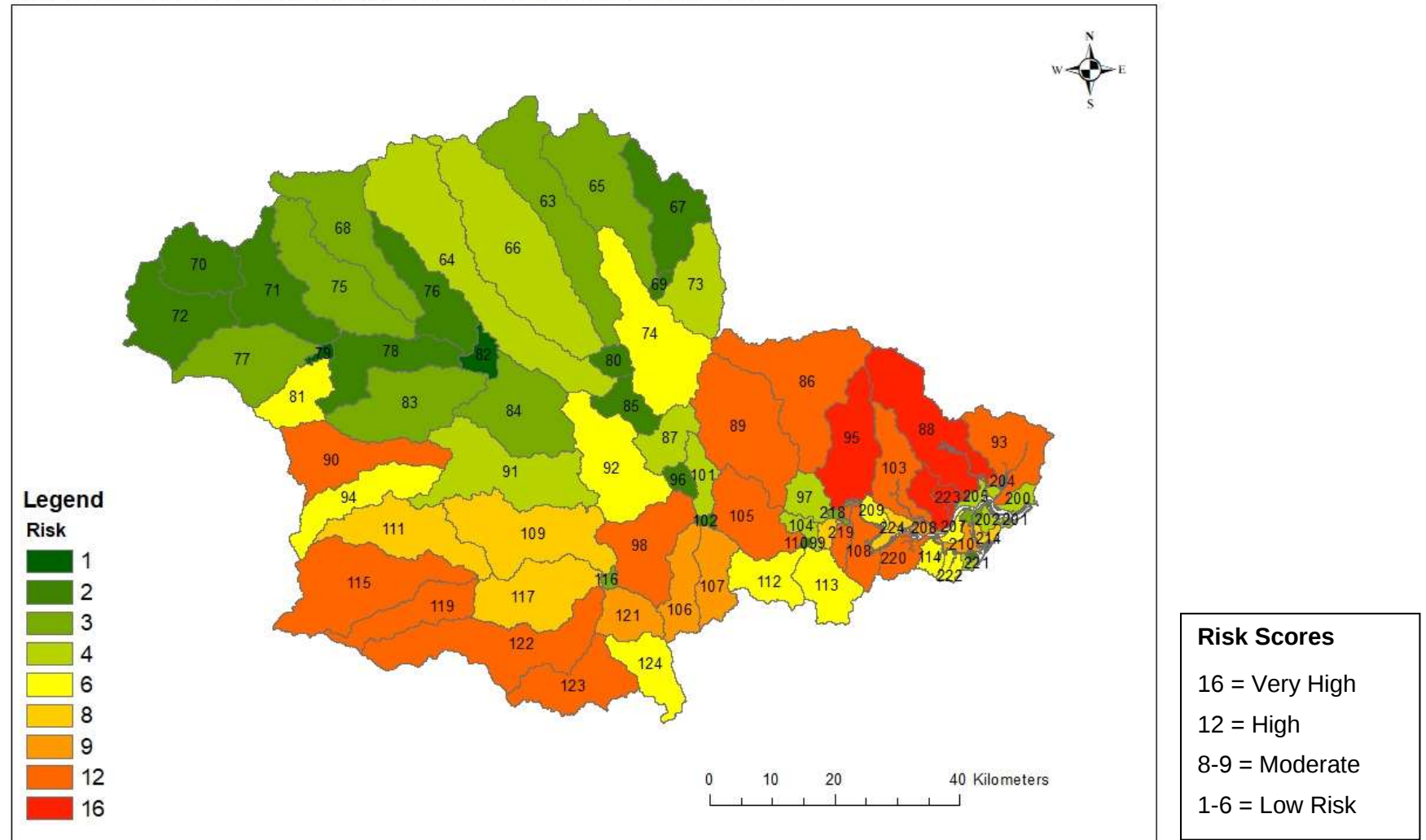


Figure 14:

Updated Estuary Health Risk Model showing overall risk that subcatchments pose to estuary health



2.2.2 Manning Threat and Risk Assessment

Threat and Risk Assessment Method

Several inputs were considered when assessing threats and risks to our objectives and the CMP Management Areas. The steps included:

- **Review of the NSW Government's Marine Estate Management Strategy** (2018) state-wide Threat and Risk Assessment (TARA) and finer scale TARA for the Northern Region (which includes the Manning estuary). These documents assess and rank risks to ecological and socio-economic values.
- **A literature review** for the Manning estuary, conducted for the Stage 1 Scoping Study.
- **A workshop with our Technical Advisory Group (TAG)** to select and assess the risks that related to the Manning estuary and its catchment, using best available scientific and local knowledge (MCC 2018). Existing management regimes, research and knowledge gaps were accounted for in the risk assessment.
- **Consultation with the Community Reference Group who were invited to identify their top three issues.** Issues that featured most strongly and aligned with the TAG consensus were acid sulfate soil discharge, sediment and erosion control and managing agricultural impacts.
- **A more detailed climate change threat and risk assessment** was conducted by Salients Consulting, based on a literature review and consultation with key stakeholders.

Using these inputs, key threats and risks to our CMP objectives for the Manning estuary were assessed and ranked using MidCoast Council's risk assessment methodology using the matrix overleaf. Once ranking was complete, a risk tolerance was assigned from low tolerance to high tolerance. All threats with a residual risk score of 40 or above were rated low tolerance. These were generally threats with at least one extreme residual risk rating. Risks assigned low to moderate tolerance were nominated as issues for further analysis. Management controls were then considered, and the scoring repeated to assess the residual risk.

A summary of results for the Manning threat and risk assessment, and the more detailed climate change threat and risk assessment, are shown in Tables 8 and 9 below.

The full Manning Threat and Risk Assessment (TARA) is shown in Appendix 4.

Risk Rating = Likelihood Rating x Consequence Rating

Risk Likelihood Rating		Risk Consequence Rating				
		Insignificant	Minor	Moderate	Major	Severe
		1	2	3	4	5
Almost Certain	5	Medium (5)	High (10)	High (15)	Extreme (20)	Extreme (25)
Likely	4	Medium (4)	Medium (8)	High (12)	High (16)	Extreme (20)
Possible	3	Low (3)	Medium (6)	Medium (9)	High (12)	High (15)
Unlikely	2	Low (2)	Low (4)	Medium (6)	Medium (8)	High (10)
Rare	1	Low (1)	Low (2)	Low (3)	Medium (4)	Medium (5)

Figure 15: MCC Risk Rating Matrix

Manning TARA results, risk tolerance and issues

THREATS	VALUES IMPACTED	RESIDUAL RISK RATING	RISK TOLERANCE	ISSUE
1. Lack of stewardship	Environment	High	LOW	Lack of stewardship
	Social	High		
	Economic	High		
2. Failure to account for long term impacts of climate change (50-100 years)	Environment	High	LOW	Climate change
	Social	High		
	Economic	High		
3. Loss and degradation of coastal wetlands	Environment	Extreme	LOW	Loss and degradation of coastal wetlands
	Social	High		
	Economic	High		
4. Floodplain drainage (ASS)	Environment	Extreme	LOW	Floodplain drainage
	Social	High		
	Economic	High		
5. Loss and degradation of riparian vegetation and adjacent habitat	Environment	Extreme	LOW	Loss and degradation of riparian wetlands
	Social	High		

THREATS	VALUES IMPACTED	RESIDUAL RISK RATING	RISK TOLERANCE	ISSUE		
	Economic	High				
6. Agricultural diffuse source run-off: Nutrients	Environment	Extreme	LOW	AGRICULTURAL IMPACTS		
	Social	High				
	Economic	High				
6.2 Agricultural diffuse source run-off: Sediments	Environment	Extreme	LOW		AGRICULTURAL IMPACTS	
	Social	High				
	Economic	High				
6.3 Stock in riparian and marine vegetation	Environment	High	LOW			AGRICULTURAL IMPACTS
	Social	High				
	Economic	High				
6.4 Agricultural diffuse source run-off: Pathogens (e.g. E coli)	Environment	Medium	MODERATE	AGRICULTURAL IMPACTS		
	Social	High				
	Economic	High				
7. Entrance modifications, including dredging, opening and permanent entrance training	Environment	High	LOW		ENTRANCE MODIFICATIONS	
	Social	High				
	Economic	High				
8. Major floods, high tides + storm surge	Environment	Medium	LOW		FLOOD, INUNDATION	
	Social	High				
	Economic	High				
9.1 Urban stormwater discharge	Environment	Medium	MODERATE	URBAN STORMWATER, LITTER, PLASTICS & MARINE DEBRIS		
	Social	High				
	Economic	High				
9.2 Water pollution on environmental values - litter, solid waste, marine debris and microplastics	Environment	Medium	MODERATE		URBAN STORMWATER, LITTER, PLASTICS & MARINE DEBRIS	
	Social	Medium				
	Economic	Medium				
10. Pests and diseases	Environment	High	MODERATE	BOIDIVERSITY LOSS		
	Social	Medium				

THREATS	VALUES IMPACTED	RESIDUAL RISK RATING	RISK TOLERANCE	ISSUE
	Economic	Medium		
11. Sewage effluent and septic runoff	Environment	Medium	MODERATE	SEWERAGE AND SEPTIC
	Social	Medium		
	Economic	High		

Table 7: Manning TARA results, risk tolerance and issues



Photo: Exposure of Acid Sulfate Soil is a significant risk to ecosystem health in the estuary

Detailed Climate Change Threat and Risk Assessment

Risk (over 20 yr. Timeframe)	Impact (Social, Environmental, Economic)	Risk Level
CC2: Due to sea level rise, coastal groundwater levels rise causing low lying roads to fail	Economic	High
CC3: Ongoing sea level rise will encourage coastal wetlands to migrate upslope and onto adjacent often private land, eventually resulting in wetlands being “squeezed”	Environmental	High
CC6: Possibility that salt dynamics change and that a salt wedge combined with greater tidal penetration begin to affect potable water offtake upstream of current tidal limit. Quite unlikely over 20 year. timeframe, but impacts would be severe (e.g., trucking water into several towns)	Economic	High
CC13: Impact of higher tide levels and interaction with adjacent groundwater drainage on acid floodplains is poorly understood. Impact of acid drainage events could be very bad for the environment.	Environment	High
CC16: The potential for unknown weeds or existing weeds from other regions to get a foothold in the Manning catchment could potentially have a devastating impact on parts of the catchment and productivity of agriculture.	Environmental/Economic	High
CC21: Changes to Environmental Flows due to a drying climate may significantly alter runoff from acid drainage areas	Environmental	High
CC22: Potential loss of subtidal habitats due to changes in environmental water quality (pH, salinity, temp, flows) with flow on effects to the productivity of fisheries.	Environmental, Economic.	High
Risk (50-100 yr. Timeframe)	Impact (Social, Environmental, Economic)	Risk Level
CC19: Over the long term, failure of the present generation to appropriately understand and plan for the impacts of climate change could have unknown, widespread and damaging impacts to future generations. Work is progressing to understand and manage the risks, and this must continue.	Social, Environmental and Economic	High
CC20: Over long term, significant or complete loss of saltmarsh/wetland habitat due to sea level rise would represent a local ecological disaster and a failure of one of the cornerstone objectives of the CM Act.	Environmental and Economic	Extreme

Table 8: Detailed Threat and Risk Assessment for Climate Change

2.3 Issues

Issues were identified via the Threat and Risk Assessment described above, along with input from the Community Reference Group. The project team then prepared a series of issue papers (Annexure I) and hosted 13 discussion groups with stakeholders who had detailed local, scientific or traditional knowledge to contribute. Participants at the discussion groups represented the Technical Advisory Group, Community Reference Group, delivery partners from Council and state agencies, Aboriginal stakeholders and community representatives.

The issue papers examined activities, stressors and impacts as shown in Figure 16. The discussion groups identified stakeholders, existing management options, what's working and what's not, opportunities and management options. A snapshot of the issues is provided below.



Figure 16: The relationship between activities, stressors and ecological impacts

2.3.1 Overview of Coastal Management Areas Impacted Issues

The twelve issues below are the focus of management actions in the CMP. Table 9 shows which of the four Coastal Management Areas are affected.

ISSUE	Coastal Wetlands	Coastal Environment Area	Coastal Use Area	Coastal Vulnerability Area
Lack of stewardship				
Climate change				
Loss of coastal wetlands				
Floodplain drainage & acid sulfate soil				
Loss of riparian vegetation				
Agricultural impacts				
Entrance modifications				
Flood, coastal & tidal inundation				
Urban stormwater, litter, marine debris				
Biodiversity loss				
Sewage effluent and septic runoff				
Erosion and sedimentation				

Table 9: CMP Management Area impacted by each issue

A concept diagram showing management of these issues to protect the health of our estuary is shown in Figure 17.



KEY FEATURES OF A HEALTHY WATERWAY

- 1 Dairy effluent is kept out of waterways and wetlands and used for productive pastures
- 2 River and estuary banks are stable and stock is excluded
- 3 Land is managed to avoid the disturbance of acid sulfate soils
- 4 Stormwater runoff from urban areas is filtered
- 5 Natural wetlands are healthy and filter sediments and nutrients
- 6 Oysters and fishing stocks are healthy
- 7 Seagrass is abundant and algae levels are low

Figure 17: Estuary with negative impacts vs well-managed estuary

2.3.2 Community Stewardship

“This is a people issue. It’s the responsibility of everyone to respect and understand our system. A lot of people don’t understand the impact of day-to-day decisions. Promote public education and publicise issues affecting the estuary. Engage with landholders in the catchment to improve decision-making.”

Chris Scott, member, Community Reference Group

Public participation and stewardship are enshrined in the Coastal Management Act 2016 and feature strongly in the NSW Marine Estate Management Strategy (MEMS).¹⁶

The need to improve community stewardship and land management practices have been highlighted during our consultation. Education and engagement were proposed as management options across almost all of the issues and identified as a high priority by the Community Reference Group.

Stakeholders called for a cohesive community engagement and education program that fosters understanding, commitment and stewardship to protect the health of the estuary and waterways. Key target audiences will include recreational river users, public and private land managers including new landholders, commercial and lifestyle farmers and the wider community.

An environmental Best Management Practice framework for the agricultural sector will be developed to provide consistent guidance. Local social research on the motivations and challenges for beef and dairy farmers called for a program which builds on existing catchment management efforts, promotes an integrated suite of practices, and demonstrates a production advantage for farmers.¹⁷

Providing incentives, training and extension advice to develop new concepts and skills; supporting peer-to-peer learning; and negotiating win-win management actions will advance the goals of farmers while influencing culture and practices to improve management of the Manning estuary. The emphasis will be on providing evidence-based guidance that supports land managers to make their own decisions.

Stakeholders: MidCoast Council; Hunter Local Land Services; Mid Coast 2 Tops Landcare; MidCoast Dairy Advancement Group; industry groups; National Parks and Wildlife Service; local schools; community groups (e.g. Manning River Turtle Conservation Group, OzFish, birding clubs); Manning Regional Art Gallery; Libraries.

¹⁶ (NSW Marine Estate Management Authority, 2018)

¹⁷ (Bullock, 2019)



Photo: Cattle access to the estuary is a common problem.

2.3.3 Climate Change

The increase in greenhouse gases within the atmosphere, largely caused by the activities of humans, is causing the earth to warm (Figure 18). The CMP contains actions that will assist effective adaptation to a changing climate. Key threats arising from climate change and their resulting impacts are summarised below.

The impacts of climate change will continue to increase in intensity. While uncertain, modelling for northern NSW indicates that impacts will start to have significant environmental, social and economic impacts in about 20 years' time (i.e. 2040). Accordingly, it is important to understand the implications of climate change now and start more detailed planning during the first five-years of the Manning Estuary CMP.

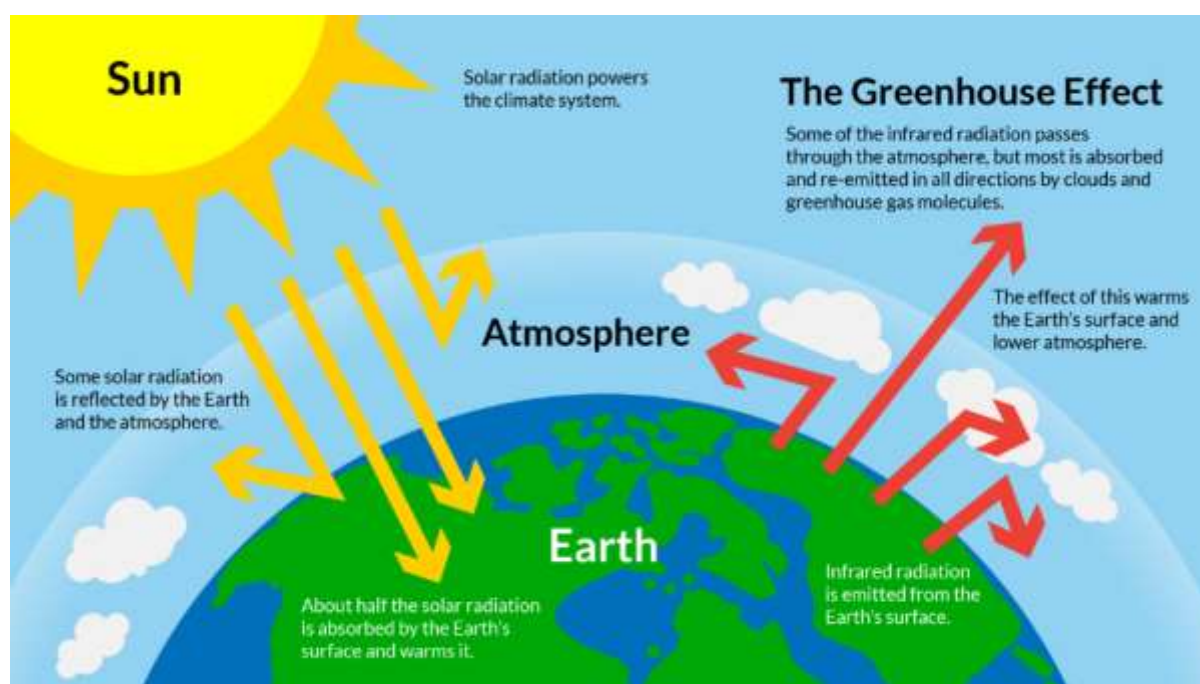


Figure 18: Conceptual diagram of the Greenhouse Effect

Key Threats

The following are the key threats facing the Manning estuary and catchment due to climate change.

Threat 1 - Sea Level Rise: Sea levels are rising as the Earth warms, mainly due to the expansion of water in the oceans as they warm, and the melting of ice from glaciers and polar ice caps. Therefore, tidal levels in the estuary will also rise.

Threat 2 - More Intense Extreme Rainfall: A warmer atmosphere can hold more moisture, leading to more intense rainfall events.

Threat 3 - Overall Drier Catchment: The warming climate will also cause the catchment to become drier over time. It is expected that droughts will become more prevalent.

Threat 4 - Warmer Water: The water in estuaries will heat up in line with the warming of the planet. One degree Celsius of warming has already occurred, and it is possible that by 2040 the estuary will have warmed by a further degree.

Impacts on Tidal Inundation

Results of the flood modelling completed for MCC in 2016 demonstrate the tidal inundation that will occur for both +0.28m of sea level rise (which could occur by 2040-2050) and +0.98m for around the year 2100. These show that inundation impacts mostly affect low lying areas adjacent to the estuary, including land which has been previously drained for agriculture.

Analysis completed by the NSW State Government indicates that a sea level rise of +0.5m would result in tides inundating around 38km of local roads and tracks, although most of these “roads” are “tracks” and local roads.

The upstream freshwater reaches of the river may be impacted by changes in tide and inundation levels.

Impacts on Sediment Dynamics

A drier catchment along with more extreme rainfall events will result in more extreme erosion from the catchment.

Proposed entrance modifications at Harrington may cause more sand to be carried into the estuary from the Ocean. The effects would depend on the entrance configuration ultimately adopted. These are presently being considered by Transport for NSW.

Impacts on Water Chemistry

Water chemistry changes due to climate change will be a complex issue. Some of the key effects are:

- More dissolved CO₂ will lead to a more acidic ocean.
- Changes in tide will affect the generation of acid from acid sulfate soils.
- Less runoff and higher water levels would increase salinity in the estuary.
- Stagnant pools of water on the floodplain (from more tide inundation) may result in algal blooms.

Long-term monitoring and review along with preparation for adaptive management are the most appropriate tools available to face this issue.

Impacts on Intertidal Habitats, Fish Communities and Ecosystems

Due to rising water levels and tides in the estuary, intertidal habitats, in particular saltmarsh, are expected to migrate upslope. It is also possible that habitats may be less robust in response to the changing environment.

In response to water temperature and sea levels changing, it is expected that fish habitats will change. This is likely to cause changes to fish communities in the estuary.

As the water gets warmer, sub-tropical and tropical species are expected to become more prevalent. Impacts could be mixed, with some new species threatening existing ecosystem functions, and some being of social or economic benefit.

The productivity of estuarine ecosystems is likely to change in response to habitat and fish community shifts. It is a complex issue and difficult to say whether the change will be positive or negative.

Impacts on floodplain drainage and Acid sulfate soil exposure

Glamore and colleagues (2016) assessed the impact of rising sea levels on the Manning estuary floodplain as projected for 2050 and 2100. Forecasted increases in high tides will reduce drainage, cause overtopping of levees, impact on backswamp connectivity, and affect agricultural productivity in some regions. The Lower Manning River Drainage Remediation Plan notes that the greater issue for land management will be elevated low tides, which will reduce drainage from low-lying backswamps.¹⁸

Stakeholders include: MCC; LLS; DPI-Fisheries; Commercial fishery and aquaculture businesses; DPIE-EES; Floodplain land holders; NPWS; Tourism (e.g., recreational fishing, ecotourism, boating); TfNSW (navigation and waterway access); Crown Lands; Local Aboriginal Land Councils, the Aboriginal community (e.g. impact on heritage sites); research institutions; DPIE-Planning; Federal government departments including the current Department of Agriculture, Water and the Environment.



Photo: Christine Price. Extreme weather events will become more regular as the climate warms up

¹⁸ (Glamore, Ruprecht, & and Rayner, Lower Manning River Drainage Remediation Action Plan, 2016)

2.3.4 Loss and degradation of coastal wetlands

Coastal wetlands in the Manning estuary are under significant threat from development, modified hydrology and the impacts of climate change. Key activities and stressors include:

- agricultural land use and associated floodplain draining and stock access
- urban development and associated filling
- degradation by pollutants such as acid drainage, increased nutrients and sediment loads
- clearing and fragmentation of vegetation
- climate change (particularly sea level rise) and drought
- weed and pest invasion
- inappropriate fire regimes
- general ignorance of wetlands values.¹⁹

Most estuarine habitats including mangroves and saltmarsh were rated *poor or fair* in the Rapid Site Assessment.²⁰ Mangrove extent and connectivity has been reduced to narrow, patchy bands, rarely exceeding 10 m wide, providing limited bank protection from high flows and boat wash. Distribution of saltmarsh identified through the Rapid Site Assessments was very low.

Stock impact on coastal wetlands and fringing vegetation was found to be a widespread threat to estuary health. Stock frequently have access to estuarine shorelines and wetlands leading to soil degradation, erosion, reduced vegetation and poor water quality.

Weed abundance within mapped wetlands was relatively low. Environmental weeds such as Lantana, Bitou Bush, Tree Pear, Coastal Morning Glory and Cassia were becoming established in some wetlands, particularly on the floodplain. Several Swamp Oak and Mangrove Forests were observed to be dominated by an understorey of the invasive weed *Juncus acutus* (Sharp Rush) which should be prioritised for treatment.²¹

Sambar deer, foxes, hares and *gambusia* fish are present in Cattai Wetlands. Deer trample and graze on wetland vegetation. Foxes prey on native species, particularly impacting threatened and migratory shorebirds near the north and south entrances.

Stakeholders include: MidCoast Council, Hunter LLS, DPIE, DPI-Fisheries, NSW Government, NPWS, WRL; private landholders, MidCoast 2 Tops Landcare, Crown Lands, Recreational and Commercial Fishers, community.

Related issues: Floodplain drainage and acid sulfate soils, biodiversity.

¹⁹ (Eco Logical Australia Pty Ltd, 2019)

²⁰ (Swanson, 2020)

²¹ (Eco Logical Australia Pty Ltd, 2019)



Figure 19: Cattai Wetlands

“We need to retain, protect and restore coastal wetlands.”

Ian Crisp, Oyster Farmer
Member, Community Reference group

2.3.5 Floodplain Management and Acid Sulfate Soil

Acid sulfate soils (ASS) formed naturally on the Manning estuary floodplain from 6,000 to 3,000 years ago. When waterlogged under natural conditions the soils are harmless. However, when exposed to atmospheric oxygen the soils produce highly acidic runoff (pH < 4.5) containing elevated concentrations of heavy metals such as iron and aluminium.

The Manning estuary floodplain has 33,797 hectares of potential acid sulfate soil (PASS) and four areas identified by the NSW government as ASS Hot Spots.²² Cattai Creek-Pipeclay Canal is classified as one of the worst ASS hotspots on the NSW coast.²³

Over the past two centuries an extensive network of drainage channels was installed on the Manning floodplain to mitigate inundation and flooding, promote dry-land pasture and prevent saline intrusion (Figure 20). As a result, prolonged drying of the floodplain allowed oxygen to penetrate the ASS sediments, acidifying soils and groundwater.³³

Following rainfall events extensive floodplain areas can be impacted by acidic runoff and high concentrations of heavy metals. The drains quickly transport the acid water into the Manning River estuary.

ASS pollution has significant adverse impacts on water quality, aquatic species and ecosystems, amenity, oyster production and fish stocks for commercial and recreational fishing.

The highest priority ASS areas for remediation are Moto, Ghinni Ghinni and Big Swamp (Figure 21). These three areas contribute 81% of the overall acid drainage risk within the lower Manning floodplain. Ghinni Ghinni Creek, Dickenson's Creek, Lansdowne River and the northern arm of the Manning River downstream of Dumaresq Island are the highest acid impacted surface water areas in the estuary.

Stakeholders include: Drainage Unions, MidCoast Council, Hunter Local Land Services (LLS), DPIE, DPI; Crown Lands; MidCoast 2 Tops Landcare; floodplain farmers; fishers and commercial oyster growers; recreational users of the estuary.

Related issues: coastal wetlands, agricultural impacts.



Remediating exposed Acid Sulfate Soils to prevent pollution events is a high priority of the CMP

²² (NSW Government, 1999)

²³ (Glamore, Ruprecht, & and Rayner, Lower Manning River Drainage Remediation Action Plan, 2016)



Figure 20: Drainage channels in the Manning River floodplain

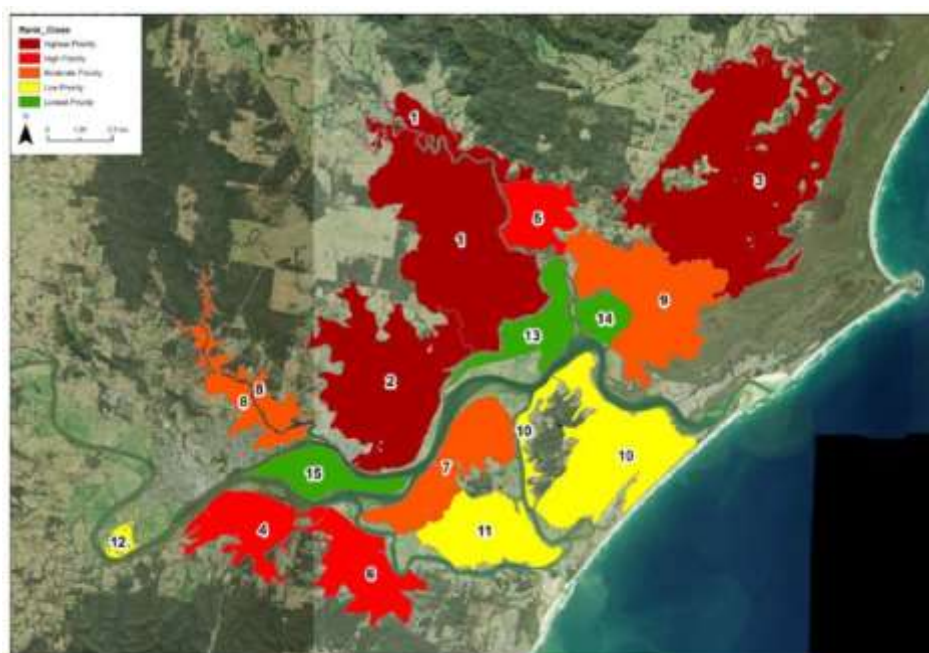


Figure 21: Priority areas for ASS remediation (Rayner et. al. 2021)

2.3.6 Loss and degradation of riparian vegetation

“My vision for the future is a stable catchment that’s well vegetated. Stock are managed and there is a healthy riparian buffer to filter run-off.”

Noel Piercy, Member, Community Reference Group

It is widely accepted that riparian vegetation plays a central role in stabilising waterways, reducing channel boundary erosion, filtering diffuse-source run-off and providing habitat. Riparian vegetation helps maintain water quality by reducing the amount of pollutants entering the waterway and serves as a physical buffer, slowing down overland flow and mitigating the negative impacts of flooding.²⁴

Vegetated riparian areas are also very important for biological connectivity. Intact and connected riparian vegetation is critical for building resilience to climate change impacts and has an important role in carbon sequestration (see also CMP Issue Analysis on wildlife conservation).

Managing riparian vegetation is a primary tool to effect catchment-scale improvements in the river environment, both in terms of its intrinsic values, and its impacts on social and economic values²⁵. The importance of riparian vegetation in maintaining water quality and ecosystem health was noted throughout consultation for the CMP.

Loss and degradation of riparian and littoral vegetation are significant stressors on estuarine health in the Manning. Riparian vegetation was cleared extensively prior to the 1950s, and stock impact on the riparian and littoral zone remains widespread.

The estuary is severely modified due to substantial clearing of natural vegetation²⁶. During the rapid assessment of the catchment (Swanson 2020b), most estuarine sites were rated *Poor* or *Fair*, primarily due to the sparse distribution of riparian vegetation (mangroves, swamp oak).

Clearing and degradation of riparian vegetation in freshwater catchments also contributes to sediment and nutrient loading in the estuary. The Estuary Health Risk Model (Figure 14) identifies the subcatchments most at risk from agricultural sediment and nutrient inputs, which can be mitigated by restoring healthy and connected riparian zones.

Cleared shorelines are exposed to erosion from high rainfall events, high flows, wind waves, tides and boat wash. Impacts from loss of riparian and littoral vegetation include floodplain stripping and bank erosion, which have been identified as the largest contributors of sediment in the river²⁷.

Bank erosion is widespread along the main estuary channels and was recorded and photographed in the Rapid Assessment Program (Swanson 2020b). This issue is mobilising large amounts of sediment into the system, causing turbidity with consequent impacts on

²⁴ (Swanson, 2020)

²⁵ (Pietsch, Daley, Stout, & Brooks, 2019)

²⁶ (Swanson, 2020)

²⁷ (Raine & Gardener, 1992)

aquatic fauna and flora and socio-economic impacts such as shallowing of the estuary for boating.

Bank stabilisation has occurred in some areas with fencing to restrict cattle access. Rock revetments have been constructed in areas with severe erosion to prevent further erosion.

Stakeholders include: Hunter LLS, DPIE, Crown Lands, Forestry Corp, NPWS; Mid Coast 2 Tops Landcare; private property owners in rural and urban areas, general community (recreation and cultural purposes, cost-bearing)

Related issues: Sediment and erosion; agricultural impacts; loss of biodiversity.



Figure 22: A legacy of land clearing on the Manning River Estuary

2.3.7 Agricultural Impacts

It is crucial that agricultural land is well-managed to prevent negative impacts on the estuary. While many farmers make concerted efforts to reduce their impacts, agriculture continues to be a significant pressure on ecosystem health and water quality in the estuary.

Activities associated with agriculture such as land-clearing and grazing accelerate the rate of rainwater runoff and erosion, carrying sediments, nutrients, pathogens and agricultural chemicals into waterways of the estuary.²⁸

In the Rapid Site Assessment, instream condition scores in estuarine subcatchments showed indicators of elevated nutrients from fertilised pastures and crops, and stock defecation.²⁹

Grazing and poor pasture management cause soil degradation including compaction and loss of soil structure and organics, which contributes to runoff by reducing the rate at which rainwater infiltrates in the soil.³⁰

Uncontrolled stock access in the riparian and instream zones was found to be a widespread threat to estuary health.³¹ Stock degrade the littoral riparian zone by disturbing the vegetation and soil, introducing weeds and increasing nutrients and pathogens through defecation. Resulting reductions in the extent, condition and connectivity of riparian vegetation increases the rate and impact of diffuse-source water pollution.³²

Diffuse agricultural run-off has been nominated as one of the highest priorities for action in the statewide and northern region Threat and Risk Assessment (BMT 2017). The priority agricultural diffuse source pollutants in the Manning catchment are nutrients (nitrogen and phosphorous) and sediments transported into the estuary via runoff after rainfall events.

Nutrients stimulate rapid growth of algae and aquatic plants which smother submerged macrophytes, degrading their condition, resilience and diversity. As excess algae block light from lower levels of the water column, it causes die-off of submerged macrophytes which are decomposed by bacteria, reducing dissolved oxygen (Serov et al 2019).

Healthy landscapes equal healthy

Many farmers are actively seeking ways to boost both productivity and environmental sustainability.

Floodplain grazer Peter Longworth has reduced surface water and maximised groundwater levels to reduce acid sulfate run off from his farm.

Peter learnt that much of the fertiliser he applied wasn't available to his pasture grass due to the acid sulfate soils on his farm. He switched to regenerative farming methods to build up soil fertility by increasing organic soil carbon. He is saving on the cost of inputs and reducing chemical run-off into the estuary.



²⁸ (NSW Government, 2009)

²⁹ (Swanson, 2020)

³⁰ (Gloucester Shire Council, 2015)

³¹ (Swanson R., 2020)

³² (NSW Government, 2009)

Sediment is released from eroding, disturbed soils associated with grazing and cropping. It causes turbidity, decreases light in the water column and reduces the extent and condition of the aquatic plant assemblage in both freshwater and marine systems (Serov et al, 2019).

Key impacts of agricultural diffuse-source run-off on estuary values are shown in Table 10 below (NSW Government 2009).

PRIORITY PROBLEM		KEY IMPACTS TO ADDRESS
1	Sediment levels exceeding ANZECC Guidelines	• smothering of aquatic ecosystems • increased water infrastructure maintenance costs
2	Nutrient levels levels exceeding ANZECC Guidelines	• nuisance weed growth and harmful algalblooms • increased water treatment cots • reduced fishery production (commercial and recreational)
3	Pathogen levels levels exceeding ANZECC Guidelines	• reduced fishery production (acquaculture, commercial and recreational fishing • human health impacts from aquatic recreation

Table 10: Key impacts associated with water pollution from diffuse source run-off

The Estuary Health Risk Model (Figure 14) identifies the subcatchments with the highest risk of impacting estuarine ecosystem health through agricultural sediment and nutrient inputs, which include several rivers in the freshwater catchment:

- Very High Risk: Lansdowne River (88, 223), Cedar Party Creek (95)
- High Risk (estuarine rivers): Manning (105, 108, 204, 219, 220) Dawson River (103), Cattai Creek (93)
- High Risk (freshwater catchment): Upper Manning (90), Dingo Creek (86, 89), Gloucester River (98, 122), Barrington River (115, 119), Avon River (123),

Stakeholders include: Hunter Local Land Services' DPIE Department of Agriculture, MidCoast Council, MidCoast Dairy Advancement Group, NSW Farmers Association, Young Farmers Network, Mid Coast 2 Tops Landcare Economic Development Council.

Related issues: loss and degradation of coastal wetlands and riparian vegetation; floodplain drainage and ASS.

Figure 23: Cattle access to the littoral zone in the estuary is a common sight



2.3.8 Entrance Modifications

The Manning Estuary CMP Planning Area commences 2 km up-river of AHD. The CMP for Old Bar-Manning Point, which addresses coastal processes will consider the issue of entrance modifications. However, proposed entrance modification has been included in the issues analysis for both the Manning Estuary CMP and Old Bar-Manning Point CMP as modifications of the entrance to the Manning River will impact both Planning Areas.

At the river entrances, a single breakwater/training wall at the northern entrance at Harrington has created a permanent ocean entrance while Farquhar Inlet is mechanically opened to the ocean when flood trigger levels are reached.³³

In March 2020, the Minister for Transport and Roads, together with the Member for Myall Lakes, announced the establishment of the Manning River Taskforce to consider options for providing a permanent entrance to the Manning River. MidCoast Council was a stakeholder to the Taskforce.

In November 2020, following its deliberation, the Taskforce released its report investigating options to improve safety and navigability of the Manning River entrance (Transport for NSW 2020). The following context is quoted from the report.

“The objective of the Taskforce was to build on a previous study (Manly Hydraulics Laboratory 2018) by providing expert advice to the NSW government about the expected economic benefits that could be generated by a permanent entrance to the Manning River at Harrington, the optimal engineering solution and consideration of how such a proposal could be designed and delivered in the context of the requirements of the Coastal Management Act 2016. The Task Force was also to consider implications for potential improvements at the southern entrance of the river at Farquhar Inlet.”

“The Taskforce was comprised of experts in coastal engineering, maritime infrastructure, coastal management and maritime industry, and was chaired by Transport for NSW - Maritime. The first two options considered were 1) Status Quo/Do Nothing and 2) Routine Dredging which was described as similar to the status quo.”

“The report then considered option 3) The Southern Entrance Breakwater option consisting of the construction of a southern breakwater to stabilise the entrance between that breakwater and the existing northern breakwater. That is the option which has been generally in the past supported by those seeking to improve safety and navigability of the Manning River Entrance – which is what the Taskforce was set up to investigate.”

“Finally, the report considered another solution 4 the Manning Point Twin Breakwaters. This would involve the creation of a new opening at the narrowest point of the Mitchell Island sand spit. The report suggested that this would be considerably cheaper than option 3.”

“The MidCoast Council has resolved to support the Expert Taskforce and its processes. As indicated in recommendation 1 set out above, before any proposal can

³³ (Parsons, 2010)

proceed to a Final Business Case a more rigorous engineering, constructability and environmental Impact statement will be undertaken.”

The Taskforce report concluded with two recommendations.

Recommendation 1 was for Transport for NSW to enter the proposed Manning River Entrance Project into the Infrastructure NSW Investor Assurance and NSW Treasury business case process. The development of a Strategic Business Case (SBC) is required to further analyse the optimal engineering outcome, the broader impacts of intervention in the area, and the relative costs and benefits of the identified options. If the benefits are found to outweigh the costs of the project, a more rigorous engineering, constructability, and environmental impact assessment should be undertaken in a Final Business Case prior to a decision to invest in a permanent solution.

Recommendation 2 provided for an extensive stakeholder consultation process that includes the local community and impacted industries and stakeholders as well as consideration of progress in the development of Mid-Coast Council's two CMPs.

Implementation of these recommendations commenced in late 2021.

Modified entrances are still influenced by tides waves, currents, sediment movement and freshwater flooding. Entrance modifications can cause significant changes to coastal and estuarine processes and require detailed environmental impact assessment.

Estuary entrance modification was rated as the top priority threat to the environment for the Northern region of NSW in an evidence-based Threat and Risk Assessment completed for the Marine Estate Management Authority.³⁴ Estuarine entrance modification and associated works were listed as the highest threat to species protected under NSW legislation.³⁵ In other locations where the entrances to estuaries have been trained, scientific evidence has demonstrated significant environmental impacts such as:

- Increased tidal ranges, increased inundation of floodplains, stormwater infrastructure, coastal wetlands, reduction in estuarine habitats, species and exposure of ASS
- Scouring of riverbanks and channels³⁶, changes to siltation and shoaling patterns
- Exacerbated down drift beach erosion
- Loss of breeding grounds for migratory birds and significant alteration of aquatic flora and fauna assemblages around the entrance and within the estuary.

Stakeholders include: Transport for NSW; DPIE; MCC; Oyster farmers; Manning River Action Group; recreation users; tourism industries; landowners.

Related issues: coastal wetlands, floodplain drainage and ASS, biodiversity loss.

³⁴ NSW Marine Estate Threat and Risk Assessment Report, BMT WBM, August 2017

³⁵ NSW Marine Estate Management Authority, July 2018

³⁶ (Nielsen & Gordon, 2008)



Photo: The modified entrance of the Manning River's north arm at Harrington

2.3.9 Flood, tidal inundation and coastal inundation

The Manning River Floodplain Risk Management Study and Plan 2019 is Council's primary planning instrument covering flood, coastal inundation and tidal inundation in the Manning Estuary CMP Planning Area.

Coastal Management Programs prepared under the Coastal Management Act are not intended to take precedence over other council plans, but rather to provide information to support the more effective consideration of coastal hazards and estuary health in other statutory and operational plans.

Objects of the Coastal Management Act 2016 relating to flood, coastal inundation and tidal inundation in our Planning Area include:

- a) to facilitate ecologically sustainable development in the coastal zone and promote sustainable land use planning decision-making
- b) to mitigate current and future risks from coastal hazards, taking into account the effects of climate change
- c) 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
- d) 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.

Under the State Environmental Planning Policy, Coastal Vulnerability Areas are defined as land subject to current and future coastal hazards. There are seven types of

coastal hazard defined by the CM Act. Within the Planning Area for the Manning Estuary CMP, the potential hazards could include:

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

Flood

There is a long and relatively frequent history of flooding within the lower Manning River. The four largest floods on record occurred in 1866 (peak flood level: 5.15 m AHD), 1929 (peak flood level: 5.9 m), 1978 (peak level: 5.75 m) and March 2021 (peak level 5.65 m) (Figure 24).

With such a big catchment, floodwaters from the mountains flow down the Manning channel with great force, especially in the constrained channel of the Manning above Wingham, then spread out across the estuary where the energy is dispersed but inundation of low-lying land becomes more of a problem.

MidCoast Council's approach to flood management is set out in the Manning River Floodplain Risk Management Study and Plan (BMT WBM 2019). The plan covers the low-lying floodplain area downstream of Wingham. The study addresses both mainstream flooding of the Manning River and the impact of climate change in the form of increased rainfall intensities and sea level rise for the following scenarios:

- Predicted increased rainfall intensity: modelled 10% and 30% increased rainfall
- Sea Level Rise (SLR): +0.28 m by 2050; and +0.98 m by 2100.

The Floodplain Risk Management Study (FRMS) has derived an appropriate plan of measures and strategies to manage present and future flood risk in accordance with the NSW Government Floodplain Development Manual. These include flood modification measures, property modification measures, risk modification measures and emergency measures (e.g. evacuation, sandbagging). MidCoast Council works closely with the NSW State Emergency Service to establish flood triggers for emergency situations.

The FRMS has also identified a Flood Planning Area for the Manning River floodplain. Development of land within the Flood Planning Area is restricted and controlled by Council due to the hazard of flooding. In defining the Flood Planning Area in the MidCoast LGA, Council has considered a future flood scenario that has accounted for climate change in the form of increased rainfall and sea level rise in a combined riverine flooding and high tail water scenario to the 1% Annual Exceedance Probability (AEP, 1 in 100-year event) plus a freeboard of 500mm.

The Manning River Floodplain Risk Management Study and Plan is therefore the appropriate management tool for flooding within the geographical extent of this CMP.

Related Issues: erosion and sedimentation; climate change

Stakeholders: MidCoast Council; NSW State Emergency Service; Adapt NSW; Department of Planning, Industry and Environment, residents, farms and businesses on the floodplain.



Figure 20: The Manning River floodplain, 20 March 2021

Photo: Evan Vale

Coastal Inundation

Coastal inundation is the flooding of coastal management areas by ocean waters, occurring “when a combination of marine and atmospheric processes raises ocean water levels above normal elevations and inundates low-lying” areas (Coastal Management Manual 2018).

Coastal inundation on the NSW coast is most often associated with east-coast lows (Heimhuber et al 2019). It is typically a short-term event with waters receding to normal conditions. Coastal inundation from storm surge in the Manning River estuary is caused by various processes including low barometric pressure, strong onshore winds, high tides, and trapped coastal waves.

Coastal inundation in the Manning generally affects the open coast and low-lying areas near the entrance, such as Harrington and Manning Point which are outside our Planning Area. For the Manning Estuary CMP Planning Area, threats associated with coastal inundation include rising groundwater, impacts on coastal wetlands and vegetation, inland estuary flooding and damage to riverbanks and infrastructure.

The Manning River Floodplain Management Study (BMT WBM 2019) considers flood events driven by both catchment and oceanic processes, addressing the current probability and future scenarios under climate change as shown above. Storm surge is factored into tail-water levels.

In general, coastal inundation causes more frequent nuisance flooding while riverine flooding is less frequent but causes more damage. Impacts include reduced efficiency of stormwater infrastructure and increased groundwater levels.

Modelling in the MRFMS (2019) shows that in storm events, the impact of water across land from high rainfall and riverine flooding will be more significant than the impact of coastal inundation. The flood mitigation, planning and emergency response measures set out in the MRFMS and Plan (2019) should therefore provide an effective management approach to coastal inundation. For more information see Section 10.

Tidal Inundation

Tidal Inundation or nuisance flooding is defined as “*the inundation of land by tidal action under average meteorological conditions*” (Coastal Management Manual 2018). It causes short term nuisance flooding in low-lying coastal areas.

Tidal inundation is mapped and managed through the Manning River Floodplain Risk Management Study and Plan (BMT WBM 2019), using the High High-Water Spring tidal signature provided in the Flood Risk Management Guide (DECCW 205) for locations south of Crowdy Head as the ocean water level boundary.

Tidal inundation impacts on infrastructure such as roads, housing and stormwater systems are addressed in the Climate Change section of this document and the Climate Change Issue Paper provided as a supporting document.

2.3.10 Urban Stormwater and Litter

Urbanisation in the towns of Taree, Wingham, Harrington and Old Bar has created large areas of impervious surfaces such as roads, rooves, driveways and carparks. As a result, there is less infiltration of rainfall to ground water, increased stormwater overland flow velocities and greater volumes of runoff (Worley Parsons 2009).

Sediment transport is particularly problematic during the construction phase of urban development, when soils are exposed. Over the life of a development 80% of sediment lost occurs during the construction phase.

Pollutants typically found in stormwater include litter and microplastics, bacteria, nutrients, petrochemicals, pesticides, heavy metals, sediment and organic matter (NSW Govt. 2009).

A preliminary spatial risk assessment for the Manning River Estuary produced for the Manning River ECMP Scoping Study found that pollutant loads from urban stormwater are relatively low compared to catchment loads from agricultural land (MCC 2020).

Potential impacts include:

- Excess nutrients fuel algal blooms which lead to habitat loss impacting on the abundance and diversity of macroinvertebrates and aquatic fauna
- Visual pollution from gross pollutants impacting scenic amenity, town pride, tourism and recreation
- Plastics can mimic natural food sources and injure/kill wildlife including birds, fish and dolphins
- Sediment reduces the amount of light available for seagrass to grow, impacting aquatic fauna
- Organic matter such as grass clippings reduces oxygen levels in the water as it breaks down, killing plants and animals.

In Taree, Browns Creek is an identified hot spot affected by runoff from the town centre and residential area which carries litter, hydrocarbons, sediments and nutrients into the creek.

In Wingham large catchments with aging infrastructure have led to increased erosion at outlets causing sedimentation in the local waterways, and as hydrocarbons and litter pollution at the Wingham Wetlands site next to the major shopping centre.

Management agencies: MidCoast Council (MCC), Hunter Local Land Service (Hunter LLS), DPIE – Environment, Energy and Science, NSW Government.

Community: Friends of Browns Creek; Team Taree, OzFish, Mid Coast 2 Tops Landcare

Who's affected? Private landholders, MCC, Crown Lands, community members, fishing and oyster industry.

2.3.11 Biodiversity Loss

Estuaries where fresh and saltwater meet are the “nurseries of the sea.” Their sheltered waters provide vital nesting, breeding and feeding habitats for many species of fish, shellfish, aquatic plants and birds. Most commercially valuable fish species depend on estuaries at some point during their development.³⁷

The entire Manning estuary and its tributaries have been designated as Key Fish Habitat by Fisheries NSW, recognising its importance to the sustainability of recreational and commercial fishing industries, the maintenance of fish populations generally and the survival and recovery of threatened aquatic species.³⁸ Eleven native fish species in the Manning estuary are diadromous, meaning they require unimpeded movement between freshwater rivers and the estuary/sea. These include the Australian bass, Sea mullet, Short and long-finned eels and several species of gudgeon (Howell and Creese 2004).

Migratory fish such as the Australian Bass play a critical role in keeping our rivers, wetlands and oceans healthy by supporting a complex food web. Populations are declining globally.³⁹

Other biodiversity assets in the Manning River Estuary include four nationally-listed migratory shorebird species (though not within the Manning Estuary CMP Planning Area) and a maternity camp of vulnerable grey-headed flying fox in a patch of Sub-tropical Lowland Rainforest (EEC) at Wingham Brush. Creating alternative habitat for the Wingham Brush colony is an action of Council’s Flying Fox Camp Management Strategy (2021) and is aligned to restoration of riparian vegetation in the Manning estuary.

At the national level, key threats to biodiversity in aquatic ecosystems and marine receiving waters include diffuse-source water pollution, degraded riparian habitats and climate change, including the impacts of changed frequency, magnitude and intensity of floods and droughts.⁴⁰

In NSW, land clearing is currently the main threat to the extent and condition of native vegetation and habitat for terrestrial fauna⁴¹. Clearing, degradation and fragmentation of vegetation due to land uses such as agriculture and urban development result in loss of diversity and degradation of natural terrestrial and aquatic environments (Commonwealth of Australia, 2017).

These threats are reflected in the Manning River estuary, where stressors include:

- Barriers to fish passage
- Habitat loss, degradation and fragmentation
- Water pollution from sediment and nutrients
- Changing climate including extreme weather events such as drought and widespread and intense wildfires

³⁷ (NSW Government, Why estuaries are important, 2020)

³⁸ NSW Department of Primary Industries (2020)

³⁹ (World Fish Migration Foundation, 2020)

⁴⁰ (Commonwealth of Australia, 2019)

⁴¹ (Commonwealth of Australia, 2017)

- Invasive plants and pest animals (foxes, rabbits/hares, feral deer, feral pigs, goldfish)

Loss of biodiversity (species and trophic levels) is classified as a high risk to social, economic and cultural benefits of the NSW Marine Estate.⁴² The pressures that have pushed biodiversity and natural ecological systems in the catchment into decline also undermine the delivery of important ecosystems services, which in turn impacts social and economic drivers in the MidCoast Region.

Stakeholders: NSW National Parks and Wildlife Service (NPWS), MidCoast Council (MCC), DPIE, Hunter LLS; Purfleet-Taree Local Aboriginal Land Council, Taree Indigenous Development and Employment (TIDE); Gloucester Environment Group, Mid Coast 2 Tops Landcare, Manning River Turtle Conservation Group, OzFish, Manning-Great Lakes Birdwatchers, Koalas in Care, FAWNA.



Photo: Red neck avocet, Karen Bettink

⁴² (Marine Estate Management Authority, 2018)

2.3.12 Sewerage and Septic System Pathogens

MidCoast Council operates seven Sewerage Treatment Plants (STPs) in the Manning estuary, at Wingham, Dawson wetlands (Brimbin), Harrington, Manning Point, Old Bar, Coopernook and Lansdowne.

Most of the region is unsewered, relying on on-site sewage management (OSSM) systems including traditional septic systems and pump-to-sewer systems. MidCoast Council (MCC) has the responsibility to ensure that all onsite sewage management systems are approved, installed and managed so that they comply with the requirements under the Local Government Act 1993 and do not pose a risk to the environment or public health.

Failing systems or mismanagement of OSSMs present a pathogen risk to groundwater and receiving waters, with consequent health risks for the oyster industry and recreation.⁴³

Sewerage and STP run-off have been found to affect water quality in the Manning, particularly during high rainfall events.⁴⁴ While the highest faecal input comes from livestock, human pathogens have the highest safety risk.

Pathogens (faecal coliforms and *E. coli*) from sewerage and septic systems are an issue for the local oyster industry, particularly at Pelican Bay, Scotts Creek and the South Channel. In the Manning oyster fishery, rainfall exceeding 25 mm in 24 hours is a trigger for closure of harvest areas due to the potential decrease in salinity and increase in faecal coliforms that can result from significant rainfall stormwater run-off.^{45, 46} Depuration requirements add time and cost to the harvest-to-market process. Critical risk on-site sewage management systems for the oyster industry are located within 100 meters of the shoreline and adjacent to a shellfish harvest area.⁴⁷

Pathogens present a hazard for passive and secondary recreation, with popular activities including swimming, boating and kayaking. This is rarely an issue. After the 1-in-100-year flood in March 2021, water quality testing by the Environment Protection Authority gave the all-clear for swimming in the Manning and Dawson Rivers less than two weeks after the flood.

Stakeholders include: NSW Food Authority, MCC Water Services, MCC Environmental Health and Natural Systems teams, Environment Protection Authority (EPA), Department of Primary Industries - Fisheries, oyster farmers, MCC Water Services (rate payers, water buyers); passive and secondary recreation users; recreation and commercial fisheries; tourism industry.

*Clean water is
essential for safe
recreation*



⁴³ (Swanson, 2019)

⁴⁴ (Williams, 1987)

⁴⁵ (Bullock, 2018)

⁴⁶ (Parsons, 2010)

⁴⁷ NSW Fisheries Spatial Data Portal - <https://www.dpi.nsw.gov.au/fishing/spatial-data-portal>

2.3.13 Erosion and Sediment

Water quality testing shows high turbidity levels after periods of rainfall in the Middle and Upper Manning Estuary. High turbidity is caused by sediments suspended in the water column. Along with agriculture and loss of riparian vegetation as previously discussed, activities that contribute to erosion and sedimentation include:

Unsealed roads, stock crossings and unsealed driveways

Forestry operations including dirt roads and timber harvest⁴⁸

Construction sites disturb soil and create dust and debris. Construction includes Council road, bridge and drainage works and private infrastructure such as homes and dams.

There is community concern that boatwash is causing significant bank erosion in the Lansdowne River and a study identified the Dawson River was at risk, exacerbated by historic clearing of riparian vegetation (McKeown and Associates, 1997). Flood, tide and wind waves are of more concern in the Manning main channels.

The bushfires of late 2019 burnt 244,173ha, representing 30% of the catchment, with several subcatchments burning over 90%. High intensity fires in the estuary were located from Tinonee to Old Bar and Cattai Creek to Harrington and included a peat fire in Cattai Wetlands. The potential for soil erosion after a bushfire can be severe due to the destruction of ground cover and the litter layer.

The estuary has an average flushing time of 31.6 days, compared with a State-wide median estuary flushing time of 9 days (Roper *et al.* 2011). Due to the long residence time of fresh water, the estuary is sensitive to the accumulation of sediments.

High concentrations of suspended sediments in estuarine rivers can:

- diminish light needed for photosynthesis, reducing condition and extent of aquatic plants including seagrass at the base of the food chain
- cause eutrophication of wetlands
- smother the stream bed, macroinvertebrate habitat and seagrass.⁴⁹

Stakeholders: MidCoast Council, Hunter LLS, Transport for NSW, Department of Primary Industries - Fisheries, DPI - Forestry, Environmental Protection Authority, Mid Coast 2 Tops Landcare, recreational boating associations, landholders.

Related issues: Loss of riparian vegetation, stormwater, agricultural impact.

Figure 25: Bank erosion and remediation on the estuary



⁴⁸ (Midcoast Water, 2011)

⁴⁹ (NSW Government, 2009)

2.3.14 Systems thinking: the interaction between issues

Ecological systems such as rivers are made up of connected interactions between living organisms, including humans, and their physical environment. The issues presented here do not occur in isolation. Many of them are “wicked problems” with no single solution and as such no single action will be able to “fix” the identified issue.

“Systems thinking” is an approach to problem solving which recognises this complexity. Problems are considered as parts of an overall system. Solutions seek to address multiple interactions in the system rather than reacting to a single impact which is frequently ineffective and can cause unintended consequences.

While the Manning Estuary CMP presents issues and actions focusing on single stressors, impacts and interventions, it is recognised that many of the issues are interrelated, and management actions will need to work together holistically to achieve long-term environmental improvement.

For example, bank erosion is a problem in the estuary. It has multiple causes including tidal movements, wind, waves and boatwash. Clearing of riparian vegetation including mangroves has made banks more vulnerable to erosion. Stock activity adds to the vulnerability. Changes in tidal movements caused by sea level rise or entrance modifications will exacerbate bank erosion.

In this scenario, a single intervention, for example rock armouring of a reach of bank, will not address the problem. The Manning Estuary CMP recognises that in many cases its actions will be most effective when working in concert to address multiple stressors holistically.

Examples of holistic actions that could work together to address an issue include:

- Riparian restoration, bank revetment, stock management, source control of boatwash erosion and education for the river users to practice responsible boating.
- Maintenance of Gross Pollutant Traps, restoration of constructed wetlands, source control of litter and community education (only rain down the drain).

Systems thinking will be used to implement the Manning Estuary CMP.

Supporting Documents:

Find out more on MidCoast Council's website at www.midcoast.nsw.gov.au/ourmanningriver

- **Annexure G:** The Manning River ECMP Spatial Risk Assessment Report (Swanson 2020)
- **Annexure H:** The Manning River ECMP Rapid Site Assessment Report (Swanson 2020)
- **Annexure I:** The Manning River Estuary ECMP Issue Analysis (MCC 2021)

3. Management Actions



“People will move here and invest here if they know we are committed to looking after the estuary.”

Ian Crisp, oyster grower
Community Reference Group

The following Management Actions were developed to mitigate risks and threats, address the issues and achieve our objectives to protect community values in the Manning Estuary. They were derived from several consultation inputs:

- One-on-one interviews with members of the Community Reference group
- A series of 13 issue analysis discussion groups with members of the Technical Advisory Group and delivery partners
- A series of 9 workshops with internal and external delivery partners to firm up the details of the management options. We assessed whether they belonged in the CMP Action Program, complementary programs or could be amalgamated, and converted them to S.M.A.R.T format (Smart, Measurable, Achievable, Timely).
- Multi-criteria analysis to assess and prioritise actions in relation to their ability to address the objects of the CM Act and objectives for the Coastal management Areas (for results see Appendix 3, Table 16)

The action identification and evaluation process was applied to both the coastal zone and broader catchment. Those actions pertaining only to the Coastal Zone Planning Area have been carried through into this CMP.

Note: When an action from the Manning River ECMP action has been omitted from the Manning Estuary CMP because it is outside the Coastal Zone Planning Area, numbering has been kept consistent between the two programs. Action numbers in this document are therefore not always sequential.

Evaluation of management options

A structured and transparent evaluation of management options against the three broad themes of feasibility, viability and acceptability is required by the Coastal Management Manual. MidCoast Council's project team managed acceptability evaluation while a team of consultants led by Salients undertook the feasibility and viability evaluation.

The method and results of the evaluation process are outlined below and shown in Figure 26. The full evaluation report is provided in Annexure K: Report: Evaluation of management options for the Manning River ECMP (Salients 2021).

The feasibility evaluation considered whether the actions could be completed in technical, engineering and/or legal terms. As a first stage of the feasibility assessment every management option was subjected to a multi-criteria assessment (see Appendix 3, Table 16). The purpose of a CMP is to give effect to the objectives of the *Coastal Management Act 2016*. For this reason, the objects/objectives of the CM Act and, by extension, the *Marine Estate Management Act 2014* were used as the criteria against which each of the management options were assessed.

Where options were identified as being suitable for direct progression (typically low cost, low regrets, high confidence of success), the multi criteria assessment was applied as a confirmatory feasibility assessment.

For other, more complex or expensive actions, the feasibility assessment also involved more detailed consideration including, at least, a qualitative evaluation of potential shortcomings and benefits.

The viability evaluation focused on economic and financial considerations, asking:

- Is the option justifiable in terms of improving overall wellbeing (economic assessment)?
- Is it possible to fund the option?

If the answer to the first question was “Yes”, the option was included in the business plan assuming there will be an opportunistic mechanism to carry it forward, even if there is no viable funding mechanism presently available. The funding environment changes from year to year and the CMP should be able to take advantage of any funding opportunities that might make an action viable in future, even if a present funding pathway cannot be readily identified.

As a minimum, all short-listed options have had a cost estimate derived, based largely on the experience of study team members, assisted by staff from MCC and Hunter LLS. When this cost estimate is combined with the qualitative multi-criteria analysis feasibility assessment, it constitutes a “Simple Economic Assessment” (in the terminology of the CM Manual).

More detailed financial assessment has been undertaken for several management options, with a specialist report prepared by the Centre for International Economics (CIE). Where this is the case, the options examined have been subjected to assessments of varying complexity, up to an “*Intermediate Level Assessment*.” The more complex options assessed by the CIE were subject to *Rapid Cost Benefit Analysis (CBA)* assessment which follows the same framework as a detailed CBA, except that it allows the use and consideration of qualitative assessments and is more accepting of imperfect data or data gaps.

All options were found to be *feasible* in the sense that there is no key impediment from a legal, technical or engineering perspective. In some cases, future study to better direct actions at specific sites and/or follow up engineering design may be required as the CMP is implemented.

All options were found to be *viable* in that they have been assessed as being good value for money except for one, a study on the viability to buy and retire water licenses. This action was excluded from the final program.

Acceptability evaluation considers whether there is broad acceptability among community and stakeholders, as determined through consultation. Consultation has been consistent and extensive during Council's CMP preparation process to ensure management actions are acceptable to community representatives and delivery partners.

Acceptability was formally assessed via:

- A meeting with the Community Reference group to review the “long-list” of actions prior to filtering at the management action workshops mentioned above.
- A series of workshops with delivery partners held in February-March to review the Management Actions and set targets.
- One-on-one meetings with lead agencies and delivery partners within and external to Council to ensure all Management Actions included in the final draft were acceptable, including the intention of the action, the wording used, S.M.A.R.T targets and budgets.
- Letters of agreement provided by all lead agencies for management actions included in the final program.

These consultations are documented in the Stakeholder report, Annexure B.

Supporting Documents:

Further information can be downloaded from www.midcoast.nsw.gov.au/ourmanningriver

- Annexure B: The Manning River ECMP Stakeholder Consultation Report (MCC 2021)
- Annexure J: Manning River ECMP Management Actions with Practice Notes (MCC 2021)
- Annexure K: Report: Evaluation of management options for the Manning River ECMP (Salients 2021)



Reference: NSW Coastal Management Manual Stage 3

Figure 26: The three stages of evaluation

THEME 1: STEWARDSHIP

Engage with the community, build capacity and support partnerships to promote understanding, connection and stewardship.



"It's the responsibility of everyone to respect and understand our iconic river system. Appreciate it, utilise it, and do their bit to keep it clean."

Sam Nicholson, Dairy Farmer,
member ECMP Reference Group

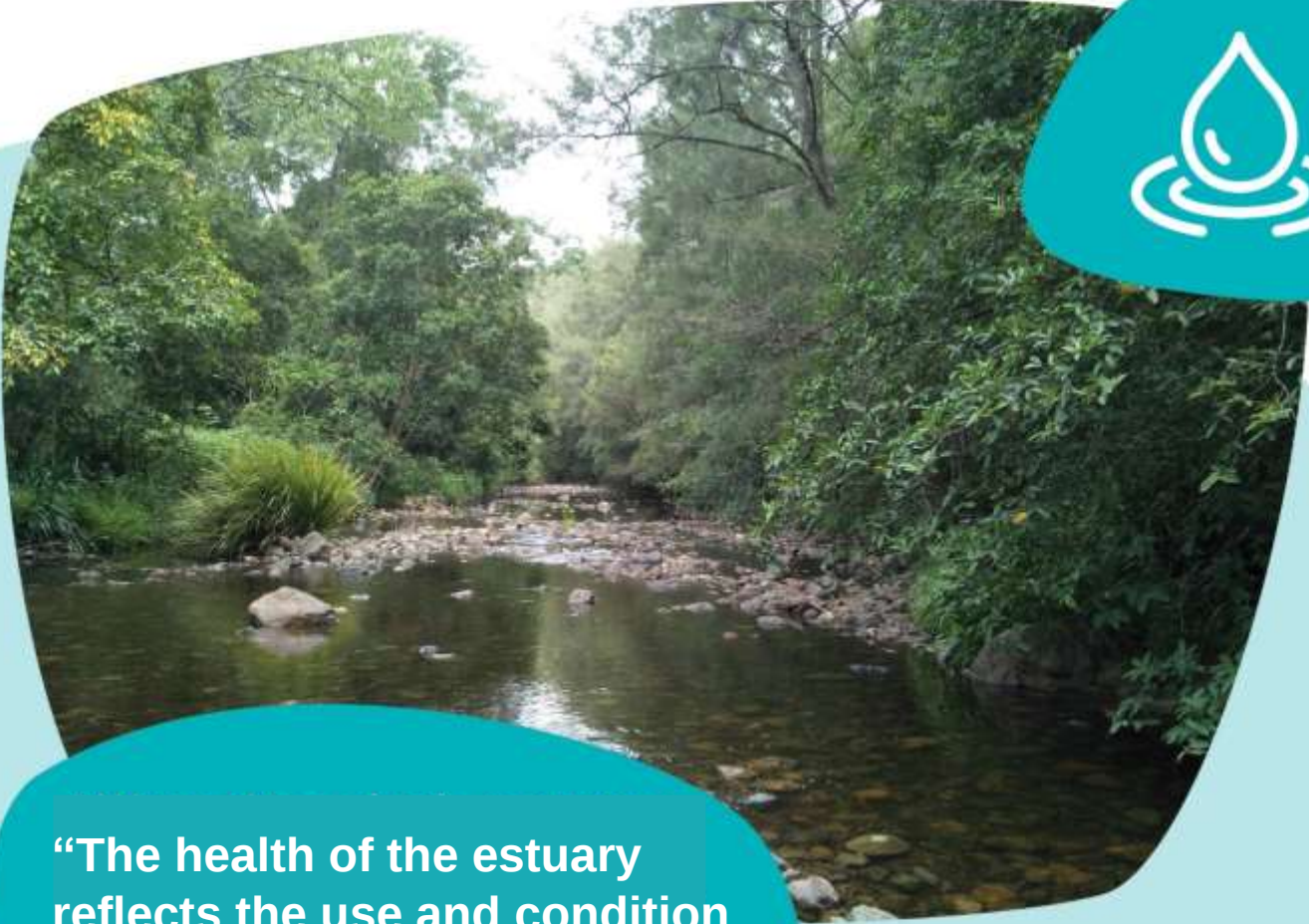
3.1 STEWARDSHIP ACTIONS

1.01	Engage river users and the whole community in an engagement program to promote understanding of ecosystem values and stewardship of the river
Issues addressed	Floodplain drainage and ASS; Agricultural impacts; Stormwater and litter; Erosion and sediment; Biodiversity loss; Coastal wetlands loss; Riparian vegetation loss; Low and modified flows
Lead agency	MCC (Lead) and Hunter LLS in partnership with MC2T Landcare and DPI-Agriculture, community groups, schools and DPIE
1.02	Promote whole-farm planning and natural resource management for catchment outcomes a) Support landholders to develop whole farm planning approaches to decision making based on best management practices.
Issues addressed	Floodplain drainage and ASS; Agricultural Impacts
Priority areas	Very High and High risk subcatchments in the Estuary Health Risk Model (Figure 14)
Lead agency	Hunter LLS in partnership with MC2T Landcare and DPI-Agriculture, Industry Groups, and DPI - Agriculture
1.03	Promote and facilitate establishment of 30 private conservation agreements covering 1500 ha in the Manning catchment and estuary by 2032, through Land for Wildlife and the Biodiversity Conservation Trust.
Issues addressed	Agricultural impacts; Biodiversity loss; Riparian vegetation loss
Lead agency	Led by Biodiversity Conservation Trust and MidCoast Council (LFW) with support from Hunter Local Land Services and MC2T Landcare
1.04	Implement a litter and stormwater pollution source control program a) Monitor and report annually on the volume, type and location of litter collected during GPT maintenance and clean-up days b) Utilise this data for targeted education and engagement campaigns c) Develop source control plans for identified hot spot locations.

	d) Support community and industry groups to complete a minimum of one litter clean up event each year in identified hot spots.
Issues addressed	Stormwater and litter
Priority area	Taree, Browns Creek
Lead agency	MidCoast Council
1.05	Develop and distribute guidelines to promote improved erosion and sediment control (ESC) for earthworks and infrastructure on private land.
Issues addressed	Erosion and sediment
Lead agency	MidCoast Council
1.06	Improve erosion and sediment control (ESC) a) Develop a comprehensive erosion and sediment control management system within MCC. Identify improvements required; set benchmarks; undertake audits and share results to build capacity. b) Develop and implement an ESC capacity building program for designers, builders, engineering consultants and developers. Follow up with a proactive, targeted compliance program by 2028
Issues	Stormwater; Erosion and Sediment
Priority areas	Estates under development such as Brimbin, Figtree and Kolodong
Lead agency	MidCoast Council

THEME 2: WATER QUALITY AND ECOSYSTEM HEALTH

Manage the Manning River catchment and its estuary holistically to maintain and improve water quality and ecosystem services

A photograph of a river flowing through a lush, green forest. The river is calm, reflecting the surrounding trees and foliage. The banks are covered in dense vegetation, including tall grasses and various trees. The water is dark and still, with some rocks visible in the shallows.

“The health of the estuary reflects the use and condition of the catchment. Take an ecosystem services approach to management, linked to benefit.”

Member, Community Reference Group

3.2 WATER QUALITY AND ECOSYSTEM HEALTH ACTIONS

2.01	Implement key priority acid sulfate soil management actions from the draft Manning River Floodplain Prioritisation Study 2021 within the Coastal Zone as shown in Figure 2 a) Reinstate 1550 ha of coastal wetlands on public and private land subject to landholder agreement by 2032 b) Audit, upgrade, replace or decommission Council floodgates within the Lower Manning Floodplain and add them to MCC's Asset Management Program. Promote rectification of floodgates on private land by 2032.
Issues addressed	Floodplain Drainage and ASS; loss and degradation of coastal wetlands
Priority areas	The highest priority ASS areas for remediation are Moto, Ghinni Ghinni and Big Swamp. These three areas contribute 81% of the overall acid drainage risk. Ghinni Ghinni Creek, Dickenson's Creek, Lansdowne River and the northern arm of the Manning River downstream of Dumaresq Island are the highest acid impacted surface water areas in the estuary.
Lead agency	MidCoast Council (lead); NSW Coastal Lands Protection Scheme, DPI-Fisheries
2.02	Investigate options and work with landholders to restore 100 ha of coastal wetlands on both public and private land by 2032, for example by managing stock and reinstating tidal flushing.
Issues addressed	Agricultural impacts, loss and degradation of coastal wetlands, biodiversity
Priority areas	CM SEPP-listed wetlands at Mitchells Island (Pelican Bay), Oxley Island, Cabbage Tree Island, Jones Island, Bohnock, Pampoolah, Mamboo Island, lower Lansdowne River, Dawson Wetlands.
Lead agency	Hunter LLS (lead) with supporting agencies MCC, DPI-Fisheries, NSW Coastal Protection Scheme, Biodiversity Conservation Trust, MC2T Landcare.
2.03	Improve the condition, extent and connectivity of riparian and estuarine bank vegetation on private and public land within the Coastal Zone as shown in Figure 2 by protecting and/or restoring 20 km of buffer vegetation by 2032.
Issues addressed	Riparian vegetation loss; Agricultural impacts, Biodiversity.
Priority Areas	Manning River, Browns Creek, Scotts Creek, South Arm, Ghinni Ghinni Creek, Cattai Creek, Lansdowne River, Cedar Party Creek (Pietsch et al 2019).

Lead agency	Hunter LLS with support from MidCoast Council.
2.04	Promote good catchment management practice on public land a) Ensure any new grazing tenures on Crown land include appropriate controls to manage stock impacts on riparian vegetation and CM SEPP-listed coastal wetlands b) Promote compliance with grazing lease tenure conditions.
Issues addressed	Agricultural impacts; Coastal Wetlands loss; Riparian vegetation loss Biodiversity loss
Priority areas	Priority subcatchments to mitigate very high and high risk agricultural inputs identified in the Estuary Health Risk Model (Figure 14).
Lead agency	Crown Lands
2.07	Implement a systematic approach to maintaining stormwater quality improvement devices in the Coastal Zone as shown in Figure 2. a) Maintain 6 GPTs within the CMP Planning Area Coastal Zone b) Incorporate Water Sensitive Design devices in the MCC asset management program by 2023 and implement the monitoring, maintenance and renewal program c) Remediate Wingham Wetlands by FY 2025-26.
Issues addressed	Stormwater and litter
Priority areas	Proprietary devices identified in audit; Wingham constructed wetland
Lead agency	MidCoast Council
2.08	Review, revise and supplement current stormwater, policies, procedures and guidance in order to create opportunities to incorporate Water Sensitive Urban Design into Council's new and upgraded capital infrastructure.
Issues addressed	Stormwater quality and litter
Lead agency	MidCoast Council
2.09	Revise the Greater Taree Capital Urban Stormwater Management Plan (2000) by end 2025. Incorporate resulting Actions into a subsequent revision of the CMP.

Issues addressed	Stormwater and litter
Priority areas	Gloucester, Taree including Browns Creek, Wingham
Lead agency	MidCoast Council
2.10	Stabilise 600m of estuarine riverbanks in priority areas using best practice that promotes native vegetation by 2032.
Issues addressed	Erosion and sediment; Riparian vegetation loss; Recreational boating
Priority subcatchments	Manning estuary, Lansdowne River, Dawson River and Scotts Creek to the tidal limit.
Lead agency	Hunter LLS with MCC, DPI-Fisheries
2.12	Implement Council's Onsite Sewerage Management System (OSSM) Audit and Compliance Strategy with a proactive inspection program at identified high-risk locations within the Coastal Zone.
Issues addressed	Pathogens (Sewerage and Septic)
Priority areas	Areas within proximity of oyster harvest leases with slow tidal exchange and potable water offtakes
Lead agency	MidCoast Council
2.13	Undertake monitoring, evaluation and reporting of ecosystem health to guide adaptive management a) Implement the Manning Estuary CMP Ecosystem Health MER Program b) Establish a platform for data sharing between agencies.
Issues addressed	Monitoring and Evaluation
Lead agency	MidCoast Council
2.14	Undertake a scientific research program in partnership with academic institutions to fill knowledge gaps and enable evidence-based adaptive management of the catchment and estuary.
Lead agency	MidCoast Council (Lead) with Hunter LLS and academic institutions

THEME 3: CLIMATE CHANGE

Understand, mitigate, adapt and build resilience to current and future hazards including the impacts of climate change



“ We need to take action to mitigate and adapt to the impacts of climate change.”

Noel Piercy, Community Representative,
Member ECMP Reference Group

3.3 CLIMATE CHANGE ACTIONS

3.01	Use research data that identifies retreat buffer zones for coastal wetlands and littoral rainforest under sea-level rise scenarios to develop a forward plan to retain suitable buffers in partnership with landholders by 2025.
Issues addressed	Coastal wetlands loss; Biodiversity
Lead agency	MidCoast Council in partnership with DPI-Fisheries and Hunter Local Land Services
3.02	Develop forward plans in Council's Asset Management Program for upgrade and replacement of Council assets at risk from sea level rise and extreme storm events (e.g. roads, stormwater systems, and river access facilities) by 2025.
Issues addressed	Impact on infrastructure
Lead agency	MidCoast Council
3.03	Work collaboratively with landholders and other stakeholders to develop an adaptation plan to mitigate the long-term (50-100 years) risk of climate change impacts on the floodplain, including management of productivity, coastal wetlands, Acid sulfate soil and blackwater events by 2027.
Issues addressed	Floodplain drainage and ASS
Priority Areas	Manning River floodplain
Lead agency	MidCoast Council in partnership with Hunter LLS, DPI-Fisheries

THEME 4: BIODIVERSITY

Protect and conserve natural character and biological diversity



“I love the wildlife the estuary supports – birds, fish, dolphins, crabs...”

Values consultation participant

3.4 BIODIVERSITY ACTIONS

4.01	Address 1 priority sites and/or re-connect 20 km of fish passage by removing or re-designing barriers identified in the audit by DPI-Fisheries.
Issues addressed	Biodiversity loss
Priority Areas	Priorities in the estuary: barriers on main stem and tributaries of the Manning with proximity to the estuary – e.g. Lansdowne Weir, Warren's Lane.
Lead agency	MidCoast Council in partnership with DPI - Fisheries
4.02	Implement cross-tenure integrated pest and weed control plans to protect priority natural assets within the Manning estuary.
Issues addressed	Biodiversity loss; loss and degradation of riparian vegetation
Lead agency	Hunter Local Land Services (lead) with supporting agencies MCC, NPWS, Forestry Corporation

THEME 5: ABORIGINAL CUSTODIANSHIP

Acknowledge and support Aboriginal peoples' spiritual, social, customary and economic connection to the Manning River Catchment and its Estuary



“Our country is bound by where the leaves touch the water from the mountains to the sea. We rely on the natural flow of the fresh to the salt for rebirth of all species and to keep the system clean.”

Joedie Lawler,
CEO Purfleet-Taree Local Aboriginal Land
Council, Member ECMP Reference Group

3.5 ABORIGINAL CUSTODIANSHIP ACTIONS

5.01	Involve Aboriginal traditional knowledge and personnel in management of the river, catchment and estuary: a) Support the Conservation and Ecosystem Management TAFE course for Aboriginal Rangers by providing guest speakers. b) Build partnerships with Aboriginal Rangers to implement conservation and land management in the Manning catchment. c) Conduct cultural burns on Council land to reduce fuel loads and maintain ecological processes.
Issues addressed	Riparian vegetation loss and degradation; Coastal Wetlands loss and degradation; Biodiversity loss - pests and weeds
Lead agency	MidCoast Council with supporting agencies Hunter Local Land Services, PT LALC, TIDE
5.02	Install interpretive signage and facilitate cultural activities to share the story of the Manning River's significance to Biripi people.
Issues addressed	Stewardship
Lead agency	MidCoast Council with support from PTY LALC
5.03	Involve Aboriginal people in monitoring of the river: a) Engage Aboriginal people including school students and commercial fishers in Waterwatch monitoring. b) Establish a single contact person at Council for the Aboriginal Community to report pollution incidents impacting on estuary health.
Issues addressed	Stormwater and litter; Floodplain drainage and ASS; Agricultural impacts
Lead agency	MidCoast Council with Hunter Local Land Services, PT LALC, TIDE
5.04	Increase involvement of Aboriginal people in the Manning Estuary CMP by appointing two Aboriginal representatives to the Community Reference Group (See Action 8.01) and inviting Council's Aboriginal Community Development Officer to attend meetings.
Issues addressed	Governance
Lead agency	MidCoast Council

THEME 6: SOCIAL AND ECONOMIC VALUES

Manage the Manning River Catchment and its Estuary to maintain and improve social, cultural, and economic opportunities and benefits



“ The river is the lifeblood of our community – we drink from it, eat fish, use it for recreation. The river serves us, and we serve it.”

Cr Len Roberts, co-chair,
Manning River ECMP Reference Group

3.6 SOCIAL AND ECONOMIC VALUES ACTIONS

6.01	Investigate and implement pathogen source control measures as required for high-risk areas in the Coastal Zone.
Issues addressed	Pathogens
Lead agency	MidCoast Council with NSW Food Authority
Priority areas	Proximity to oyster harvest leases, potable water offtakes and aquatic recreation areas.

THEME 7: LAND USE PLANNING

Facilitate ecologically sustainable development and promote sustainable land use planning decision-making



“ We need good planning for development that allows the river space to be a river. Minimise damage by not putting development in harm’s way.”

Kirsty Hughes, Community Representative
and Member ECMP Reference Group

3.7 LAND USE PLANNING ACTIONS

7.01	Provide evidence, undertake landholder consultation and submit a planning proposal recommending amendments to the Coastal Management SEPP to support purchase, rezoning and remediation of coastal wetlands to improve ecosystem services and sequester carbon. See section 11 and Annexure M.
Issues addressed	Coastal Wetlands
Lead agency	MidCoast Council
7.02	Prepare mapping of the Tidal Inundation Coastal Vulnerability Area and undertake stakeholder consultation to inform a future planning proposal recommending amendments to the Coastal Management SEPP.
Issues addressed	Climate Change; Tidal inundation
Lead agency	MidCoast Council
7.03	Use the Risk Based Framework to identify water quality objectives and associated management targets for development within the Manning River Catchment. Develop and include stormwater quality targets in MCC's harmonised LEP and DCP.
Issues addressed	Stormwater; Erosion and Sediment
Lead agency	MidCoast Council

THEME 8: GOVERNANCE

Build stakeholder partnerships for good governance and integrated management



“Look at the whole picture and manage holistically”

Peter Neal, Dairy Farmer,
Member ECMP Reference Group

3.8 GOVERNANCE ACTIONS

8.01	Establish a CMP Working Group to coordinate operational implementation of the Manning Estuary CMP, with representation from all government agencies involved in project delivery.
Issues addressed	Fragmented Governance
Lead agency	MidCoast Council
8.02	Implement a holistic, interagency approach to compliance and regulation focussing on identified CMP risks and issues. a) Promote compliance through community education. b) Develop organisational systems and capacity for proactive compliance. c) Build community capacity to report illegal activities.
Issues addressed	Vegetation loss and degradation; Low and modified flows; Erosion and sediment
Lead agency	MidCoast Council, Crown Lands



3.9 Actions to be implemented by Council or by Public Authorities

Action #	Management Action	Lead agency	Supporting agencies	Impact Score*	SHORT TERM YEAR 1	MEDIUM TERM YEARS 2-5					LONG TERM - YEARS 6-10
					FY23	FY24	FY25	FY26	FY 27	FY28-32	
1.01	Stewardship program	MCC	HLLS, MC2T Landcare, DPI, Community Groups, Schools	93							
1.03	Promote and Facilitate Establishment of Private Conservation Agreements – Land For Wildlife program	MCC	BCT, HLLS, MC2T Landcare	76							
1.04	Develop and implement a Litter and Stormwater Pollution Source Control Program	MCC	Community groups	65							
1.05	Develop and Distribute Education Material and Guidelines for ESC	MCC		46							
1.06	Improve Erosion and Sediment Control	MCC		73							
2.01	Implement Key Priority ASS Management Actions in Coastal Zone	MCC	DPI-Fisheries	106							
2.07	Implement a Systematic Approach to Maintaining SQIDs in the Coastal Zone	MCC		53							
2.08	Review, Revise and Supplement MCC's Current Stormwater Guidance	MCC		44							
2.09	Revise the Greater Taree Urban Stormwater Management Plan	MCC		60							
2.12	Implement Onsite Sewerage Management System Audit and Compliance Strategy in the Coastal Zone	MCC		84							
2.13	MER for Ecosystem Health	MCC		91							
2.14	Scientific research program	MCC	Academic institutions, HLLS								
3.01	Identify Retreat Buffer Zones for Coastal Wetlands and Littoral Rainforest	MCC	DPI-Fisheries, Hunter LLS	102							
3.02	Develop forward plan for Council Assets at Risk from Sea Level Rise and extreme weather events	MCC		45							
3.04	Long Term Adaptation Plan for Manning Floodplain	MCC	HLLS, DPI	122							
4.01	Address Barrier to Fish Passage	MCC	DPI-Fisheries	45							
5.01	Involve Aboriginal Community in Management of the River, Catchment and Estuary	MCC	HLLS, TIDE, PT LALC	87							
5.02	Install Interpretive Signage and Facilitate Cultural Activities	MCC	PT LALC	32							
5.03	Engage Aboriginal People in Water Quality Monitoring	MCC	TIDE, PT LALC	43							
5.04	Involve Aboriginal People in Implementation of the Manning Estuary CMP	MCC	HLLS, TIDE, PT LALC	87							
6.01	Implement Site-Specific Pathogen Source Control measures	MCC	NSW Food Authority	49							
7.01	Submit a Planning Proposal for CM SEPP	MCC		90							
7.02	Prepare Mapping of Coastal Vulnerability Area for Tidal Inundation	MCC		78							
7.03	Identify Water Quality Objectives and Management Targets	MCC		70							
8.01	Establish Multi-Stakeholder Management Committee	MCC		169							

Table 11: Implementation program - actions led by Council

* The Impact Score is provided in place of prioritisation. The higher the score, the more geographically widespread is the impact of the action. It was derived from the Multi-criteria Analysis conducted during the evaluation of management options. Find out more in Section 7, Appendix 4 and Annexure K.

Action #	Management Action	Lead agency	Supporting agencies	Impact Score	SHORT TERM YEAR 1	MEDIUM TERM YEARS 2-5				LONG TERM - YEARS 6-10
					FY23	FY24	FY25	FY26	FY 27	FY28-32
1.02b	Promote Whole Farm Planning and Best Management Practice	HLLS	MCC, MC2T Landcare, DPI, Industry Groups	110						
1.03	Promote and Facilitate Establishment of Private Conservation Agreements	BCT, MCC	MCC, HLLS, MC2T Landcare	76						
2.02	Protect and/or Rehabilitate Coastal Wetlands	HLLS	MCC, DPI-Fisheries, BCT, MC2T Landcare	104						
2.03	Improve Riparian and Estuarine Bank Vegetation in the coastal zone	HLLS	MCC, MC2T Landcare	101						
2.04	Promote good catchment management practice on public land	Crown Lands	MCC, HLLS	32						
2.10	Stabilise 5 km of priority sensitive Estuarine Riverbank Areas	HLLS	MCC, DPI-Fisheries	64						
4.02	Integrated Pest and Weed Control for estuary target species	HLLS	MCC, NPWS, Forestry Corp	76						
8.02	Holistic approach to Compliance Programs	Crown Lands	MCC	71						

Table 12: Implementation program - actions led by other agencies

3.10 Complementary Management Programs

Some of the management options identified during consultation have been included in alternate programs of Council and other agencies, rather than including them in the Manning Estuary CMP Action Program.

Including actions in the CMP introduces a legal obligation to carry through. However, it also provides access to the DPIE Coast and Estuary Grants funding stream, acknowledging this is a competitive process.

Throughout the consultation process, participants took a holistic view of the estuary and its catchment. In total 127 management options were proposed.

During the final series of consultation workshops on management options held in February-March 2021, stakeholders identified 25 management options that either were already being managed by other programs or would be best be delivered through other programs.

Several criteria were used to make these decisions:

- Is the option subject to separate NSW government legislation?
- Is it already managed adequately in an alternate program?
- Is it securely funded under a separate process?

A description of the complementary programs and their Management Actions which will contribute to the objectives of the Manning Estuary CMP are outlined below. These actions will be monitored and reviewed through the CMP's Monitoring, and Evaluation Program, with progress reported through our Reference Group on an annual basis.

3.10.1 Land Use Planning for the Future

Council Team: Land Use Planning Theme: Land Use Planning

Objective 7 of the Manning Estuary CMP is to facilitate ecologically sustainable development and promote sustainable land use planning decision-making. Council is developing a land use plan that will help achieve this and other objectives of the CMP, ensuring future development meets the objects of the Act.

Council's strategic direction for each of the CM Areas, and our land-use strategies to meet the objectives of the Coastal Management Areas under the Act are provided in Table 3. The provision of public infrastructure is an important part of Council's role, ensuring that people can move through our towns safely and encouraging healthy recreational alternatives to the car. Council carefully considers the design and installation of public infrastructure that meets the community's needs in an environmentally sensitive manner, and aligns with the objectives of the Coastal Management SEPP.

Urban development

Development in the region is guided by the Hunter Regional Plan 2036. The Hunter Regional Plan priorities for the Mid Coast region most relevant to the Manning Estuary CMP are to:

- Support the visitor economy by leveraging the natural beauty of the area and enhancing nature-based tourism infrastructure
- Protect productive landscapes that sustain poultry, dairy and beef industries
- Manage development within sensitive water catchments and protect environments that sustain the oyster industry.

The document also includes a specific priority for Taree to “encourage greater utilisation of the Manning River for tourism, recreational and commercial purposes.” These priorities are closely aligned to community aspirations for the Manning Estuary CMP Planning Area, as expressed throughout our consultation.

Future housing and urban renewal opportunities identified in the CMP Planning Area include the *Figtrees* development on the Manning River, a mixed use redevelopment of a previous industrial site along the Manning River that will provide around 500 units and Brimbin New Town to the North of Taree that will accommodate approximately 20,000 people in 8,000 homes.

The MidCoast Urban Land Monitor 2016-2036 was adopted by Council in December 2020. The ULM found that, overall, the entire MidCoast has adequate supply of residential zoned land to meet historic average growth rates until 2036, though additional land supply will be required in coastal settlements to meet demand.

An estimated 800 new lots will be developed at Brimbin (an approved new town north of Taree) by 2036. Cundletown is fully developed from a residential perspective but has 74 ha recently rezoned for a transport hub to capitalise on its location adjacent to the Pacific Highway and between the Taree Regional Airport.

MidCoast Council is currently reviewing land identified in the Mid North Coast Regional Strategy 2006-36 for future urban development that has not yet been rezoned. This review considers 47 previously identified urban release areas, recommending that 10 of these no longer be considered and three new ones be added. Within the Manning this includes two areas at Wingham for residential development; two at Taree for residential and one for a mixed-use outcome; and two at Cundletown for employment uses.

The provision of public infrastructure is an important part of Council's role, ensuring that people can move through our towns safely and encouraging healthy recreational alternatives to the car. Council carefully considers the design and installation of public infrastructure that meets the community's needs in an environmentally sensitive manner.

Redevelopment of foreshore areas such as Chatham in Taree is expected to occur over time and Council plans for associated infrastructure from road upgrades through to footpaths/cycleways, sewer pump stations and so on. An example of this is the “Figtrees on the Manning” development in Taree where \$8.5 m is being spent at time of writing on public infrastructure to support a \$455 m mixed use redevelopment of a former dairy factory site along the Manning River foreshore. A Review of Environmental Factors (REF) under Part 5 of the EP&A Act 1979 was prepared following the completion of detailed designs for a walkway/cycleway over Browns Creek, another bridge over the disused rail corridor, raised boardwalks, concrete footpaths/cycleways, road extensions, intersection upgrades and the

construction of a sewer pump station to cater for the increase in development. The Coastal Management SEPP forms part of assessment of the designs and environmental impacts. The recent revision to the REF template to update and standardise assessment of REFs will ensure consistent application of the SEPP.

The Rural Strategy

Rural and environmental lands cover around 95% of the MidCoast LGA. The development of a draft Rural Strategy is underway and examines rural, environmental and waterway zones. The four goals of the draft Rural Strategy will support the objects of the Coastal Management Act and objectives of the Manning Estuary CMP.

Find out more about the draft Rural Strategy on MidCoast Council's website.

3.10.2 The Manning River Floodplain Risk Management Plan

Council Team: Community Spaces, Recreation and Trades

Theme: Social and Economic Values

As has been discussed in sections 2.3.3 and 2.3.9., the Manning River Floodplain Risk Management Study and Plan 2019 (BMT WBM 2019) is Council's primary planning instrument covering flood, coastal inundation and tidal inundation in the Manning Estuary CMP Planning Area.

The Floodplain Risk Management Study (FRMS) has derived an appropriate plan of measures and strategies to manage present and future flood risk in accordance with the NSW Government Floodplain Development Manual. Development of land within the Flood Planning Area is restricted and controlled by Council due to the hazard of flooding.

The Manning River Floodplain Risk Management Plan 2019 will be benchmarked against the mandatory requirements of the Coastal Management Act and is noted here as the appropriate management approach for flooding.

3.10.3 Recreation Needs Assessment

Council Team: Coastal Flooding and Drainage

Theme: Social and Economic Values

Objective 6 of the Manning Estuary CMP is to improve social, cultural, and economic opportunities and benefits of the estuary and its catchment.

Council is currently undertaking a recreation needs assessment that will help us achieve this objective. The recreation needs assessment will consider community demographics, participation and demand, open space planning and community consultation. Once complete, the recreation needs assessment will be used to develop an Open Space and Recreation Strategy (OSRS) to improve the quality of public space in the MidCoast LGA for wellbeing & economic growth.

Two actions identified through the CMP consultation process will be addressed through the recreation needs analysis and OSRS:

- Explore opportunities to promote reorientation of riverfront towns to face the river and take advantage of the views.
- Develop a strategic mix of family-friendly passive recreational facilities including nature-based experiences that improve access while encouraging understanding and conservation of environmental and Biripi cultural values.

3.10.4 The Barrington Coast Destination Management Plan

Council Team: Community Spaces and Services Theme: Social and Economic Values

Council's Barrington Coast Destination Management Plan (DMS 2017) sets out to achieve the vision that by 2030, MidCoast is renowned as a place where outstanding natural beauty meets vibrant country living, inspiring healthy and active lifestyles.

This Plan includes a range of actions to develop and promote improved visitor recreational access and experiences in the Manning estuary and wider region.

3.10.5 Community Recovery and Resilience Program

The Community Recovery Officer (CRO) is responsible for supporting community recovery after the 2019/2020 bushfires and 2021 floods. The CRO works with the community to identify needs, develop local recovery programs, assist in accessing information and resources and provide leadership and community capacity building.

A key part of recovery from bushfire and floods is to build community capacity to be more resilient and prepared for future disasters. This includes encouraging individuals to complete and maintain individual bushfire, flood and disaster preparedness plans, and working with communities to map community assets and vulnerabilities and develop local recovery plans.



4. Recommended changes to relevant planning controls

Council flagged our intent to submit a planning proposal for amendment of Coastal Wetlands mapping in the *State Environmental Planning Policy (Coastal Management) 2018* (CM SEPP) in the Stage 1 Scoping Study for the CMP. We engaged Locale Consulting to prepare evidence for the planning proposal for the Manning Estuary CMP and Old Bar-Manning Point CMP Planning Areas. Their report is provided in Annexure M: Recommendations and evidence to support a future Planning Proposal to amend the CM SEPP (Locale Consulting 2021). It covers both coastal wetlands and littoral rainforest, noting there is no littoral rainforest in the Manning Estuary CMP Planning Area.

It is Council's intent to wait until fine-scale mapping and analysis has been completed for coastal wetlands across the entire LGA before submitting the planning proposal. The current exercise is therefore a first step in this process. A comprehensive community engagement and consultation program with affected landholders will be undertaken prior to submission of a planning proposal.

As part of MidCoast Council's commitment to the Coastal Management Program, detailed mapping of two of the coastal management areas was undertaken in 2019 - coastal wetlands and littoral rainforests. This finer-scale mapping shows additional areas outside currently mapped areas in the *State Environmental Planning Policy (Coastal Management) 2018*.

The report prepared by Locale Consulting presents the results of a detailed analysis of the mapping and justification for the mapped areas in the *State Environmental Planning Policy (Coastal Management) 2018* to be updated, via the Planning Proposal process.

The mapping analysis gave detailed consideration to the following:

- Existing *State Environmental Planning Policy (Coastal Management) 2018* mapping
- Definition of coastal wetlands and littoral rainforest
- Confidence in mapping methodology
- Condition of coastal wetlands and littoral rainforest

The technical mapping analysis identified an additional 317.97 hectares comprising 112 wetlands in the Manning River catchment, noting these generally include parts of lots. Of the areas identified as coastal wetlands 123 lots (284.98 hectares) of private property are included.

The environmental protection of these areas will have positive value to the broader community (being consistent with both the MidCoast Local Strategic Planning Statement and Community Strategic Plan) and will contribute to priorities under the Coastal Management Program.

Much of the land to which the mapping applies has already been identified as having high conservation biodiversity value and as such represents "endangered ecological communities" under the *Biodiversity Conservation Act 2016*. Biodiversity values of coastal wetlands are further protected under MidCoast Council's respective Local Environmental

Plans, *Fisheries Management Act 1994*, *Water Management Act 2000* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Ensuring that the locations of the coastal wetlands are correctly mapped under the policy that provides high level planning controls (i.e. *State Environmental Planning Policy (Coastal Management) 2018*) will help to protect them in their natural state, including their biological diversity and ecosystem integrity. In turn, this will promote the rehabilitation and restoration of degraded parts of these important coastal management areas. This is consistent with the management objectives of the *Coastal Management Act 2016*, the *Marine Estate Management Act* and the NSW Government's NSW Wetland Policy's principles for management and conservation.

The Greater Taree Local Environment Plan is aligned to the NSW Government's Standard Instrument—Principal Local Environmental Plan (2006 EPI 155a). It states that “exempt or complying development must not be carried out on any environmentally sensitive area for exempt or complying development.” For the purposes of this clause environmentally sensitive areas for exempt or complying development include “land within the coastal wetlands and littoral rainforests area within the meaning of the Coastal Management Act 2016.”

If the CM SEPP is amended following Council's proposal, this clause will remain appropriate as per the Standard Instrument. It will be carried across into the consolidated MidCoast LEP when this document is developed.

Supporting Documents:

The full report including maps can be downloaded from
www.midcoast.nsw.gov.au/ourmanningriver

- Annexure M: Recommendations and evidence to support a future Planning Proposal to amend the CM SEPP – Coastal Wetlands (Locale Consulting 2021)

5. Business Plan

This Business Plan was prepared to meet the mandatory requirements of the Coastal Management Manual. It outlines the key components of the funding strategy, including the cost of proposed actions, proposed cost-sharing arrangements and funding mechanisms.

The Business Plan is presented as follows:

Section 9.1 discusses the overarching funding environment for coastal management actions, the uncertainty of funding streams and the key funding sources that will be utilised.

Section 9.2 summarises the key considerations that have governed scheduling and funding decisions.

Section 9.3 discusses the issue of benefits and beneficiaries from this CMP.

Section 9.4 contains the business plan schedules.

The Business Plan was first developed for the Manning River ECMP and has been amended to reflect changes in the extracted CMP including removal of those catchment actions outside the Coastal Zone.

5.1 Key funding sources and the funding environment

5.1.1 Funding Environment

According to the Coastal Management Manual (Part B), *"the CMP should contain sufficient information to stand alone as a framework for sustainable management of the coastal zone for the coming 10 years."* The manual also calls for CMPs to be reviewed every ten years. For this reason, a ten-year business plan has been presented. However, there is an important caveat.

MidCoast Council has a dedicated Environmental Levy that raises income for environmental projects. These funds are not sufficient to address the entire range of environmental issues faced by our LGA, which covers an area of 10,053 km². The Manning Estuary CMP is just one of a suite of strategic plans and operational programs to protect our natural assets. An annual funding allocation for the CMP has been estimated, allowing the remaining funds in the Environmental Levy to be directed to other needs. These needs and Council's priorities may change over time, and our financial contribution will be subject to review and adoption through the annual budget process.

Council gets the best from the Environmental Levy by leveraging these funds to attract co-investment, frequently from grant programs such as the NSW Coast and Estuary Grants, NSW Environmental Trust and federal programs. Grant programs are contestable, and the likelihood of success can be affected by:

- Demand for the program
- The rules surrounding the matching funding required can change from year to year

- Variability in the pool of available funding, depending on other demands on public funds
- Changes in policy and legislation that see funds re-directed to new priorities, which in the longer term (5-10 years) may be unforeseen
- Competing interests from across the state.

Future funding from grants, including both state and federal government sources, is therefore uncertain in the medium and long term.

This variability is also a factor for Council's project partners such as Hunter Local Lands services, whose funding pool depends on state allocations (for example from the Marine Estate Management Strategy).

This means that while the Manning Estuary CMP budget shown below has been estimated for 10-years, there is considerable uncertainty over time. Council's ability to implement the CMP will depend on successfully obtaining matching funds at the ratio of 2:1 DPIE:MCC as allowed under the current Coast and Estuary grants. Similarly, it will depend on our project partners being able to secure sufficient funds to meet the budget estimates provided, and their willingness and ability to continue contributing to the Manning Estuary CMP at the estimated rates.

If funding allocations change, the program will be scaled back in response to budget constraints.

As has been mentioned in section 7, actions have been included in the CMP in good faith that the funds shown will be secured. Our project team will take advantage of any funding opportunities that become available in the future, even if a present funding pathway is uncertain. Novel funding mechanisms are also being explored, such as a Blue Impact Bond under development in partnership with the Nature Conservancy and HSBC Bank.

The key funding sources are outlined below. A more detailed discussion of funding options and responsibilities is provided in Appendix 7.

5.1.2 MidCoast Council

MidCoast Council presently has an income of approximately \$270M per annum with around 60% coming from general rates. Council commonly uses rates revenue to leverage additional funding from external grant programs.

Rate revenue includes an environmental rate which raises approximately \$4M per year. This funds the Natural Systems team which will administer the Manning Estuary CMP and is the primary funding mechanism for delivery of actions in the program.

A total annual contribution of approximately \$250,000 per annum has been allocated from the environmental rate for either direct expenditure or as a contribution to leverage grant funding sources.

Council also charges a Stormwater Levy, raising approximately \$850,000 annually to deliver projects that address local flooding and improve stormwater quality across the whole LGA. A portion of Stormwater Levy funds will be applied to actions to improve stormwater management in the Manning Estuary CMP.

Several Management Actions will be delivered in-house by Council personnel using existing resources. These do not require additional funds and have been marked with an * in schedule 9.4.1.

5.1.3 Hunter LLS and the Marine Estate Management Strategy

Hunter Local Land Services presently administers substantial funds arising from delivery of the Marine Estate Management Strategy to cover works associated with riparian repair, bank erosion protection and to improve the quality of drainage from roads and tracks.

Hunter LLS manages additional funding sources including:

- The National Landcare Program
- The Catchment Action NSW Program

A portion of funds from each of these programs will be allocated to implementation of the Manning Estuary CMP.

Hunter LLS generally secures funding on an annual basis. Allocations may vary depending on changes in policy and priorities both within Hunter LLS and their funding agencies. Hunter LLS funds committed to the Manning Estuary CMP are therefore subject to variation. It is understood that changes in funding may affect the ability to achieve program targets.

5.1.4 Coast and Estuary Grants

There are two broad streams of *coast and estuary grant* funding provided by the Department of Planning Industry and Environment: the planning stream and the implementation stream. Generally, the grants program funds on a 2:1 (State :Local) ratio but cannot be used for the following:

- Maintenance of funded projects
- Projects eligible for funding under natural disaster relief
- Amenity works (car parking, footpaths, seating, shelters and lighting etc.)
- Projects within freshwater environments unless they are shown to significantly improve estuary health
- Variations exceeding +30% of the original amount requested.

5.1.5 Other Sources

Other potential funding sources for some actions include:

- Floodplain Management Grant Funding from DPIE (presently funding on a 2:1, State : Local)

- NSW Environmental Trust: Environmental Education, Environmental Research and Restoration and Rehabilitation grants administered by DPIE (funding ratio is variable, success more likely with some contribution)
- DPI Fisheries: Habitat Action Grants (1:1 funding available for projects up to \$40,000). DPI Flagship Fish Habitat Rehabilitation Grants (supports works including hydrological and environmental investigations and on-ground works, a maximum of \$400,000 with projects running for up to two years)
- MIDO *Boating Now* Program: For the case of studies into boating, works would require 1:1 funding. To be successful, works would typically need to be of primary benefit to navigation
- Novel funding mechanisms such as a proposed Blue Impact Bond being developed by The Nature Conservancy in partnership with HSBC and MidCoast Council.

5.2 Considerations

The timing of actions in the Business Plan is based on the following considerations:

- **Prioritisation:** A prioritisation score, representative of efficiency or utility for dollars spent was derived based on a multi-criteria analyses, the scale of expected impact and estimated cost. These were used to guide the sequencing of actions within the program. Exceptions to this general rule were made where funding was known to have already been allocated for proposed management actions
- **Sequencing:** The reliance of one action upon completion of another was considered and actions ordered accordingly
- **Available funding:** The expected annual budget from different sources was researched and total expenditure from those sources was limited to those estimates. Available funds or “cash flow” will have a strong influence on how quickly the full program of actions can be rolled out.

The business plan contains a detailed schedule for the first 5 years. After 5 years, a review of the CMP will be undertaken to revisit likely funding sources and recalibrate some actions. This is due to:

1. the uncertainty surrounding the funding environment (see Section 9.4)
2. the uncertainty around several actions, which will be guided by the results of studies and plans still under development.

5.3 Cost Benefit Distribution (Public/Private)

All CMP management actions have been designed to have a public benefit. Multicriteria analysis of the management actions (Appendix 3) shows that the focal Coastal Management Areas are the *Coastal Wetland* and *Coastal Environment Areas*. Where actions don't have “Environmental Benefit” as their primary focus, they deliver social and economic public benefits. Where benefits accrue to a particular group, this group is a significant part of the Manning community (e.g., Farming community, Aboriginal groups) and the benefits are often multi-faceted and can be seen to contribute more broadly to society and the local economy.

Examples of the beneficiaries for actions in the Manning Estuary CMP include:

- Residents and visitors
- The tourism sector
- Primary producers
- Recreational users
- Landholders
- Land Management Agencies

Based on these considerations, all actions can be justifiably funded from public sources (Local, State and Federal Government).

Some actions will occur on both private land (e.g. coastal wetland and riparian vegetation restoration). Such actions have a private cost (e.g. loss of pasture for production) and a public benefit (e.g. improved biodiversity and mitigation of diffuse source run-off). Environmental works on private land will be undertaken on a voluntary basis subject to a landholder agreement. A cost sharing basis of 1:1 will be sought from the landholder, along with a maintenance agreement to ensure the public benefit is sustained.

5.4 Budget Schedules

5.4.1 Funding Schedule

MA#	Management Action	Total Capital Expenses	Total Annual Operating Expenses	Total MCC contribution (10 years)	Total HLLS contribution (10 years)	Total DPE contribution (10 years)	Total budget (10 years)
MA_1.01	Develop and Deliver an Engagement Program	\$ -	\$ 490,000	\$ 150,000	\$ 40,000	\$ 300,000	\$ 490,000
MA_1.02	Promote Whole Farm Planning and NRM for farmers	\$ -	\$ 85,000	\$ 15,000	\$ 40,000	\$ 30,000	\$ 85,000
MA_1.03	Promote and Facilitate Establishment of Private Conservation Agreements	\$ -	\$ 50,000	\$ 50,000	\$ -	\$ -	\$ 50,000
MA_1.04	Develop a Litter and Stormwater Pollution Source Control Program	\$ -	\$ 400,000	\$ 133,332	\$ -	\$ 266,668	\$ 400,000
MA_1.05	Develop and Distribute Education Material and Guidelines for ESC on Private Land	\$ -	\$ 5,000	\$ 5,000	\$ -	\$ -	\$ 5,000
MA_1.06	Improve Erosion and Sediment Control for Council and Developers	\$ -	\$ 300,000	\$ 100,000	\$ -	\$ 200,000	\$ 300,000
MA_2.01	Implement Key Priority ASS Management Actions in the coastal zone	\$ 2,100,000	\$ 630,000	\$ 910,000	\$ -	\$ 1,820,000	\$ 2,730,000
MA_2.02	Protect and/or Rehabilitate Coastal Wetlands	\$ -	\$ 438,000	\$ 120,000	\$ 78,000	\$ 240,000	\$ 438,000
MA_2.03	Improve Riparian and Estuarine Bank Vegetation in the coastal zone	\$ -	\$ 1,803,000	\$ 401,000	\$ 300,000	\$ 1,102,000	\$ 1,803,000
MA_2.04	Promote Good Catchment Management Practice on Public Land*	\$ -	0	\$ -	\$ -	\$ -	\$ -
MA_2.07	Implement a Systematic Approach to Maintaining SQIDs in the coastal zone	\$ 500,000	\$ 450,000	\$ 616,667	\$ -	\$ 333,333	\$ 950,000
MA_2.08	Review, Revise and Supplement MCC's Current Stormwater Guidance	\$ -	\$ 50,000	\$ 16,667	\$ -	\$ 33,333	\$ 50,000
MA_2.09	Revise the Greater Taree Urban Stormwater Management Plan	\$ -	\$ 250,000	\$ 83,334	\$ -	\$ 166,666	\$ 250,000
MA_2.10	Implement Stabilisation of Sensitive Estuarine Riverbank Areas	\$ 600,000	0	\$ -	\$ 600,000	\$ -	\$ 600,000
MA_2.12	Implement OSSM Audit and Compliance Program*	\$ -	0	\$ -	\$ -	\$ -	\$ -
MA_2.13	MER for Ecosystem Health	\$ -	\$ 1,681,000	\$ 560,332	\$ -	\$ 1,120,668	\$ 1,681,000
MA_2.14	Implement a Scientific Research Program	\$ -	\$ 150,000	\$ 50,000	\$ -	\$ 100,000	\$ 150,000
MA_3.01	Forward Plan to Retain Retreat Zones for Coastal Wetlands	\$ -	\$ 60,000	\$ 20,000	\$ -	\$ 40,000	\$ 60,000
MA_3.02	Forward Plans for Council Assets at Risk from Sea Level Rise	\$ -	\$ 50,000	\$ 50,000	\$ -	\$ 100,000	\$ 150,000
MA_3.03	Long Term Adaptation Plan for Manning Floodplain in Collaboration with Landowners	\$ -	\$ 69,000	\$ 69,000	\$ -	\$ -	\$ 69,000
MA_4.01	Remediate Barrier to Fish Passage	\$ 60,000	0	\$ 20,000	\$ -	\$ 40,000	\$ 60,000
MA_4.02	Integrated Pest and Weed Control Plans for Local Priorities	\$ -	\$ 120,000	\$ 40,000	\$ -	\$ 80,000	\$ 120,000
MA_5.01	Involve Aboriginal Community in Management of the Estuary	\$ -	\$ 150,000	\$ 50,000	\$ -	\$ 100,000	\$ 150,000
MA_5.02	Install Interpretive Signage and Facilitate Cultural Activities	\$ 52,500	0	\$ 17,500	\$ -	\$ 35,000	\$ 52,500
MA_5.03	Engage Aboriginal People in Water Quality Monitoring**	\$ -	0	\$ -	\$ -	\$ -	\$ -
MA_5.04	Appoint Two Aboriginal Members to the Reference Group*	\$ -	0	\$ -	\$ -	\$ -	\$ -
MA_6.01	Implement Site-Specific Pathogen Source Control measures	\$ -	\$ 60,000	\$ 20,000	\$ -	\$ 40,000	\$ 60,000
MA_7.01	Submit a Planning Proposal for CM SEPP	\$ -	\$ 50,000	\$ 16,667	\$ -	\$ 33,333	\$ 50,000
MA_7.02	Prepare Mapping of Coastal Vulnerability Area for Tidal Inundation	\$ -	\$ 100,000	\$ 33,333	\$ -	\$ 66,667	\$ 100,000
MA_7.03	Identify Water Quality Objectives and Management Targets	\$ -	\$ 100,000	\$ 33,333	\$ -	\$ 66,667	\$ 100,000
MA_8.01	Establish Multi-Stakeholder Management Committee*	\$ -	0	\$ -	\$ -	\$ -	\$ -
MA_8.02	Holistic approach to Compliance Programs*	\$ -	0	\$ -	\$ -	\$ -	\$ -
		\$ 3,312,500	\$ 7,641,000	\$ 3,581,165	\$ 1,058,000	\$ 6,314,335	\$ 10,953,500

* Items with zero cost represent an in-kind contribution using staff time within existing allocations

** Funded through engagement program - RiverWatch

5.4.2 Annual budget

	Management Option	Funding and Delivery Program																			TOTAL
		2022/2023			2023/2024			2024/2025			2025/2026			2026/2027			Mid 2027 onwards				
		\$ MCC	\$ HLLS	\$ DPE (C&E)	\$ MCC	\$ HLLS	\$ DPE (C&E)	\$ MCC	\$ HLLS	\$ DPE (C&E)	\$ MCC	\$ HLLS	\$ DPE (C&E)	\$ MCC	\$ HLLS	\$ DPE (C&E)	\$ MCC	\$ HLLS	\$ DPE (C&E)		
MA_1.01	Develop and Deliver an Engagement Program	15,000	5,000	30,000	15,000	5,000	30,000	15,000	5,000	30,000	15,000	5,000	30,000	15,000	5,000	30,000	75,000	15,000	150,000	490,000	
MA_1.02	Promote Whole Farm Planning and NRM	0	0	0	15,000	10,000	30,000	0	10,000	0		10,000	0	0	10,000	0	0	0	0	85,000	
MA_1.03	Establishment of Private Conservation Agreements	5,000	0	0	5,000	0	0	5,000	0	0	5,000	0	0	5,000	0	0	25,000	0		50,000	
MA_1.04	Litter and Stormwater Pollution Source Control	13,333	0	26,667	13,333	0	26,667	13,333	0	26,667	13,333	0	26,667	13,333	0	26,667	66,667	0	133,333	400,000	
MA_1.05	Education Guidelines for ESC on Private Land	0	0	0	0	0	0	5,000	0	0	0	0	0	0	0	0	0	0	0	5,000	
MA_1.06	Improve ESC for Council and Developers	10,000	0	20,000	10,000	0	20,000	10,000	0	20,000	10,000	0	20,000	10,000	0	20,000	50,000	0	100,000	300,000	
MA_2.01	Priority ASS Management Actions in the coastal zone	0	0	0	350,000	0	700,000	175,000	0	350,000	175,000		350,000	35,000		70,000	175,000		350,000	2,730,000	
MA_2.02	Protect and/or Rehabilitate Coastal Wetlands	12,000	13,000	24,000	12,000	13,000	24,000	12,000	13,000	24,000	12,000	13,000	24,000	12,000	13,000	24,000	60,000	13,000	120,000	438,000	
MA_2.03	Riparian and Estuarine Bank Vegetation in coastal zone	130,333	50,000	260,667	87,000	50,000	174,000	43,667	50,000	87,333	20,000	50,000	40,000	20,000	50,000	40,000	100,000	50,000	500,000	1,803,000	
MA_2.04	Good Catchment Management Practice on Public Land*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
MA_2.07	Systematic Approach to Maintaining SQIDs coastal zone	40,000	0	0	40,000	0	0	90,000	0	0	540,000	0	0	40,000	0	0	200,000	0		950,000	
MA_2.08	Revise MCC’s Current Stormwater Guidance	0	0	0	0	0	0	16,667	0	33,333	0	0	0	0	0	0	0	0	0	50,000	
MA_2.09	Revise Greater Taree Stormwater Management Plan	0	0	0	41,667	0	83,333	41,667	0	83,333	0	0	0	0	0	0	0	0	0	250,000	
MA_2.10	Stabilisation of Sensitive Estuarine Riverbank Areas	0	100,000	0	0	100,000	0	0	100,000	0	0	100,000	0	0	100,000	0	0	100,000		600,000	
MA_2.12	Implement OSSM Audit and Compliance Program*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
MA_2.13	MER for Ecosystem Health	98,733	0	197,467	45,733	0	91,467	45,733	0	91,467	45,733	0	91,467	45,733	0	91,467	278,667	0	557,333	1,681,000	
MA_2.14	Implement a Scientific Research Program	5,000	0	10,000	5,000	0	10,000	5,000	0	10,000	5,000	0	10,000	5,000	0	10,000	25,000	0	50,000	150,000	
MA_3.01	Forward Plan for Coastal Wetlands Retreat Zones	0	0	0	0	0	0	20,000	0	40000	0	0	0	0	0	0	0	0	0	60,000	
MA_3.02	Forward Plans for Council Assets at Risk from Sea Level Rise	0	0	0	0	0	0	50,000	0	100,000	0	0	0	0	0	0	0	0	0	150,000	
MA_3.03	Long Term Adaptation Plan for Manning Floodplain	0	0	0	0	0	0	23,000	0		23,000	0	0	23,000	0	0	0	0	0	69,000	
MA_4.01	Address Barrier to Fish Passage	0	0	0	0	0	0	20,000	0	40,000	0	0	0	0	0	0	0	0	0	60,000	
MA_4.02	Integrated Pest and Weed Control Plans for Local Priorities	0	0	0	40,000	0	80,000		0		0	0	0	0	0	0	0	0	0	120,000	
MA_5.01	Involve Aboriginal Community in Management of Estuary	5,000	0	10,000	5,000	0	10,000	5,000	0	10,000	5,000	0	10,000	5,000	0	10,000	25,000	0	50,000	150,000	
MA_5.02	Install Interpretive Signage and Facilitate Cultural Activities	0	0	0	0	0	0	17,500	0	35,000	0	0	0	0	0	0	0	0	0	52,500	
MA_5.03	Engage Aboriginal People Water Quality Monitoring**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
MA_5.04	Two Aboriginal Members to the ECMP Reference Group*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
MA_6.01	Site-Specific Pathogen Source Control measures	0	0	0	0	0	0	6,667	0	13,333	0	0	0	0	0	0	13,333	0	26,667	60,000	
MA_7.01	Submit a Planning Proposal for CM SEPP	0	0	0	0	0	0	0	0	0	0	0	0	16,667	0	33,333	0	0	0	50,000	
MA_7.02	Mapping of Coastal Vulnerability Area for Tidal Inundation	0	0	0	0	0	0	0	0	0	33,333	0	66,667	0	0	0	0	0	0	100,000	
MA_7.03	Identify Water Quality Objectives and Management Targets	0	0	0	0	0	0	33,333	0	66,667	0	0	0	0	0	0	0	0	0	100,000	
MA_8.01	Establish Multi-Stakeholder Management Committee*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
MA_8.02	Holistic approach to Compliance Programs*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		\$ 4,400	\$ 168,000	\$ 578,800	\$ 684,733	\$ 178,000	\$ 1,279,467	\$ 653,567	\$ 178,000	\$1,061,133	\$ 902,400	\$ 178,000	\$ 668,800	\$ 245,734	\$ 178,000	\$ 355,466	\$ 1,093,667	\$ 178,000	\$ 2,037,333	\$ 10,953,500	

* Items with zero cost represent an in-kind contribution using staff time within existing allocations
** Funded through engagement program - RiverWatch

5.4.3 Total Budget Schedule

Financial Year	Source of funding			TOTAL
	\$ MCC	\$ HLLS	\$ DPE (C&E)	
FY23	\$ 334,400	\$ 168,000	\$ 578,800	\$ 1,081,200
FY24	\$ 684,733	\$ 178,000	\$ 1,279,467	\$ 2,142,200
FY25	\$ 653,567	\$ 178,000	\$ 1,061,133	\$ 1,892,700
FY26	\$ 902,400	\$ 178,000	\$ 668,800	\$ 1,749,200
FY27	\$ 245,734	\$ 178,000	\$ 355,466	\$ 779,200
Yrs 6-10	\$ 1,093,667	\$ 178,000	\$ 2,037,333	\$ 3,309,000
	\$ 3,914,500	\$ 1,058,000	\$ 5,981,000	\$ 10,953,500



6. Coastal Zone Emergency Sub-Plan

Under the mandatory requirements of the Coastal Management Act, a coastal management program must have an emergency sub-plan if the LGA contains land within the coastal vulnerability area and beach erosion, coastal inundation or cliff instability is occurring on that land.

The MidCoast Council Local Emergency Management Plan (EMPLAN) contains SES Flood Emergency Sub Plans for the Former Greater Taree, Great Lakes and Gloucester LGA areas. These Plans have been prepared in accordance with the provisions of the State Emergency Service Act 1989 (NSW) and are authorised by the MidCoast Council Local Emergency Management Committee in accordance with the provisions of the State Emergency and Rescue Management Act 1989 (NSW).

The Greater Taree and Great Lakes Local Flood Plans also cover arrangements for the management of coastal erosion in the council area. In addition to these Flood Plans there is a NSW State Storm Plan as well as a NSW State Tsunami Plan which describe the risk to the community, outline roles and responsibilities for the NSW SES and supporting agencies and set out how the SES as the relevant combat agency will manage these events.

These Plans along with the EMPLAN provide appropriate multi agency emergency response and planning measures to manage such weather events.

7. Monitoring, Evaluation and Reporting Program

Monitoring, evaluation and reporting (MER) is vital to assess implementation of the Action Program and progress against our targets and objectives. Council has added a fourth step – improvement. The purpose and steps in the MER program are shown in Figure 27 below.

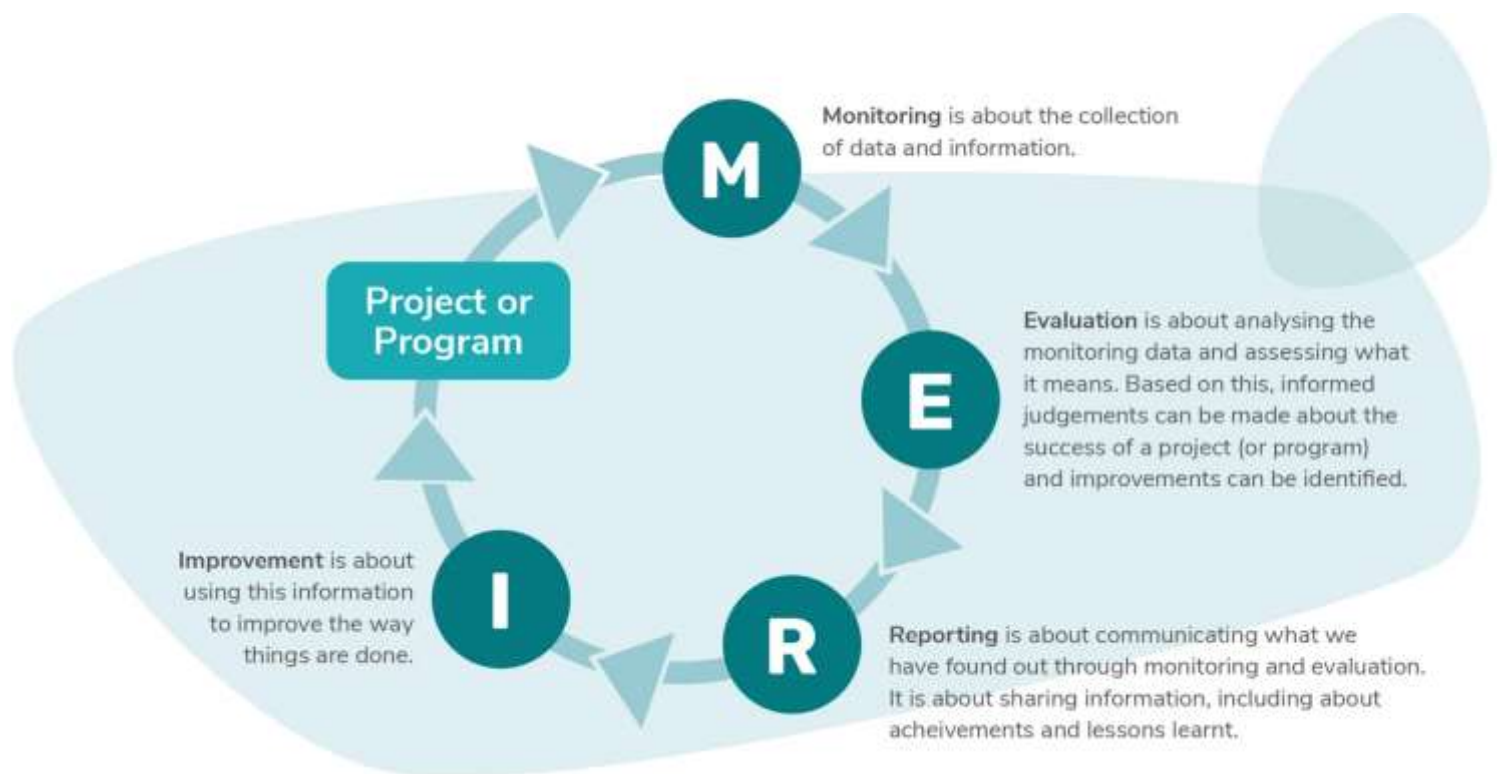


Figure 21: Steps in the MER Program

7.1 MER for the Manning Estuary

MidCoast Council will implement a broadscale environmental monitoring, evaluation, and reporting (MER) program to support the management objectives of the CMP.

The MER Program will provide a high-level assessment of environmental quality to ensure the values in Section 2 are maintained across the Manning River estuary and catchment. Implementing the MER Program will assist Council and our stakeholders to establish a baseline of data characterising water quality including ecological health. Continued long-term monitoring will enable us to detect changes (positive or negative) in water quality over time. Analysing the data will aid decision-making and adaptive management, helping us to improve the program and achieve our objectives. The MER Program constitutes the science program defined in the CMP Program Logic Model (see Section 3.4).

7.1.1 Principles

The MER Plan adopts the following Principles:

- **Uses SMART Objectives** – Specific, Measurable, Achievable, Realistic, Time-bound
- **Relies on an agreed program logic** – robust methodology to ensure outcomes can be effectively measured
- **Uses Best Practice** - current best practice and scientific knowledge and multiple (environmental indicator) lines of evidence
- **Adopts a risk-based approach** – assists MidCoast Council to prioritise monitoring of ecological responses and stressors that pose the highest risk to ecological health
- **Emphasises collaboration** – builds on existing programs to improve efficiency and reduce duplication in effort
- **Transparent reporting** – offers open access to information
- **Adaptive Management** – adopts a systematic approach to improving natural resource management by learning from management outcomes and making changes to improve the ecological response and reduce stressors
- **Values cultural knowledge** – recognises the importance of cultural knowledge holders in increasing understanding of the condition and health of the Manning River estuary and catchment and the influence environmental change may have on physical and non-physical elements of cultural heritage
- **Values local knowledge** – recognises the value of local knowledge in understanding and interpreting scientific results about the health and condition of the Manning River estuary and catchment
- **Values citizen science** – recognises the role of citizen science programs in filling knowledge gaps and increasing understanding of the condition and health of the Manning River estuary and catchment.

7.1.2 Approach

Council's approach to development of the MER Program for the Manning River estuary and catchment included the following steps:

- **Examining current understanding** - to inform decisions at subsequent steps, MidCoast Council developed conceptual models of how the Manning River estuary and catchment waterway systems work, the issues they face and how to manage them
- **Defining community values and management objectives** - community values and more specific management goals (including level of protection) were defined for the Manning River estuary and catchment at stakeholder involvement workshops (refer to Section 2)
- **Defining relevant indicators** - indicators were selected for relevant pressures identified for the system, the associated stressors and the anticipated ecosystem receptors
- **Determining water quality guideline values** - MidCoast Council determined the water quality guideline values for each of the relevant indicators required to provide the desired level of protection to meet the management goals of the Manning River estuary and catchment
- **Implement management strategy** - MidCoast Council developed this MER Program to document its approach to achieving the water quality objectives and the environmental monitoring programs for implementation.

This approach was based on the principles and guidelines of the National Water Quality Management Strategy (NWQMS 2018), with regard to the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018). The focus of the approach is on maintaining existing water quality, identifying where management and/or remediation actions may be required and measuring the effectiveness of these actions.

The water quality management framework adopted in the MER Program is shown in Figure 28.

MERI programs to be implemented for the Manning River estuary and catchment are summarised in Table 13.

The full MER Program for water quality and ecosystem health is provided at Annexure L: Manning River ECMP Monitoring, Evaluation, Reporting and Improvement Program – Water Quality (MCC 2021).

7.1.3 Evaluation and Continual Improvement

The MER Program will be continuously reviewed to:

- **Assess if water quality objectives are met** - Use measurements from monitoring of each relevant indicator to assess whether water quality meets the water quality objectives
- **Consider additional indicators or refine water quality objectives** - Assess the need to revise or add to the lines of evidence or indicators and the water quality guideline values
- **Consider alternative management strategies** - Evaluate the effectiveness of current management strategies to address the identified water quality issues and recommend possible improvements. Improved or alternative management strategies are formulated, assessed and prioritised
- **Assess if water quality objectives are achievable** - Use information gained to assess whether the water quality objectives are achievable.

The project team will use adaptive management to improve on-ground management decisions in order to meet the water quality objectives of the Manning Estuary CMP. Adaptive management allows Council and stakeholders to adjust our approach in response to current climatic conditions, new information and local knowledge.

7.1.4 Reporting

MidCoast Council is committed to open access to information. The results of implementing the MER Plan for the Manning River estuary and catchment will be reported to the Community Reference Group and community through established engagement methods (e.g. Water Quality Report Card, Creek to Coast newsletters).

Supporting Documents:

Further information can be downloaded from www.midcoast.nsw.gov.au/ourmanningriver

- Annexure L: Manning River ECMP Monitoring, Evaluation, Reporting and Improvement Program – Water Quality (MCC 2021)



Photo: Water quality monitoring will guide adaptive management

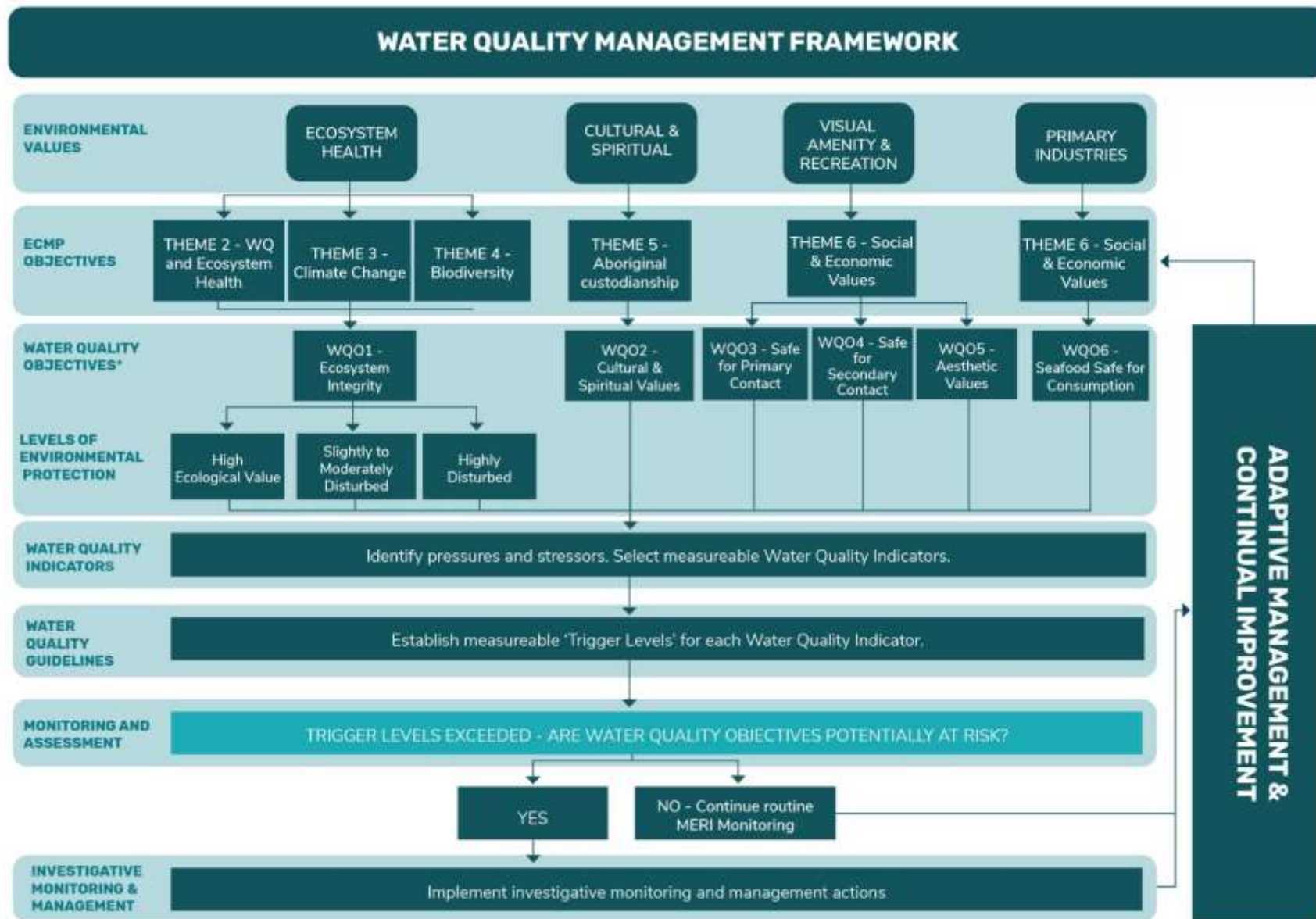


Figure 22: Water Quality Management Framework for the Manning River Estuary and Catchment

7.1.5 Summary of the MER Programs to be implemented for the Manning River Estuary

Environmental Monitoring Program	Environmental Value	CMP Objective	Environmental Issue	The 'Why' – Questions driving the monitoring program	Indicators	Triggers/Thresholds*	Monitoring Frequency
Estuary Ecological Health Report Card Monitoring	Ecosystem Health	Theme 2: Water Quality and Ecosystem Health Theme 4: Biodiversity	Erosion and sedimentation Urban stormwater quality Litter, plastics and marine debris Floodplain drainage and ASS Biodiversity loss Agricultural Impacts	- What is the ecological health of the Manning River estuary? - How does the condition of the Manning River estuary compare to past conditions? - Is the environmental value 'ecosystem health' being maintained? - Does the condition of the estuarine reaches of the Manning River change following the implementation of the CMP?	Turbidity Chlorophyll-a Seagrass depth range	A requirement for further investigation will be triggered if: - there is a decline in the overall grade at any site, - there is a decline in the score (for turbidity or chlorophyll-a) within a grade, and/or - poor grades are recorded for the stressors at a site. Investigation will be stepwise and include analysis of climatic conditions, the stressor data, potential pressures (through catchment investigations) followed by more detailed sampling and spatial analysis to determine the location and nature of the impact that could be contributing to the change in grade and score.	Annually
Riparian Health Report Card Monitoring	Ecosystem Health	Theme 2: Water Quality and Ecosystem Health Theme 4: Biodiversity	Erosion and sedimentation Agricultural Impacts Biodiversity loss Loss and degradation of riparian vegetation	- What is the ecological condition of the riparian zone in the estuary and high risk subcatchments (Figure 14)? - Is the ecosystem health of riparian zones in the estuary and high risk subcatchments being maintained over time? - Does the ecosystem health of riparian zones in the estuary and high risk subcatchments following implementation of the CMP?	Turbidity Chlorophyll-a Macroinvertebrates Riparian condition Reach condition	A requirement for further investigation will be triggered if: - there is a decline in the overall grade at any site, - there is a decline in the score (for macroinvertebrates, chlorophyll-a, riparian condition and/or geomorphic condition) within a grade, and/or - poor grades are recorded for the stressors at a site. Investigation will be stepwise and include analysis of climatic conditions, the stressor data, potential pressures (through catchment investigations) followed by more detailed sampling and spatial analysis to determine the location and nature of the impact that could be contributing to the poor score on the stressor data or change in grade and score.	Twice in 10 years: base-line and program completion
Freshwater Water Quality Monitoring	Ecosystem Health	Theme 2: Water Quality and Ecosystem Health Theme 4: Biodiversity	Erosion and sedimentation Agricultural Impacts Low and modified flow	- What are the baseline water quality levels for high risk subcatchments within the freshwater reaches of the Manning River catchment? - How does the water quality at high risk subcatchments in the freshwater reaches of the Manning River catchment compare to past measurements? - How is water quality in the freshwater reaches of the Manning River catchment affected by climate (rainfall, drought, climate change)?	Turbidity Chlorophyll-a Salinity Nutrients	Water quality trigger levels are the default guideline values (ANZG 2018) for slightly to moderately disturbed systems.	Quarterly
Acid Sulfate Runoff Monitoring	Ecosystem Health	Theme 2: Water Quality and Ecosystem Health	Floodplain drainage and ASS	- What is the quality of the water draining off the Big Swamp floodplain into the Lower Manning estuary? - Is the rehabilitation of the Big Swamp floodplain influencing the water quality draining into the Lower Manning estuary?	pH Dissolved oxygen Electrical conductivity Temperature	Water quality trigger levels are the default guideline values (ANZG 2018) for slightly to moderately disturbed systems.	Annually
Climate Change Baseline Monitoring	Ecosystem Health	Theme 3: Climate Change	Climate Change	- How is climate change affecting waterway conditions - salinity, temperature and tidal influence in the Manning River estuary? - Does salt intrusion become more prevalent over time at different locations along the Manning River as a result of climate change?	Water level Salinity Temperature (measured at depth and at the surface)	Not applicable - data for this program is being collected to understand climate change impacts in this locality.	Annually

Environmental Monitoring Program	Environmental Value	CMP Objective	Environmental Issue	The 'Why' – Questions driving the monitoring program	Indicators	Triggers/Thresholds*	Monitoring Frequency
Stormwater Gross Pollutant Trap Monitoring	Ecosystem Health Visual Amenity & Recreation	Theme 2: Water Quality and Ecosystem Health Theme 5: Social and Economic Values	Urban stormwater quality Litter, plastics and marine debris	- What is the condition of the gross pollutant traps in the Manning River estuary and catchment? - Are the gross pollutant traps in the Manning River estuary and catchment being maintained to MidCoast Council standards? - When is the optimum time to clean out the gross pollutant traps?	Measured pollution as a percentage of sump volume	Measured gross pollutant traps pollution volume is >80% sump volume.	Bi-monthly
Citizen Science Monitoring – Waterwatch	Ecosystem Health Visual Amenity & Recreation	Theme 2: Water Quality and Ecosystem Health Theme 5: Social and Economic Values	Erosion and sedimentation Litter, plastics and marine debris Agricultural Impacts	What is the condition of water quality at Waterwatch sites in the Manning River estuary and catchment and do these change over time?	Macroinvertebrates Turbidity Oil/Debris/Wrack	Water quality trigger levels are the default guideline values (ANZG 2018) for slightly to moderately disturbed systems.	Ad Hoc by community volunteers
Water Quality Monitoring – Recreational Use (Human Health)	Visual Amenity & Recreation	Theme 5: Social and Economic Values	Pathogens	- Is the water quality in the Manning River estuary and catchment safe for primary contact recreation (e.g. swimming)? - Is the water quality in the Manning River estuary and catchment safe for secondary contact recreation (e.g. fishing and boating)?	Faecal Coliform	Water quality trigger levels are the default guideline values (NHMRC 2008) for recreational use.	Varies depending on purpose (e.g. weekly, bi-monthly, event based)
Event Based Monitoring	Ecosystem Health	Theme 2: Water Quality and Ecosystem Health Theme 3: Climate Change Theme 4: Biodiversity	Erosion and sedimentation Urban stormwater quality Litter, plastics and marine debris Agricultural Impacts Flood, coastal & tidal inundation Biodiversity loss Floodplain drainage and ASS	<u>Ecosystem Health</u> - How does the ecological health of the Manning River estuary respond to flood conditions, fire or drought? - How long does it take for the estuary to return to baseline conditions? <u>Estuary hydrodynamics</u> - How far does the tide extend into the Manning River estuary under normal conditions and following moderate to major floods? - How quickly does the flood wave propagate downstream following moderate to major floods? - How does data collected during floods correlate with flood modelling results? - Does opening Farquhar affect water levels of the estuary?	Indicators differ depending on the type of event (e.g. flood, bushfire, drought) and the waterway responses MidCoast Council seeks to monitor (e.g. pH for acid events)	Not applicable - data for this program is being collected to understand the impact of major flooding, fire or drought events on estuary health and hydrodynamics.	Coincides with extreme weather events

Table 13: Summary of MER programs for the Manning Estuary CMP

* The trigger values for different indicators of water quality may be given as a threshold value or as a range of desirable values (DEC, 2006).

7.2 MER for the CMP Action Program

The purpose of the component of the Monitoring, Evaluation, Reporting and Improvement Program is to clearly set out the project measures, targets, monitoring and reporting protocols for the CMP's activities and outcomes. The plan ensures that the process for monitoring progress and achievements is defined. This will support accountability of achievements and an adaptive management approach. This component of the MER Program will be reported on, reviewed and updated (where necessary) annually, with a five-year review to re-set targets for the final tranche of the CMP program.

Monitoring and reporting our progress against the action will involve two levels:

1. Monitoring and reporting on results to the Community Reference Group on an annual basis
2. Monitoring and reporting on results through Council's IP&R Framework.

For Reference Group reporting, a set of standard project measures and data collection methods will be used across all activities to monitor outputs as shown in Table 14 below.

We will track the progress of each action against its targets using the template in Table 15, Appendix 8. This will be collated throughout the year and reported to the Reference Group on an annual basis. The results will inform an annual review to consider project success, barriers and improvements.

For the IP&R reporting, we will have a single item in Council's Delivery Program and Operating Plan for implementation of the Manning Estuary CMP, led by the Natural Systems Team. The tracking used above will be converted to an annual percentage completion score against our targets and reported quarterly.



Project measures	How will data be collected?	When will data be collected?	Who is responsible?
Number of education resources produced	Maintain register of all materials produced	Add item to register on completion	MCC CMP lead
Number of engagement events	Record date, location, theme, presenters for all engagement events	After each event	MCC CMP lead
Number of individuals engaged	Complete a participation registration sheet for all events	At each event	MCC CMP lead
Changes in knowledge, skills, commitment and practice	- Distribute a survey for participants to complete at the end of each engagement event - Analyse survey results and prepare an evaluation report	Annually, end financial year	MCC CMP lead
Water Quality and Ecosystem Health MER Program	See WQ and Ecosystem Health MER Program	See WQ and Ecosystem Health MER Program	MCC CMP lead
Ha/linear m/km/sites remediated	All project areas mapped in a GIS layer	After each project is completed	MCC CMP lead
Plans/studies/reports complete	Maintain register of all plans/studies/reports produced	Add item to register on completion	MCC CMP lead
Number of organisations involved	Maintain register of all organisations involved	Add organisation to register as appropriate	MCC CMP

Table 14: Standard measures and data collection

10-year outcome	Performance indicator
Improved land management practices reduce pressures on ecosystem health and resilience	Total area of land and water covered by conservation actions including remediation works, conservation agreements, restored fish passage
The community adopts sustainable behaviours and best practice for land and water management	- Number of individuals engaged - Percentage of post-event survey participants who report a positive change in knowledge, skills and commitment to behaviours
CMP is implemented with strong partnerships between responsible agencies	- Number of organisations involved - Number of Community Reference Group meetings

Table 15: Performance indicators for the 10-year outcomes

7.3 The Manning Estuary CMP Research Program

MidCoast Council and our partners at Hunter Local Land Services have a long history of co-funding and supporting scientific research in partnership with academic institutions. Such research may be conducted by honours, masters or PhD candidates or scientists co-funded through research grants. Research results support evidence-based decision-making to ensure our projects are effective.

During development of the Manning River ECMP, numerous knowledge gaps were identified, which will inform the development of research projects during the life of this program. These can be found in the Manning River ECMP Issue Analysis Report 2021.

Those research projects relating specifically to the Coastal Zone Planning Area for the Manning Estuary CMP have been brought forward into this document.

Table 15 overleaf outlines a recommended research program to be completed over the ten-year course of the Manning Estuary CMP.

S1	Undertake a bathymetric survey combined with hydrodynamic and water quality monitoring at key locations within the lower catchment/estuary and develop a baseline condition hydrodynamic and water quality model for all future research and planning.
Details	Previous studies were completed in 1998 and 1999. A present-day estuary bathymetry survey and a comprehensive field monitoring campaign covering different seasons is called for. The intention is to establish and validate a three-dimensional numerical hydrodynamic model and an accompanying water quality model for the lower catchment and estuary. The models will assist with investigating how the estuary may change over time and under climate projection scenarios, different configurations of training walls, and/or changed entrance conditions, as well as different levels of nutrients and sediments entering the river system. For instance, it is possible that the salt wedge may begin affecting the potable water offtake upstream of the present tidal limit; conditions for such a change may be assessed using the validated model outcomes.
S2	Model sediment inputs to the estuary from significant sources across the catchment to prioritise management actions.
	A sediment input modelling study is used to characterise the rates, nature and relative contributions of different sources of sediment to overall sediment pollution in the River. By ranking the importance of different sources of sediment, funding can be more strategically directed during a future revision of the CMP. The study would consider sources such as agricultural land uses, urban stormwater runoff, streambank erosion, forestry, and unsealed roads.
S4	Complete an oral history study on the ecology of the Manning River Fishery
Details	This action is intended to deepen our understanding of the ecology of the Manning River Estuary, how it has changed over time and the important role it plays in the livelihoods of the people that rely on it. This research project will capture oral histories from local fishermen, oyster growers and first nations people and the stories collected will inform stewardship actions 1.02 and 5.02. The information captured will also be used to inform prioritisation of actions outlined in the CMP and identify areas for future research and investigation.

Table 15: Recommended research program

8. Maps

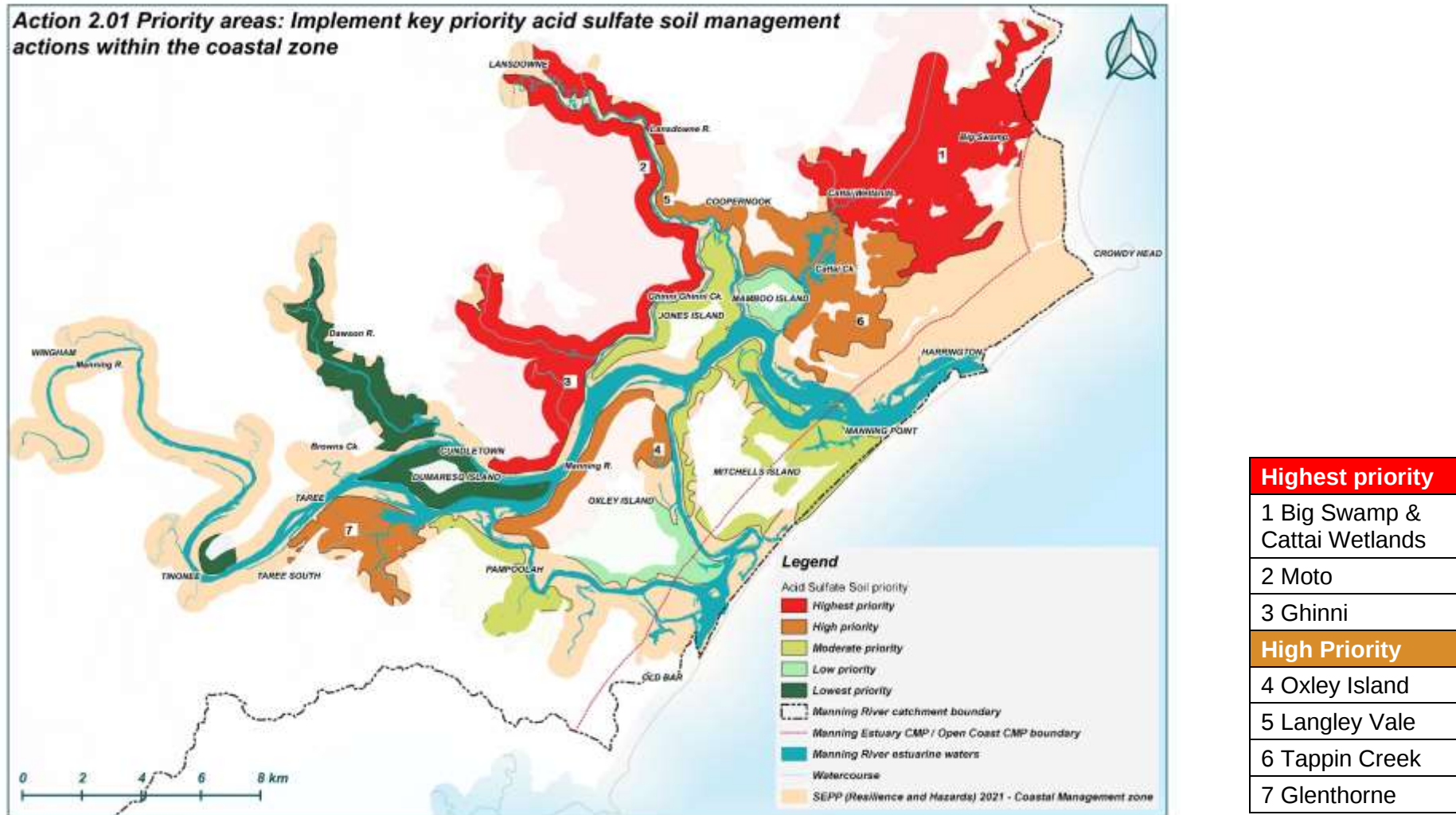


Figure 23: Action 2.01 Priority Area Map - Acid Sulfate Soil Management (from Rayner et. al. 2021)

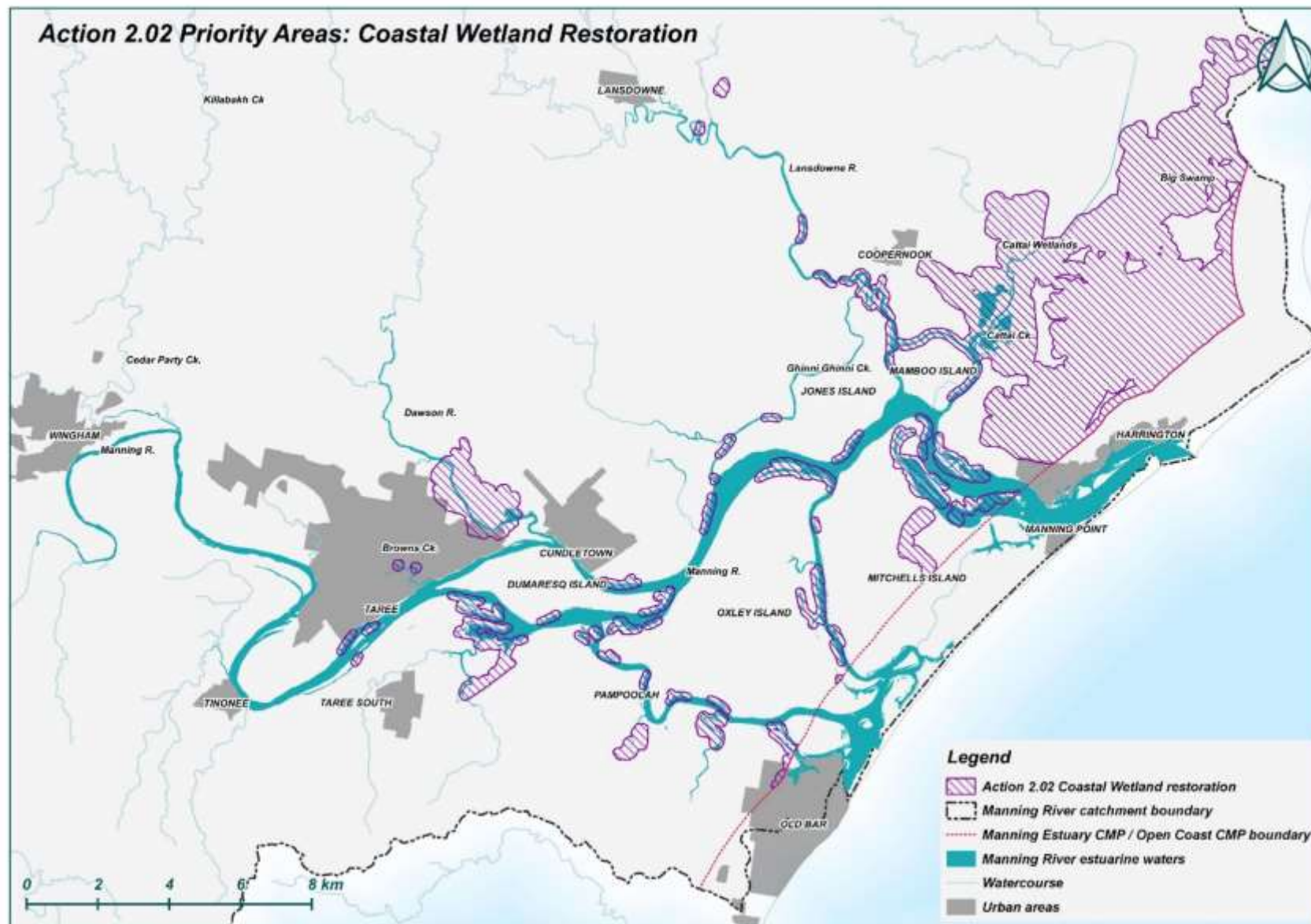


Figure 24: Action 2.02 Priority Area Map - Coastal Wetland Restoration

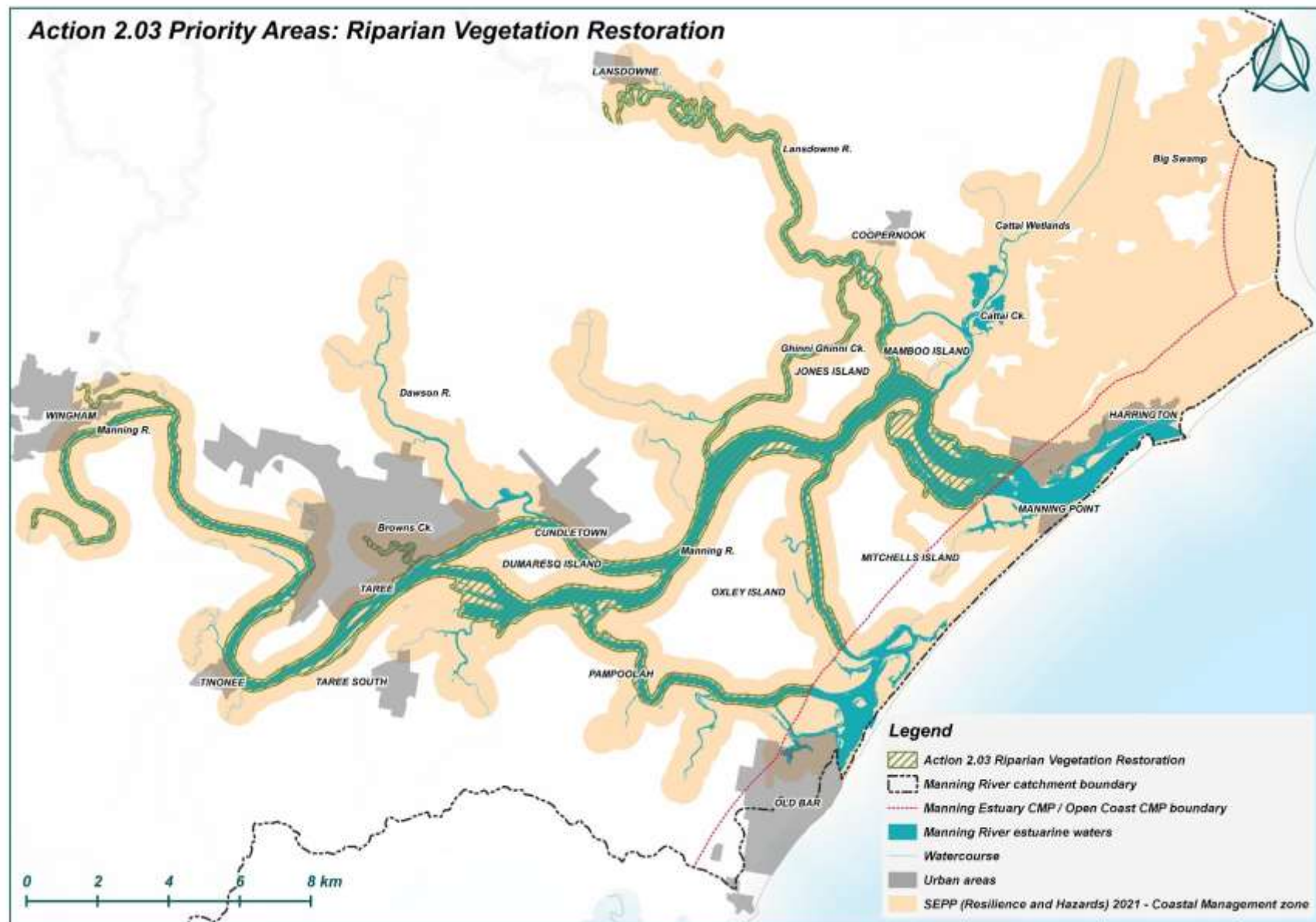


Figure 25: Action 2.03 Priority Area Map - riparian vegetation restoration

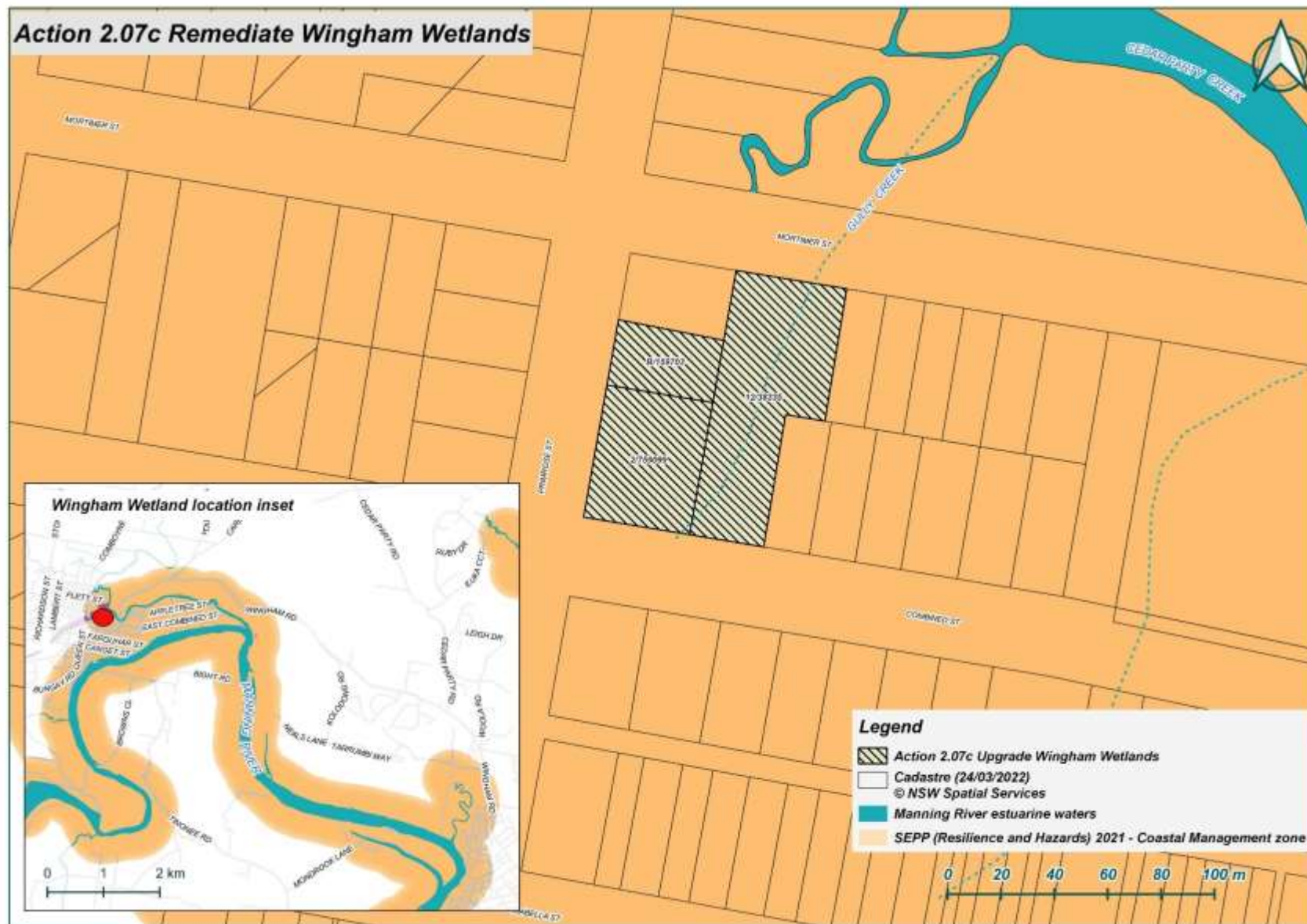


Figure 26: Map of Action 2.07c Remediate Wingham Wetlands

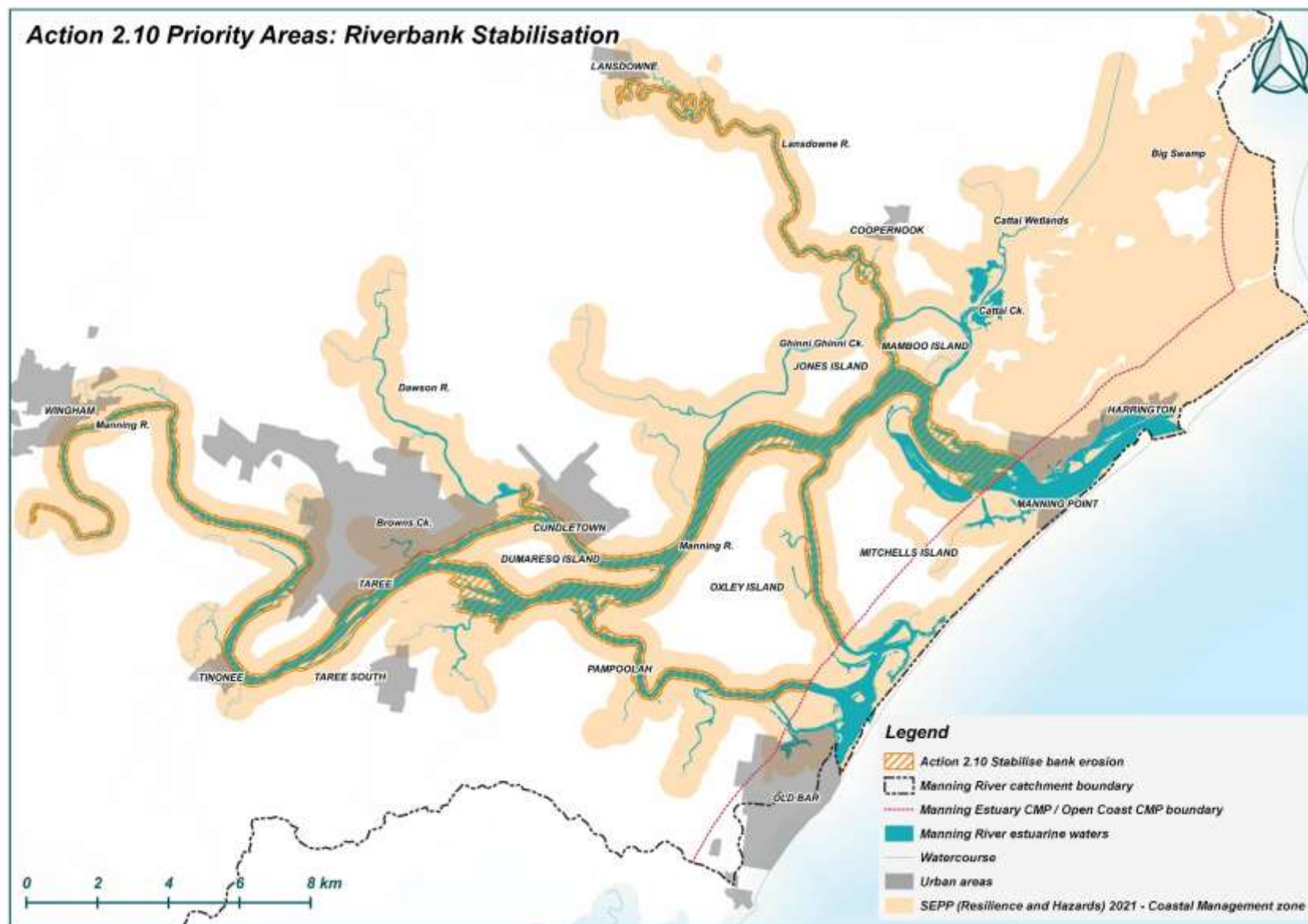


Figure 27: Action 2.10 Priority Area Map - bank stabilisation

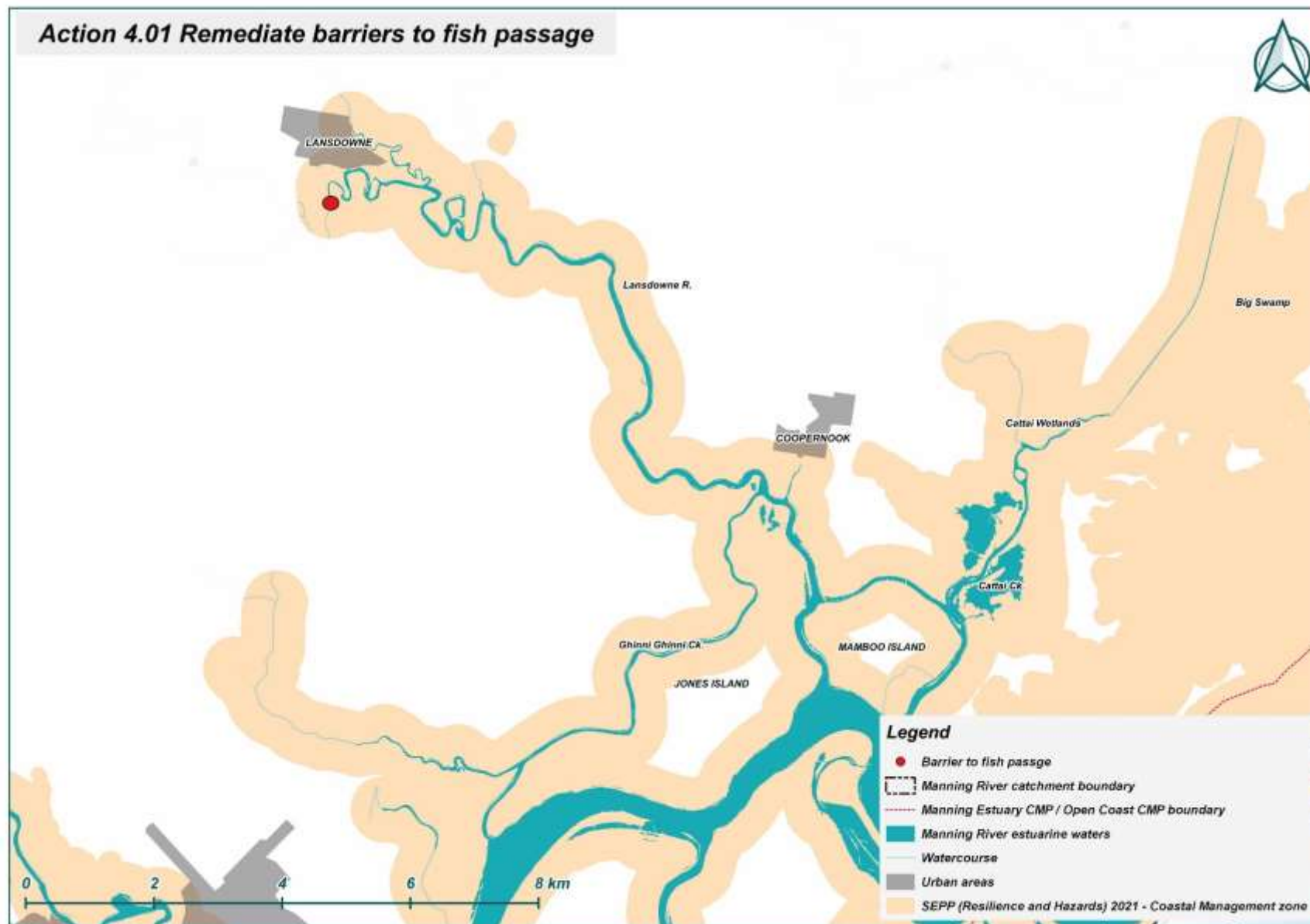


Figure 28: Action 4.01 Priority Area Map – remediate barrier to fish passage

9. Conclusion

The Manning estuary is important for oyster-growing, fishing, tourism and recreation. Our community values the beautiful scenery, the cool places to swim and relax, and aquatic wildlife. All these uses depend on a healthy ecosystem and clean water.

Some of the issues we need to manage are lack of stewardship, climate change, loss of coastal wetlands and riparian vegetation, floodplain drainage, Acid Sulfate Soils, and agricultural impacts.

By working with our community and partner organisations to implement the Manning Estuary CMP, MidCoast Council will lead a 10-year action program to address these issues.

Together we will manage the estuary holistically and respond to a changing climate - safeguarding environmental, social, cultural and economic values.

10. Reference List

- Australian Bureau of Meteorology BOM. (2020). Atlas of Groundwater Dependent Ecosystems. Retrieved 6/7/2020 from <http://www.bom.gov.au/water/groundwater/gde/map.shtml>
- ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at: www.waterquality.gov.au/anz-guidelines
- Ball, J., Babister, M., Nathan, R., Weinmann, P., Weeks, W., Retallick, M., Testoni, I., 2019. Australian Rainfall and Runoff-A guide to flood estimation.
- Betteridge L. and Rabbidge T. (2016) Water Sharing Plan for the Lower North Coast Unregulated and Alluvial Water, NSW Office of Water
- Bishop, K. (2016). *Studies on the Manning River NSW*. Retrieved from Living, growing data on our rivers: <https://keithabishop.wixsite.com/living-growing-data/manning-river-nsw>
- BMT WBM, 2016. Manning River Flood Study (Final Report). Greater Taree City Council.
- BMT (2017). New South Wales Marine Estate Threat and Risk Assessment Report Final Report. NSW Marine Estate Management Authority.
- BMT (2019). Manning River Floodplain Risk Management Study and Plan. MidCoast Council.
- Bullock, N. (2019). Understanding the motivators and challenges for farmland and water management in the Manning Valley. MidCoast Council.
- Commonwealth of Australia (2006). Australia's National Programme of Action for the Protection of the Marine Environment from Land-Based Activities, Case Study 24 -Great Lakes.
- Commonwealth of Australia (2013). Monitoring, Evaluation, Reporting and Improvement Strategy – Caring for our Country and the Biodiversity Fund. Australian Government.
- Commonwealth of Australia (2017-18). *Australia State of the Environment – Groundwater Resources*. Retrieved 6/6/2020 from <https://soe.environment.gov.au/theme/inland-water/topic/2016/groundwater-resources>
- Department of Environment and Conservation NSW 2006, Local planning for healthy waterways using the NSW Water Quality Objectives, Sydney
- Department For International Development (DFID). 2009. Guidance on using the revised logical framework.
- Destination Marketing Store (DMS). (2017).The MidCoast Destination Management Plan (2017). MidCoast Council.
- DPIE 2020. NSW Department of Planning, Industry and Environment, The NSW Monitoring, Evaluation and Reporting Program, Sydney. Available at: [NSW Water Management Monitoring, Evaluation and Reporting Framework](#)

Ecological (2019). *Manning River Coastal Wetland Mapping*. MidCoast Council.

Environment Protection Authority EPA (2000), Water Quality and River Flow Objectives Interim Environmental Objectives, NSW Environment Protection Authority, Sydney

Geoscience Australia (undated). Groundwater Dependent Ecosystems Retrieved 7/6/2020 from <http://www.ga.gov.au/scientific-topics/water/groundwater/understanding-groundwater-resources/groundwater-dependant-ecosystems>

Glamore, W.C., Ruprecht, J. E. & Rayner, D.S. (2016) *Lower Manning River Drainage Remediation Action Plan* [Report], Technical Report 2016/01, August 2016, Water Research Laboratory, University of NSW.

Global Water Partnership Technical Advisory Committee (GWP TAC) (2000) *Integrated Water Resources Management. TAC Background Paper No. 4*. Stockholm, GWP.

Hanslow, D.J., Morris, B.D., Foulsham, E., Kinsela, M.A., 2018. A regional scale approach to assessing current and potential future exposure to tidal inundation in different types of estuaries. *Sci. Rep.* 8, 1–13.

Howell, T. and Creese, B. (2004). Freshwater fish communities of the Hunter, Manning, Karuah and Macquarie-Tuggerah catchments: a 2004 status report. Industry & Investment NSW.

International Association for Public Participation IAP2. (2018). *Public Participation Spectrum*. Retrieved 7/6/2020 from <https://www.iap2.org.au/resources/spectrum/>

Intergovernmental Panel on Climate Change IPCC, (2013). *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Intergovernmental Panel on Climate Change IPCC, (2022). *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Available at Climate Change <https://www.ipcc.ch/report/ar6/wg2/>

Jonsch-Clausen, T. & Fugl, J. (2001), Firming up the Conceptual Basis of Integrated Water Resources Management, *Water Resources Development* 17(4):501-510.

McIntosh, B.S. & Taylor, A. (2013). Developing T-shaped water professionals: reflections on a framework for building capacity for innovation through collaboration, learning and leadership, *Water Policy* 15:42-60.

McKeown and Associates (1997). *Manning Riverbank Management Study*.

MidCoast Council MCC (2018). *Scoping Study – Manning River Estuary Coastal Management Program*, available at www.midcoast.nsw.gov.au/ourmanningriver

MidCoast Council (2018) *Catchment and Waterways Report Card 2017* [Report] MidCoast Council, Forster.

MidCoast Council (2018) *MidCoast Regional Economic development Strategy 2018-2022*. MidCoast Council, Forster.

MidCoast Council MCC (2019). *Manning River Estuary Community Values Study*. MidCoast Council.

MidCoast Council. (2020), Manning River Estuary Coastal Management Program Community Values Study.

MidCoast Council (2020). Technical Report - Waterway and Catchment Report Card.

NHMRC, 2008. Australian Government 2008, *Guidelines for Managing Risks in Recreational Water*, National Health and Medical Research Council, Canberra.

NSW Government (undated). *Inputs into the NSW Rivers Condition Index*. Retrieved 7/6/2020 from <https://www.industry.nsw.gov.au/water/science/surface-water/monitoring/river-health/inputs-river-condition-index>

NSW Government (2009). Water Sharing Plan for the Lower North Coast Unregulated and Alluvial Water Sources. NSW Government.

NSW Government. (2016). *WSP for Lower North Coast unregulated and alluvial water sources: Background document 2016*. Retrieved 7/6/2020 from https://www.industry.nsw.gov.au/data/assets/pdf_file/0004/166855/lower-nth-coast-unreg-alluvial-background.pdf

NSW Government (2017). Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-Use Planning Decisions.

NSW Government (2018a) *Coastal Management Manual*. NSW Government.

NSW Government (2018b) Guidelines for community and stakeholder engagement in coastal management. NSW Government.

NSW Government. (2020) Marine Estate Management Act 2014 No 72

NWQMS 2018. Australian Government 2018, Charter: National Water Quality Management Strategy, Department of Agriculture and Water Resources, Canberra.

NSW Office of Environment and Heritage 2016, Assessing estuary ecosystem health: Sampling, data analysis and reporting protocols NSW Natural Resources Monitoring, Evaluation and Reporting Program, Office of Environment and Heritage NSW, Sydney – [Assessing estuary ecosystem health: Sampling, data analysis and reporting protocols \(nsw.gov.au\)](https://www.nsw.gov.au/assessing-estuary-ecosystem-health-sampling-data-analysis-and-reporting-protocols)

OEH, 2018. NSW Estuary Tidal Inundation Exposure Assessment. Office of Environment and Heritage.

Our Rivers Our History (OROH). (2015). *The Manning River*. Website published by Arts NSW, Museums and Galleries NSW and Arts Midnorth Coast. Retrieved 7 June 2020 from <http://www.oroh.com.au/our-rivers/manning-river/>

Pietsch, T. J., Daley, J. S., Stout, J., & Brooks, A. (2019). *Riparian and Shoreline Vegetation in the Manning, Great Lakes and Karuah Catchments: Report to the Hunter Local Land Services*. Griffith University .

Rayner, D. S., Ruprecht, J. E., Harrison, A. J., Tucker, T. A., Lumiatti, G., Rahman, P.F. & Glamore, W. C. 2021 (draft). Manning River Floodplain Prioritisation Study WRL TR 2020/09. Water Research laboratory, University of New South Wales.

Roper T, Creese B, Scanes P, Stephens K, Williams R, Dela-Cruz J, Coade G, Coates B and Fraser M (2011), Assessing the Condition of Estuaries and Coastal Lake Ecosystems in NSW: Technical Report – NSW State of the Catchments 2010, Department of Environment, Climate Change and Water NSW, Sydney –
www.environment.nsw.gov.au/resources/soc/20110717EstuariesTRS.pdf

Roy, P. S; Williams, R. J; Jones, A. R; Yassini, I; et al. (2001). "Structure and Function of South-east Australian Estuaries". *Estuarine, Coastal and Shelf Science*. 53: 351–384. doi:10.1006/ecss.2001.0796

Saphere Group (2018). MidCoast Regional Economic Development Strategy 2018-2022

Swanson, R. (2020a). *Manning River Estuary and Catchment Spatial Risk Assessment*. NSW Department of Planning, Industry and Environment.

Swanson, R. (2020b). *Manning River Estuary and Catchment Rapid Site Assessment*. NSW Department of Planning, Industry and Environment.

Thom, B. (2018). Coastal reforms in NSW – the next stage. *Australian Coastal Society blog* posted 5 April 2018, retrieved 31 May 2020 from <https://australiancoastalsociety.org/blog/2018/april/05/coastal-reforms-in-new-south-wales-the-next-stage>

Thom, B. (2015). Minister Stokes and the NSW Coast. *Australian Coastal Society blog* posted 22 December 2015, retrieved 31 May 2020 from <https://australiancoastalsociety.org/blog/2015/december/22/minister-stokes-and-the-nsw-coast/>

Worley Parsons (2009). *Manning River Estuary Management Study*. Greater Taree Council.

Worley Parsons (2010). Farquhar Inlet, Old Bar Entrance Opening Management Plan. Prepared for Greater Taree City Council and the Coastline Management Committee.

World Fish Migration Foundation. (2020). *The Living Planet Index for migratory freshwater fish - technical report*. World Fish Migration Foundation.

11. Appendices

Appendix 1: The project team

MidCoast Council

Project Lead	Louise Duff, Catchment Coordinator
Contributors	Prue Tucker, Water Quality & Estuary Management Coordinator
Belinda Kennewell	Environmental Officer
Erin Masters	Environmental Officer
Karen Bettink	Catchment Officer
Alisha Madsen	Catchment Officer

Consultants

Salients Pty Ltd	Dr. David Wainwright
Locale Consulting	Katrina Burbidge, Cinnamon Dunsford, Alison Martin, Fiona Dawson

Sub-consultants

Centre for International Economics	Nigel Rajaratnam
University of Newcastle	Troy Gaston
Alluvium Consulting	Mark Wainwright

Appendix 2: Stakeholders consulted for this plan

The Public Participation Spectrum



The Public Participation Spectrum

(Reference: International Association of Public Participation Australasia 2018)

(Reference: International Association of Public Participation Australasia 2018)

Members of the Manning River ECMP Reference Group

Name	Sector represented	Agency, community interest groups represented
Cr. Katheryn Smith	Co-Chair	MidCoast Council
Cr. Len Roberts	Co-Chair	MidCoast Council
Peter Bignell	Beef	
Sam Nicholson	Dairy	Mid-Coast Dairy Advancement Group; MidCoast Young Dairy Network
Peter Neal	Dairy	Manning delta Advisory Group/North Oxley Island Drainage Union/MCC Flood Plain Committee
Peter Longworth	Beef	Manning Delta Landholders Group/Taree West Fishing Club
Dr. John Harris	Fisheries	Recreational fishing representative
Chris Scott	Landcare	Manning Landcare

Ian Crisp	Oysters	Manning River Oyster Farmer's Association
Tony Wales	Community	Manning Coastcare
Kirsty Hughes	Community	
Noel Piercy	Community	
Geoff LeMessurier	Public Authority	Hunter Local Land Services – MEMS Program
Andre Uljee	Public Authority	Transport for NSW – Maritime
Neil Kelleher	Public Authority	Department of Planning, Industry and Environment (DPIE)
Josh Chivers	Public Authority	DPIE – NPWS
Joedie Lawler	Purfleet-Taree Local Aboriginal Land Council	Biripi Traditional Owners

Members of the Technical Advisory Group

Name	Agency
Brian Hughes	Hunter Local Land Services (HUNTER LLS)
Catherine Knight	DPIE - Crown Lands
Neil Kelleher	DPIE – Coast and Estuary Program
Josh Chivers	DPIE – NPWS
Gerard Tuckerman	MCC
Lisa Andersons	MCC
Judy Arusanilai	MCC
Peter Scanes	DPIE
Rebecca Swanson	DPIE -
Scott Carter	DPI - Fisheries
Will Glamore	UNSW – Water Research Lab

Delivery partners consulted – MidCoast Council

Name	Position title	Team
Dan Aldridge	Manager Community Spaces, Recreation and Trades	Community Spaces, Recreation and Trades
Mat Bell	Senior Ecologist	Natural Systems
Karen Bettink	Catchment Officer – Ecosystem Management	Natural Systems
David Bowland	Environmental Scientist Sustainability	Water Services
Robyn Brennan	Economic Development Coordinator	Growth, Economic Development & Tourism
Sharon Bultitude	Destination Management Coordinator	Community Spaces and Services
Nicholas Colman	Environmental Projects Officer	Natural Systems
Tanya Cross	Sustainability and Natural Assets Coordinator	Natural Systems
Thomas Doyle	Senior Coastal and Flooding Engineer	Natural Systems
Peter Hatton	GIS Technician	Information and Communication Systems
Malcolm Hunter	Senior Environmental Health Officer – Projects and Policy	Building and Environmental Health Services
Ryan Fenning	Coordinator Environmental Health and Food Safety	Building and Environmental Health Services
Peter Goonan	Environmental Officer – Projects	Natural Systems
Becky Hunter	Compliance Officer	Regulatory Services
Belinda Kennewell	Environmental Officer	Natural Systems
Harry Lloyd	Graduate Planner	Strategic Planning
Aaron Kelly	Strategic Planner	Strategic Planning
Alexandra Macvean	Senior Land Use Planner	Strategic Planning
Alisha Madsen	Catchment Officer	Natural Systems
Anthony Marchment	Environmental Officer – Natural Assets	Natural Systems

Erin Masters	Environmental Officer – Education and Engagement	Natural Systems
Bob McDonnell	Environmental Officer	Natural Systems
Gary Mead	Manager Building and Environmental Health Services	Building and Environmental Health Services
Drew Morris	Catchment Officer	Natural Systems
Scott Nicholson	Manager Transport Assets	Engineering
Richard Pamplin	Principal Land Use Planner	Planning and Natural Systems
Brock Simpson	Recreation Officer	Parks and Recreation Services
Andrew Staniland	Coastal Management Coordinator	Natural Systems
Prue Tucker	Water Quality & Estuary Management Program Coordinator	Natural Systems
Deb Tuckerman	Manager Growth, Economic Development and Tourism	Growth, Economic Development & Tourism
Gerard Tuckerman	Manager Natural Systems and Acting Manager Land Use Planning	Natural Systems and Strategic Planning
Adam Turville	Asset Planning Coordinator	Water Services
Evan Vale	Team Leader Coastal, Flooding and Drainage	Transport Assets

Other agencies and academic institutions consulted

Agency	Name
Department of Primary Industries - Fisheries	Kylie Russell
DPIE - Water and Science Group	Claire Evans
DPIE – Threatened Species program	Andrew Steed
Griffith University	Tim Pietsch
Hunter Local Land Services	Kirby Byrne, Rye Gollan, Reegan Walker, Jesse Gollan, Albert Mullen, Toby Whaleboat
MidCoast-2-Tops Landcare	Jessica Leck, Lyn Booth

NSW Food Authority	Anthony Zammit
Taree Indigenous development and Employment	Chris Sheed
Transport for NSW - MIDO	Kevin Morton ().
University of Technology Sydney	Shauna Murray and Matt Tesorario
University of NSW Water Research Laboratory	Brad Henderson

Appendix 3: Multi-criteria analysis of Management Actions

Our consultant Dr David Wainwright also undertook a multi-criteria analysis of the Management Actions, in consultation with the two project leads from Council's Natural Systems team. Each management option was scored against each object of the CM Act, the objectives for each Coastal Management Area from the CM Act, and the objects of the Marine Estate Management Act 2014.

This is presented in full in Annexure K Appendix D, with results for the final management actions provided in Table 16 below. The analysis demonstrated that the Manning Estuary CMP aligns well against objectives in several of the Coastal Management Areas specified in the CM Act.

Management Actions were scored against the object/objectives using the scoring scale presented in below. The higher Impact Score in the far-right column, the greater the spatial impact of the action.

Scoring Scale for Alignment of Options against Objects/Objectives of CM Act

Score	Alignment Descriptor
-2	Poor (Counterproductive) Alignment
-1	Negative Alignment
0	Neutral / Not Relevant
1	Positive Alignment
2	Excellent Alignment

Scoring of Geographical Impact Scale for Management Options

Score	Scale Descriptor
1	Localised Impact
2	River Reach / Embayment Impact
3	Estuarine, Floodplain or Catchment Zone
4	Entire Estuary and/or Catchment

Management Action Assessment - Manning River Estuary																																																		
No.	Management Option	Criteria (Objects/Objectives from CM Act and MEM Act)																																								Impact Scale	Scaled Impact Score							
		CM Act Objects												MEM Act Objects								Wetlands				Environment				Use				Vulnerability																
		Coastal Processes/Values	Social and Cultural Values	Aboriginal Values/Uses	Coastal Economies	Ecologically Sustainable Development	Coastal Hazards / Climate Change	Ambulatory Recognition	Integrated Planning/Management	Resilience of Coastal Assets	Co-ordinated Management Activities	Public Participation/Understanding	Identify Land for Protection	Biologically diverse and healthy	Economic Opportunities	Cultural, Social, Recreational	Ecosystem Integrity	Scientific Research and Education	Promote Coordination	Management of Marine Parks	Natural Biodiversity/Integrity	Rehabilitation/Restoration	Resilience/Migration	Social/Cultural Values	Promote State Policies/Programs	Environmental Values/Processes	Resilience of Coastal Waters	Water Quality	Social/Cultural Values	Beaches / Dunes / Natural Features	Public Access/Amenity	Natural Scenic Quality	Cultural / Built Environment Heritage	Urban Design	Public Open Space	Use of Surf Zone	Urbanised and Natural Coastline	Public Safety	Mitigate Coastal Hazards	Maintain Beaches	Public Amenity			Sensible Land Use	Reduce Hazard Exposure	Do no harm	Essential Infrastructure	Resilient Development		
1.01	Stewardship program	1.7	2	1	1.3	0.7	0.3	0	0.7	0	0.3	2	0	1	0.3	2	0.7	1.3	1.3	0	0.3	0.3	0.3	1.7	1	0.3	0.3	0.3	1.7	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	93	
1.02	Promote Whole Farm Planning and NRM for landholders	1.7	1	0.7	1.7	1.7	0.7	0.3	0.7	0.3	0.3	2	0	1.3	1.7	0.7	1.3	1.3	0.7	0	1	1.3	1.3	1	0	1.3	1.3	1.7	1	0	0	0.3	0	0	0	0	0	0	0	0	0.3	0	0	0.7	0.3	0	0	0.3	3.67	110
1.03	Promote and Facilitate Establishment of Private Conservation Agreements	1	0.3	0.7	0.7	1.3	0.3	0	0	0	0.3	1.7	0.7	1.3	0.3	0.3	1.3	0.7	0.3	0	1.7	1.3	1.3	0.3	1.3	1.3	1.3	1	0.7	0.3	0	0.3	0	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0	3.33	76	
1.04	Litter and Stormwater Pollution Source Control Program	1	1.3	0.7	0.7	1	0	0	0.3	0	0.3	2	0	0.7	0.3	1	1	1.7	0.7	0	0.3	0.3	0.3	1	1.3	1	0.7	1.7	1.3	0.3	0.3	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	65	
1.05	Develop and Distribute Education Material and Guidelines for ESC	0.7	0	0	0.3	1	0	0	0	0	0	2	0	1	0.3	0.3	0.7	0.7	0	0	0.7	0.3	0.3	0	0	1.3	1	1.3	0	0	0	0.3	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	3.67	46	
1.06	Improve Erosion and Sediment Control	1	0.7	0.3	0.7	1.7	0.3	0	0.7	0	0.7	0.7	0	1.3	0.3	0.7	0.7	0.7	0	0	1	1	0.7	0.3	0.7	1.7	1.3	1.7	0.7	0	0	0.3	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	3.67	73	
2.01	Implement Key Priority ASS Management Actions	2	1	1	1.7	1.3	0.7	0.7	0.7	0.7	0	0.3	1.3	2	1	0.3	2	1	0	0	2	2	1.7	1.3	2	2	2	2	1	0.7	0	0.7	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0	3	106	
2.02	Protect and/or Rehabilitate Coastal Wetlands	2	1	0.7	1.7	1	0.7	0.7	0.7	0.7	0	0.3	2	2	0.7	0.3	2	1	0	0	2	2	1.7	1.3	1.7	2	2	2	2	1	0.7	0	0.7	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0	3	104	
2.03	Improve Riparian and Estuarine Bank Vegetation	1.3	1	0.7	1.3	1	0.7	0.7	0	0.7	0	0.3	1.3	2	0.7	0.7	2	0.3	0.3	0	1.7	1.7	0.7	1	1.3	2	2	2	2	1	0.7	0	0.7	0	0	0.3	0	0	0	0	0	0	0	0	0	0	0	3.33	101	
2.04	Promote good catchment management practice on public land	1.3	0.7	0	0.7	1	0	0.7	0	0.7	0	0.7	0.7	1.3	0	0.7	1.3	1	0.7	0	1.7	1.7	1	0.7	1.7	1.3	1.3	1.3	1	0.7	0	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.33	32		
2.07	Implement a Systematic Approach to Maintaining SQIDs	1	0.3	0	0.7	0.7	0	0	1.3	0	0.7	0	0	1	0.3	0.7	1.3	0.3	0.7	0	1.7	0.7	1	1	0.3	1.7	1	1.7	1.3	0.3	0.7	0.3	0	1	0.3	0	0	0	0	0	0	0	0	0.3	0.3	2.33	53			
2.08	Review, Revise and Supplement MCC's Current Stormwater Guidance	0.7	0.3	0	0.7	1.3	0.3	0	1.3	0.3	0.7	0	0	1	0	0.7	1	0	0.7	0	1	0	0.7	0.3	0	1	1	1.3	0.7	0.3	0.3	0.3	0.3	1.3	0.3	0	0	0	0	0	0	0	0	0	0.3	0.3	2.33	44		
2.09	Revise the Greater Taree Urban Stormwater Management Plan	1	0.7	0	1	0.7	0.3	0	1.3	0.3	1	0	0.3	1	0.3	0.7	1.3	0	0.7	0	1	0	1	0.7	0	1.7	1	1.7	1	0.3	0.7	0.3	0	1.7	0.3	0	0	0	0	0	0	0	0	0	0.3	0.3	2.67	60		
2.10	Study and Prioritise Sensitive Estuarine Riverbank Areas for Management and Stablilise 7.5 km	1.3	0.3	0.3	0.3	0.7	0.3	0.3	1	1	0.3	0	1	1.3	0.3	0.3	2	0.3	0.3	0	0.7	0.7	1	0.3	0.7	2	2	1.7	1.3	0.3	0.3	0.3	0	0	0	0	0	0	0.3	0.3	0	0	0.3	0	0	0	2.67	64		
2.12	Implement Onsite Sewerage Management System Audit and Compliance Strategy	1.7	0.7	0.7	0.7	1.3	0	0	0.7	0	0.7	0	0	1.7	1	1.3	1.7	0.3	0.3	0	0.7	0	0	0.7	0.7	1.7	1	1.7	1	0	0.7	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	4	84		
2.13	MER for Ecosystem Health	1.3	0.3	0.3	0.3	1	0	0.7	1.3	0.7	0	1	0.7	1.3	0.3	0.3	1.3	1.3	0.3	0	1	1	1	0.3	1	1.3	1	1.3	0.7	0.7	0	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	91		
3.01	Identify Retreat Buffer Zones for Coastal Wetlands and Littoral Rainforest	1.7	0	0.3	0.7	0.7	0.7	0.7	1.3	1.3	0.7	0	1.7	2	0.7	0.3	2	0.7	1	0	2	1	2	1	1.3	2	2	1	0.7	0.7	0.3	0.7	0	0	0	0	0	0	0	1	0	0	0.7	0.7	0	0	0.7	3	102	
3.02	Identify Council Assets at Risk from Sea Level Rise	0	1.3	0.3	1.3	0.7	2	0	1	2	0.7	0	0.3	0	1.3	1	0	0	0	0	0	0	0	0.7	0.7	0	1	0.7	1	0	0	0.3	0	0	0.7	0	0	0	0.7	1	0	0.3	1	0.7	0	1.3	0.7	2	45	
3.03	Examine Future Effectiveness of Coastal Inundation Emergency Strategies	0	1	0	1	0	1.7	0	0.7	0.7	0.3	0	0	0	1.3	1	0	0	0.3	0	0	0	0	0.7	0	0	0.3	0	0.7	0	0.3	0	0	0	0.7	0	0	0	0	0.7	1.3	0	0	0.7	0.7	0	0.3	0.7	3	45
3.04	Long Term Adaptation Plan for Manning Floodplain	2	1	0	2	1	2	0.7	1.3	2	0.7	1.3	2	2	1.3	1	1.3	0.7	1	0	2	0.3	2	1.7	0.3	1.7	1.7	1.7	1.7	0.7	0.3	0.7	0	0	0	0	0	0	0	1	0	0	0	0	0.7	3	122			
4.01	Remediate Barriers to Fish Passage	1.7	1	0.7	1	0.7	0	0	0	0.3	0.3	0	0	2	0	1	2	0	0	0	0.7	0.3	0.3	0.7	0.7	2	0.3	0	1.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.67	45	
4.02	Develop Integrated Pest and Weed Control Plans	1.7	0.7	0.3	0	0.3	0	0	0.7	0	0.3	0	0.7	2	0	0.3	2	0.3	0.3	0	1.3	1.3	1.3	0.3	0.7	2	0.7	0	0.3	0.7	0.3	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	76		

[illegible]

Appendix 4: Manning Estuary CMP Threat and Risk Assessment

Threat	Description	Causes/Stressors	Values impacted	Inherent Consequence Rating (1-5)	Inherent Likelihood Rating (1-5)	Risk Value	INHERENT RISK RATING	Existing key controls	Control effectiveness	Residual Consequence Rating (1-5)	Residual Likelihood Rating (1-5)	Risk Value1	RESIDUAL RISK RATING	Total residual score	RANKING	Risk tolerance
Lack of engagement and stewardship	Lack of community participation in stewardship, governance, compliance; Lack of community awareness understanding and skills	High level of concern raised CMP reference group. Underpins all other threats.	Environment	4	5	20	Extreme	Range of education and engagement activities such as discovery tours, antilitter campaigns, field days and extension work with farmers, Landcare capacity building activities. Engagement efforts are adhoc. Requires consistent effort over time.	Ineffective	4	4	16	High	46	1	LOW
			Social	3	5	15	High			3	5	15	High			
			Economic	3	5	15	High			3	5	15	High			
Failure to account for long term impacts of climate change (50-100 years)	Potential maladaptation and restriction of future flexibility in addressing risks.	Warming climate due to greenhouse gases	Environment	5	3	15	High	Overarching and important long-term	NA	5	3	15	High	45	2	LOW
			Social	5	3	15	High			5	3	15	High			
			Economic	5	3	15	High			5	3	15	High			
Clearing and degradation of coastal wetlands	Draining and clearing of coastal wetlands inhibits ecosystem services incl. flood mitigation, nutrient and sediment filtration, habitat, ASS exposure	Agriculture and drainage on the floodplain, urban and peri-urban land-use	Environment	5	5	25	Extreme			4	5	20	Extreme	44	3	LOW
			Social	4	3	12	High			4	3	12	High			
			Economic	4	3	12	High			4	3	12	High			
Floodplain drainage (ASS)	Loss of habitat within catchment resulted in loss of species diversity of plants, animals, invertebrates and degradation of natural environment - audit and address land degradation including wind and water erosion, scalding, loss of nutrients, soil acidity, decline in soil structure, loss of biodiversity	Loss of habitat within catchment resulted in loss of species diversity of plants, animals, invertebrates and degradation of natural environment - audit and address land degradation including wind and water erosion, scalding, loss of nutrients, soil acidity, decline in soil structure, loss of biodiversity	Environment	5	4	20	Extreme	Implementation of Lower Manning River Drainage Remediation Action. Land acquisition program to remediate high priority localities; Drain Maintenance Guidelines in DCP; No co-ordinated community capacity building program in place; Assistance to landholders to undertake floodgate modifications where	Effective	5	4	20	Extreme	44	3	LOW

Threat	Description	Causes/Stressors	Values impacted	Inherent Consequence Rating (1-5)	Inherent Likelihood Rating (1-5)	Risk Value	INHERENT RISK RATING	Existing key controls	Control effectiveness	Residual Consequence Rating (1-5)	Residual Likelihood Rating (1-5)	Risk Value1	RESIDUAL RISK RATING	Total residual score	RANKING	Risk tolerance
								it reduces ASS runoff								
			Social	4	3	12	High			4	3	12	High			
			Economic	4	4	16	High			4	3	12	High			
Clearing and degradation of riparian vegetation and adjacent habitat	Widespread clearing and degradation of riparian buffer vegetation causes bank erosion and loss of habitat	Agricultural, peri-urban and urban land-use	Environment	5	5	25	Extreme	Incentive programs with landholders to restore riparian vegetation. Natural regeneration via stock exclusion	Somewhat effective	4	5	20	Extreme	44	3	LOW
			Social	4	3	12	High			4	3	12	High			
			Economic	4	3	12	High			4	3	12	High			
Agricultural diffuse source run-off: Nutrients	Elevated nutrients in the Manning River and estuary, causing excess macrophyte and algal growth, declines in water quality and seagrass extent and condition Decline in health of aquatic biodiversity quality and extent, including macro invertebrates	Excess fertilizer use Farm effluent used on pasture; Dairy and other effluent direct inputs to waterways; Stock in waterways.	Environment	4	5	20	Extreme	Limited number of dairy effluent plans in lower Manning Pelican Bay study and remediation works LLS Extension Program	Somewhat effective	4	5	20	Extreme	44	3	LOW
			Social	3	4	12	High		Somewhat effective	3	4	12	High			
			Economic	3	4	12	High		Somewhat effective	3	4	12	High			

Threat	Description	Causes/Stressors	Values impacted	Inherent Consequence Rating (1-5)	Inherent Likelihood Rating (1-5)	Risk Value	INHERENT RISK RATING	Existing key controls	Control effectiveness	Residual Consequence Rating (1-5)	Residual Likelihood Rating (1-5)	Risk Value1	RESIDUAL RISK RATING	Total residual score	RANKING	Risk tolerance
Agricultural diffuse source run-off: Sediments	Due to the long residence time of fresh water, the estuary is sensitive to the accumulation of sediments. Diffuse runoff from agriculture contributes sediment, leading to elevated turbidity in estuary, sedimentation, reduction in seagrass productivity, available habitats. Sediment also mobilises nutrient pollution.	Stock in waterways Clearing of riparian and adjacent vegetation Forestry Run off from non-perennial pastures.	Environment	4	5	20	Extreme	Ad Hoc incentive projects and remediation works		4	5	20	Extreme	44	3	LOW
			Social	3	4	12	High		Ineffective	3	4	12	High			
			Economic	3	4	12	High			3	4	12	High			
Stock in riparian and marine vegetation	Widespread stock access to the river throughout fresh and saltwater catchments	Sediment, nutrient and pathogen run-off; reduces condition and extent of riparian veg.	Environment	4	4	16	High	Some ad-hoc exclusion of stock and placement of rock fillets by landholders in conjunction with public authorities in catchment and lower estuary	Somewhat effective	4	4	16	High	40	4	LOW
			Social	3	4	12	High			3	4	12	High			
			Economic	3	4	12	High			3	4	12	High			
Modified hydrology/hydraulics and flow regime, Modified freshwater flows	Effect on hydrology of climate change (altered flows) and extractions; Current WSP conditions have high ecological risks as a result of the paucity of ecological information used to determine an appropriate CTP threshold; Low flow periods obstruct species' passage (e.g. fish, turtles), increase exposure to predation (e.g. platypus). Saltwater intrusion into in upper estuary around Wingham results in plant deaths (e.g. water ribbons)	Water licenses for extraction, climate change. Medium sensitivity of the estuary to changes in freshwater inflows;	Environment	4	4	16	High	10-year Water Sharing Plans for water sources within the Catchment. Cease to pump regulations imposes access restrictions when flows fall below a set level. No new extraction licences - must purchase entitlement from existing access licences.	Somewhat effective	4	3	12	High	40	4	LOW

Threat	Description	Causes/Stressors	Values impacted	Inherent Consequence Rating (1-5)	Inherent Likelihood Rating (1-5)	Risk Value	INHERENT RISK RATING	Existing key controls	Control effectiveness	Residual Consequence Rating (1-5)	Residual Likelihood Rating (1-5)	Risk Value1	RESIDUAL RISK RATING	Total residual score	RANKING	Risk tolerance
			Social	4	4	16	High			4	4	16	High			
			Economic	3	4	12	High			3	4	12	High			
Entrance modifications, including dredging, opening and permanent entrance training	Permanently opening the entrance of the estuary at entrances has/will have a range of ecological impacts to coastal wetlands and ASS and result in changes in the salt wedge	Entrance opening modifies salinity / freshwater exchange in the estuary; Listed in top three threats in statewide the NSW Marine Estate Management Strategy 2018 – 2020	Environment	4	4	16	High	Ecological and geomorphological impacts from dredging addressed through REF process; Community advocacy to further train Harrington and install additional breakwall and open Farquhar. A Parliamentary Taskforce is investigating the engineering and economic feasibility of a second break water at the Harrington entrance.	Somewhat effective	4	3	12	High	40	4	LOW
			Social	4	4	16	High			4	4	16	High			
			Economic	3	4	12	High			3	4	12	High			
Flood and inundation	Major floods occurring 1 in 50 yrs., coastal inundation with storm surge and king high tides	Extreme rainfall events exacerbated by loss of vegetation. Legacy issues with development in inundation zones.	Environment	4	3	12	High	Development control in flood zones; stormwater system; flood warnings and recovery efforts.	Somewhat effective	3	3	9	Medium	33	5	LOW
			Social	5	3	15	High			4	3	12	High			
			Economic	5	3	15	High			4	3	12	High			
Agricultural diffuse source run-off: Pathogens (e.g. E coli)	Current practices associated with the management of effluent e.g. dairy	Run from manures, irrigating pasture with effluent, stock in waterways	Environment	2	3	6	Medium	Some dairy effluent plans on selected properties on the lower Manning. MCC Water Services monitoring dairy effluent plans for selected properties in Lower Manning (LLS)		2	3	6	Medium	33	5	MODERATE
	Potential to reduce social values (e.g. swimming) due to contamination of estuary		Social	5	4	20	Extreme		Somewhat effective	5	3	15	High			
			Economic	4	3	12	High			4	3	12	High			

Threat	Description	Causes/Stressors	Values impacted	Inherent Consequence Rating (1-5)	Inherent Likelihood Rating (1-5)	Risk Value	INHERENT RISK RATING	Existing key controls	Control effectiveness	Residual Consequence Rating (1-5)	Residual Likelihood Rating (1-5)	Risk Value1	RESIDUAL RISK RATING	Total residual score	RANKING	Risk tolerance
Stormwater discharge including erosion and sediment, litter and plastics	Discharge of sediment, nutrient, chemicals and litter from stormwater system. Due to the long residence time of fresh water, the estuary is sensitive to the accumulation of sediments. There are about 800 unsealed road crossings in MidCoast LGA, most in the Manning which is the largest catchment. Run-off of sediment from unsealed roads causes localised high turbidity in high flow periods. Urban pollutant loads are low comparatively to catchment loads.	Failure to address source control; lack of appropriate in-line infrastructure e.g. GPTs; failure to maintain systems; non-compliance with DCP. Report card monitoring indicates decline in extent and condition of seagrass in estuary. For litter, marine debris and plastics potential sources, include urban areas, tourism sites, fishing.	Environment	2	4	8	Medium	Neutral or beneficial effect is applied to new subdivisions in accordance with the Manning Region LEP. Sediment and erosion management training provided to Council staff; MEMS-funded project for source pollution from roads. Some gross pollutant traps in Taree. Clean up days and education programs.	Somewhat effective	3	3	9	Medium	33	5	MODERATE
			Social	3	4	12	High			3	4	12	High			
			Economic	3	4	12	High			3	4	12	High			
Climate Change 20-year timeframe	Sea Level Rise causes Migration of coastal wetlands & conflicts with land use. Also, impacts on low lying rainforest		Environmental	4	3	12	High			4	3	12	High	30	6	MODERATE
	SLR and extreme weather events cause damage and failure of essential infrastructure		Social	3	3	9	Medium			3	3	9	Medium			
			Economic	3	3	9	Medium			3	3	9	Medium			
Pests and diseases	Introduced plants, animals and diseases are present throughout the catchment and estuary, incl. deer, pigs, European fox, Indian mynah, gambusia, goldfish	Introduced species predating, competing, displacing native species, altering ecosystems	Environment	4	4	16	High	MCC biosecurity (weeds) program for high priority weeds. Control program for deer at Cattai wetlands. Site based control of foxes (Minimbah, Manning inlets).		3	4	12	High	27	7	MODERATE
			Social	3	3	9	Medium		Somewhat effective	3	3	9	Medium			
			Economic	3	2	6	Medium			3	2	6	Medium			

Threat	Description	Causes/Stressors	Values impacted	Inherent Consequence Rating (1-5)	Inherent Likelihood Rating (1-5)	Risk Value	INHERENT RISK RATING	Existing key controls	Control effectiveness	Residual Consequence Rating (1-5)	Residual Likelihood Rating (1-5)	Risk Value1	RESIDUAL RISK RATING	Total residual score	RANKING	Risk tolerance
Sewage effluent and septic runoff	Pathogens e.g. E coli within catchment and estuary	Septic tanks leaking/not functioning, runoff	Environment	3	3	9	Medium	MCC sewage treatment plants treat water to a tertiary level under licences from the EPA. Over the past 20 years, MCC Water Services, has expanded off-site sewerage services to smaller villages in environmentally sensitive areas. MCC has prepared an On-site Sewage Management Strategy. MCC carried out inspections of all pump-to-sewer on-site sewage management systems in Pelican Bay 2019.	Somewhat effective	2	3	6	Medium	27	6	MODERATE
			Social	4	3	12	High			3	3	9	Medium			
			Economic	4	3	12	High			4	3	12	High			
Recreational boating impacts - bank erosion	Localised boatwash bank erosion from powerboats in tributaries to the estuary. Loss of riparian vegetation. Report card estuary monitoring data shows high turbidity associated with high flow events from catchment.	Anecdotal concern from landowners in Lansdowne but no quantified data. Potential causes include improved boat ramp facilities, increasing domestic tourism and rise in popularity of wake boats.	Environment	2	4	8	Medium	Regional Boating Plan completed 2015. The only no-wake zone is at the confluence of the Dawson and Manning Rivers. Program of revetment and fillets to stabilise banks funded via MEMS and MCC.	Ineffective	2	4	8	Medium	27	6	MODERATE
			Social	2	2	4	Low			2	2	4	Low			
	Positive impact for tourism and rec industries, negative impact for landowners with bank erosion		Economic	2	4	8	Medium			2	4	8	Medium			
Recreational fishing - shore and boat-based line and trap fishing, hand gathering	Recreational fishing has potential to impact fish stocks.	Illegal or excessive take; Inadequate regulation; inappropriate access, environmental degradation	Environment	4	2	8	Medium	Manning River estuary designated as a Recreational Fishing Haven, only recreational fishing is permitted downstream from Ghinni and Berady Creek		4	2	8	Medium	20	7	HIGH
			Social	3	2	6	Medium			3	2	6	Medium			
			Economic	3	2	6	Medium			3	2	6	Medium			

Threat	Description	Causes/Stressors	Values impacted	Inherent Consequence Rating (1-5)	Inherent Likelihood Rating (1-5)	Risk Value	INHERENT RISK RATING	Existing key controls	Control effectiveness	Residual Consequence Rating (1-5)	Residual Likelihood Rating (1-5)	Risk Value1	RESIDUAL RISK RATING	Total residual score	RANKING	Risk tolerance
Commercial fishing - estuary prawn haul, estuary general	Commercial fishing depletes fish stock and damages ecosystem health.	Commercial fishing operations under license	Environment	3	4	12	High	DPI regulations: risk to stocks managed with controls/regulations in place.	Effective	3	3	9	Medium	19	8	HIGH
			Social	3	4	12	High			3	2	6	Medium			
			Economic	3	4	12	High			2	2	4	Low			
Population growth	Increased pressure - system functions and the possible localised and downstream impacts of reduced flow and declining water quality	Population growth forecast from .id profile used by MCC is from 40,540 to 47,453 within our CMP planning area from 2021-2036 e.g. 17%	Environment	3	4	12	High	Range of measures in Rural strategy, LEP and DCP to mitigate impacts of population growth	Somewhat effective	3	2	6	Medium	18	9	HIGH
			Social	2	3	6	Medium			2	3	6	Medium			
			Economic	2	3	6	Medium			2	3	6	Medium			
Foreshore development	Projections for future growth within coastal localities	Projections for future growth within coastal localities	Environment	3	2	6	Medium	Neutral or beneficial effect applied to new developments	Somewhat effective	2	3	6	Medium	14	10	HIGH
			Social	2	2	4	Low	DCPs in former GTCC		2	2	4	Low			
			Economic	2	2	4	Low			2	2	4	Low			
Oyster aquaculture (in estuaries)	Oyster leases, infrastructure, operations	Infrastructure past, present and future in shallow areas of estuary and on land base Land-based impacts from occupancy of waterfront land for farming operations & storage of cultivation infrastructure and associated equipment Disturbance of sediments through deep water oyster harvesting Fuel or oil spills Wash from oyster punts travelling	Environment	3	2	6	Medium	Environmental Management System for Manning River Oyster Farmers (2013) Growers encouraged to work with Authorities to develop Emergency Response Plans to help prepare for fires, explosions, fuel & oil spills, release of hazardous chemicals, effluent spill/release Pelican Bay desktop study/plan and implementation		2	2	4	Low	12	11	HIGH
			Social	2	2	4	Low			2	2	4	Low			
			Economic	2	2	4	Low			2	2	4	Low			
Oil, gas, minerals, sand, aggregate, coal mining	Coal mining, sand mining	Coal mining and proposed mining in middle and upper catchment, risk assessed through local studies	Environment	3	2	6	Medium	EPA regulations, EIS		3	2	6	Medium	12	12	HIGH
			Social	2	2	4	Low			2	2	4	Low			
			Economic	2	1	2	Low			2	1	2	Low			

Threat	Description	Causes/Stressors	Values impacted	Inherent Consequence Rating (1-5)	Inherent Likelihood Rating (1-5)	Risk Value	INHERENT RISK RATING	Existing key controls	Control effectiveness	Residual Consequence Rating (1-5)	Residual Likelihood Rating (1-5)	Risk Value1	RESIDUAL RISK RATING	Total residual score	RANKING	Risk tolerance
Excessive or illegal extraction			Environment	3	2	6	Medium			3	2	6	Medium	10	12	HIGH
			Social	1	2	2	Low			1	2	2	Low			
			Economic	1	2	2	Low			1	2	2	Low			
Agricultural diffuse source run-off: Pesticides & chemicals	Diffuse runoff of pesticides and herbicides	Current farm and forestry practices.	Environment	3	1	3	Low	Legislative controls. Nil detected in Water Services samples and same result in a research study undertaken in upper catchment.		3	1	3	Low	8	13	HIGH
			Social	3	1	3	Low			3	1	3	Low			
			Economic	2	1	2	Low			2	1	2	Low			

Appendix 5: Funding responsibilities and options

Introduction

There are several agencies responsible for coastal management in New South Wales and a range of different streams for grant funding. These are described in the following sections, with each section dealing with a specific agency, their key responsibilities, and the funding opportunities they provide.

Historically, the situation surrounding responsibilities and funding opportunities have been extremely fluid. Accordingly, the summary provided herein should be considered as a snapshot, current during April 2021, and subject to ongoing change.

The agencies with responsibility for the Coast and having some mechanism to provide funds are dealt with in separate sections, as follows:

- MidCoast Council.
- Hunter Local Land Services, which implements projects to support the Marine Estate Management Strategy.
- Department of Planning, Industry and Environment (Environment, Energy and Science).
- Department of Primary Industries - Fisheries.
- Maritime Infrastructure Delivery Office (within Transport for NSW).
- Marine Estate Management Authority.
- Other Funding Sources.

MidCoast Council

MidCoast Council (MCC) takes responsibility for, among other things, roads and bridges, parks, sporting grounds, waterway facilities, water and sewer provision, community services, libraries and environmental planning as services within the Local Government Area. The organisational structure of MCC is illustrated in Figure 29: MCC.

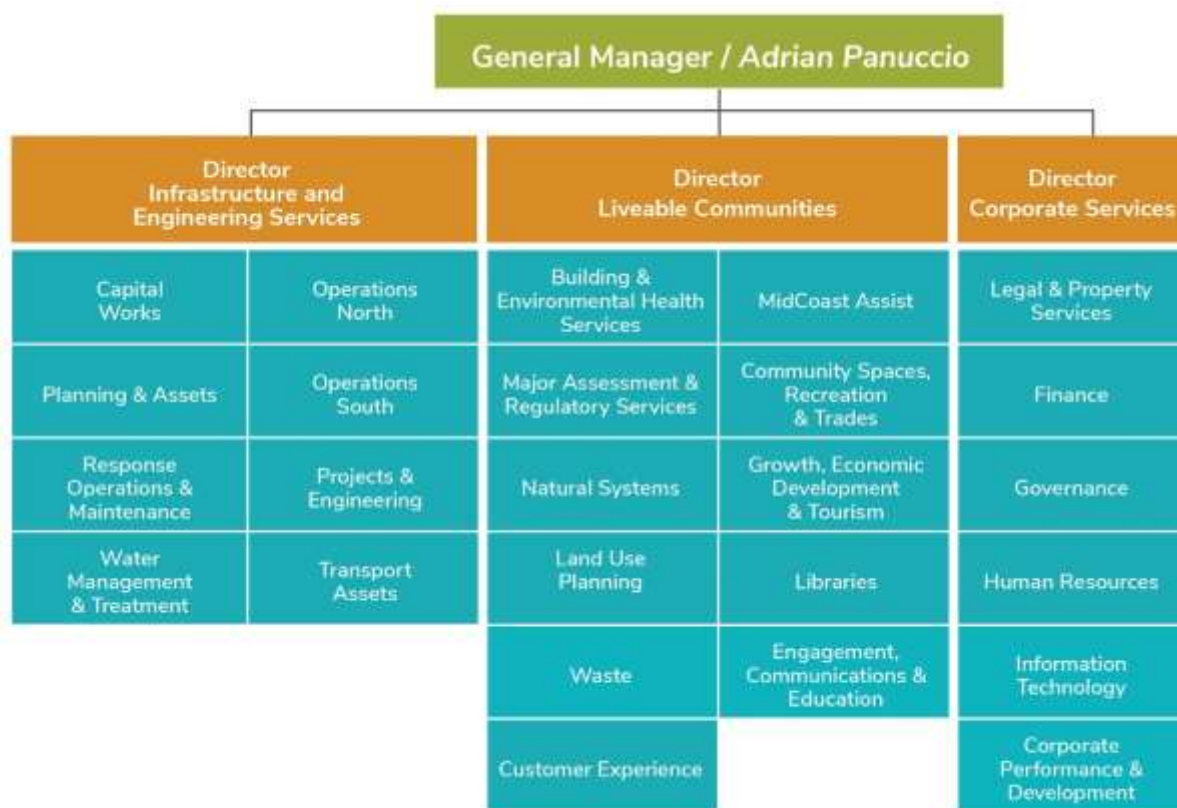


Figure 29: MCC Organisational Structure

The Manning Estuary CMP will be administered internally by the Natural Systems Team of Council and direct implementation of different actions will primarily be through teams in the Liveable Communities Directorate and the Infrastructure and Engineering Directorate.

MidCoast Council (MCC) presently has an income of approximately \$270M per annum with around 60% coming from general rates. MCC commonly uses rates revenue to leverage additional funding from external grant programs.

MCC's rate revenue includes an environmental rate which raises approximately \$4M per year. This funds the Natural Systems team which will administer the Manning Estuary CMP and is the primary funding mechanism for delivery of actions in the program.

A total annual contribution of approximately \$250,000 per annum has been allocated from the environmental rate for either direct expenditure or as a contribution to leverage grant funding sources.

MCC also charges a Stormwater Levy, raising approximately \$850,000 annually to deliver projects that address local flooding and improve stormwater quality across the whole LGA. A

portion of Stormwater Levy funds will be applied to actions to improve stormwater management in the Manning Estuary CMP.

Hunter Local Land Services

Under Goal 3 of the South East Strategic Plan (*“Healthy, diverse, and connected natural environments”*), Hunter LLS identifies priorities including:

- Improving water quality in Rivers and estuaries.
- Improving native vegetation connectivity.
- Supporting land managers to rehabilitated degraded habitat including weeds and pests and supporting recovery of threatened species and ecological communities.
- Assisting landholders to manage water resources and sustain productive agriculture and natural assets.

Hunter LLS has recently been receiving funding to assist with implementation of the Marine Estate Management Strategy as follows:

- To improve the quality of drainage from roads and tracks. This funding is commonly provided to councils to undertake maintenance work.
- To undertake riparian works including fencing, weeding, planting and maintenance.
- To undertake bank erosion remediation works, where LLS will engage and manage contractors to complete the work.

Funding which comes through MEMA is not constrained in terms of usage on private and public land. In other words, MEMA funding via LLS can be used to undertake repair/rehabilitation works on riparian reserves that are under the care and control of Council.

Based on discussions with Hunter LLS staff, it is expected that, on average, around \$800,000 per annum would be available for works in the Manning Catchment from MEMA sources.

Hunter LLS manages several other funding sources. The National Landcare Program (NLP) provides the major environmental federal funding source for the Natural Resource Management Team within Hunter LLS. Around 1.8M has been allocated over the June 2019 – June 2023 period, with 1.2M of that forming the operational budget (~300,000 per year). Considering the area covered by Hunter LLS, around 100K could be allocated per annum on projects within the Manning Catchment.

Over the next 14 months (till mid 2022), Hunter LLS is also managing federal funds relating to bushfire recovery, including \$650,000 on actions relating to weeds, pests, threatened ecological communities, threatened species and fire. This funding is earmarked for the Manning Catchment.

Hunter LLS also administers the Catchment Action NSW Program, funded by the NSW Government with a focus of using those funds for the repair of riparian areas within the Manning Catchment. \$80,000 is presently available annually from this funding source.

Department of Planning, Industry and Environment

DPIE: Environment, Energy and Science

Several sections of state government traditionally focussed on coastal management were moved from the Office of Environment and Heritage into the Environment Energy and Science (EES) group of the Department of Planning, Industry and Environment in 2019. The functions of relevance to the Manning CMP are presently contained as listed below:

1. Within the Biodiversity, Conservation and Science Secretariat:

- Water, Wetlands and Coasts Science Directorate: Includes scientists which undertake targeted research and monitoring relating to estuaries and may provide an avenue for completion of some additional studies needed to better inform management.
- Hunter Central Coast Directorate: Containing regional staff, largely located in Newcastle and on the Central Coast, with a detailed focus on coasts and estuaries along the NSW coast from the Hawkesbury River, extending northwards to the Manning Catchment.
- Marine, Coastal, Estuaries and Floods Directorate: Including specialists in coastal and estuarine policy and management who have an overarching role in the delivery of coastal and 4.3.2 focused programs and policy, including the delivery of high-level guidance such as the development of the Coastal Management Manual and supporting documentation.

2. Within the Executive Directorate, Office of the Coordinator General of EES:

- The Grants Directorate: which manages the Coast and Estuary Management, Floodplain Management and NSW Environmental Trust contestable grants programs.

Staff within all these directorates contribute to the provision of both technical and financial assistance to local councils in managing the coast. In the context of the Manning CMP, whereby

Coast and Estuary Grant Funding Streams

The coast and estuary grants⁵⁰ cover several streams, of which the “Implementation” stream is the main one of interest to progress on-ground actions of a CMP. For many other parts of a CMP, which relate to ‘planning’ studies, grant applications can be made under the planning funding stream.

At present, the guidelines for the coast and estuary grants indicate that funding will be provided on a 2:1 basis (State Government: Applicant).

A strict read of the funding guidelines indicates that administration costs, non-monetary (e.g., in-kind) or voluntary contributions from other sources cannot be used as matching funding. The contribution of the applicant and any partners needs to be a monetary contribution. One exception is the project management allowance outlined below.

⁵⁰ <https://www.environment.nsw.gov.au/topics/water/coasts/coastal-and-estuary-grants>, accessed 27 April 2021

The guideline indicates that the following won't be funded:

- Maintenance of funded projects.
- Projects eligible for funding under natural disaster relief.
- Amenity works (car parking, footpaths, seating, shelters and lighting etc).
- Projects within freshwater environments unless they are shown to significantly improve estuary health.
- Variations exceeding +30% of the original amount requested.

Coast and Estuary Planning Stream

These grants effectively cover the actions which lead to the implementation 'on-the-ground' works that would be funded under the various implementation funding streams discussed below.

These include the preparation of CMPs and studies that are needed to develop a CMP. Investigations and designs for works recommended in a CMP are also covered, along with cost benefit / distributional analyses to support such works.

A strict read of the most recent guidelines for grants indicates that the planning stream is only valid for activities which are needed to develop a CMP, transition from a CZMP to a CMP, or to undertake investigations, designs and cost-benefit analyses for infrastructure works recommended in a certified CMP. In other words, general planning and investigation required for mapping, additional processes investigation or other supporting studies to fill data gaps or help formulate actions do not seem to be covered by either the Planning Stream or the Implementation Stream (see next section).

Implementation Streams

For the *coastal vulnerability area*, activities that can be demonstrated to reduce the threat from coastal hazards can be funded. These include beach nourishment; dune restoration works and seawalls.

For the *coastal wetlands and littoral rainforests area*, actions indicated as being suitable for funding include the management of weeds and invasive animals, trails and accessways, works to reduce exposure to coastal erosion, replanting and stabilising vegetation and habitat restoration/conservation.

For the *coastal environment area*, actions indicated as being suitable for funding include community education, access management, environmentally beneficial dredging, monitoring (linked with actions to improve ecosystem health), the protection of Aboriginal heritage, management of stormwater quality (where demonstrated to be beneficial to the receiving environment), revegetation and weed management, sediment and erosion control actions. Activities in the upper catchment, where beneficial to estuarine health may also be funded.

For the *coastal use area*, actions indicated as being suitable for funding include community education, the management of public access, actions to protect Aboriginal heritage, stormwater management, revegetation and weed management and monitoring.

For the most part, funding for activities identified in a certified CMP will be provided at a 2:1 ratio (state: local contribution). For projects costing over \$1M, this ratio will only apply to that

component which is determined to be of public benefit. That component assessed as benefiting private interests will not be funded. For projects valued over \$500,000, investigation and design must be completed before application.

In recent years, it has been common for DPIE to accept grant applications for implementation of coastal management actions during a limited time window each year. For example, the most recent funding round opened on 11 August 2020 and closed on 29 September for the implementation streams.

Floodplain Management Grants

DPIE runs a parallel grants program relating to floodplain risk management in NSW. There are opportunities to pursue grants under this program to address the hazards associated with tidal inundation (and its interaction with catchment flooding).

Grants are usually provided within strands representing different stages of the floodplain risk management process in NSW (NSW Government, 2005):

1. Flood study.
2. Floodplain risk-management study.
3. Feasibility study.
4. Implementation.

Funding has historically been at a level of 2:1, although higher funding ratios have also been awarded for implementation of works, particularly in rural areas. Applications for these grants are generally accepted during a limited window annually, with the most recent window between February 4 and the end of March 18.

NSW Environmental Trust

The NSW Environment Trust provides opportunities for the funding of community and government organisations to conserve, protect and rehabilitate the NSW environment, or to promote environmental education and sustainability. The Trust promotes several programs of funding. The different streams open and close at varied times, and grants are available, for example, to support:

- Environmental Education (most recent round closed 16 November 2020), with a pool of \$1M available and up to \$250,000 per project being funded.
- Environmental Research (open to collaborations and research institutions), with a pool of \$1M most recently available and up to \$200,000 per project being funded.
- Restoration and Rehabilitation (open to state and local government and community groups), with a total of \$4M in funding provided and up to \$170,000 per project being available, although the amounts available are dependent upon experience. The last round of funding for Restoration and Rehabilitation closed on 14 December 2021.

For the Restoration and Rehabilitation program, funding for supporting threatened species and addressing climate change (including adaptation) are immediate funding priorities. It appears that actions to promote the adaptation of saltmarsh, for example, to sea level rise should be viewed favourably.

Department of Primary Industries

DPI-Fisheries - Responsibilities

DPI-Fisheries is responsible for the management of recreational and commercial fishing, marine protected areas, aquaculture industries and the management of threatened aquatic species.

DPI-Fisheries is responsible for administration of the *Fisheries Management Act 1994*, including the conservation of estuarine vegetation such as seagrasses, mangroves and saltmarsh.

Habitat Action Grants

Habitat Action Grants are funded by NSW recreational fishing fees and are available to local councils and organisations looking to rehabilitate fish habitats throughout NSW. Grants are classified as small (up to \$2,000) and large (up to \$40,000).

Typical projects include:

- Removal or modification of barriers to fish passage.
- Rehabilitation of riparian land (including fencing to exclude stock).
- Waterway re-snagging.
- Weeding and replacement with native species.
- Bank stabilisation.

Typically, 25-30 individual projects have been funded each year over the past decade, with a total of around \$550,000 to \$750,000 funding provided per year.

Funds provided through the program must be at least matched by in-kind contributions, such as voluntary labour and/or the supply of materials.

Flagship Fish Habitat Rehabilitation Grants

The Flagship Grants are available for projects that significantly enhance fish habitat, water quality and fish passage within coastal catchments of NSW. The intention of this pool of grant funding is to tackle much larger scale projects. The grants support a range of actions including on-ground works, of a similar nature but larger scale than those of the Habitat Action Grants, and hydrological and environmental investigations, community consultation and economic assessments.

A maximum project funding of \$360,000 is set, with \$360,000 available across the program each year.

Successful projects in recent years have included funding for MCC to address actions in the Lower Manning River Drainage Remediation Action Plan, works to address acidic discharge from wetlands, works to address riverbank erosion, and the removal of barriers to fish passage.

Maritime Infrastructure Delivery Office (within Transport for NSW)

Transport for NSW (TfNSW) is responsible for maritime policy, including safety, access and infrastructure. Their role includes on-water compliance activities.

MIDO

The Maritime Infrastructure Delivery Office (MIDO) combines the previous maritime division of TfNSW and the maritime related functions that were previously contained within Crown Lands. MIDO was recently formed and aims to streamline the delivery of maritime infrastructure and dredging.

Delivery of the NSW Maritime Infrastructure Plan for 2019-2024⁵¹ is largely the responsibility of MIDO, and several programs support delivery of that plan which focusses on assets and facilities including:

- Entrance breakwaters.
- Harbours.
- Dredged navigation channels.
- Boat ramps, wharves and jetties.
- Boat maintenance and repair facilities.
- Moorings.
- Fuel and sewage pump out.
- Navigation aids and lighthouses.

The Maritime Infrastructure Plan lists 14 key investment locations. The list doesn't include the Manning River. However, MIDO is overseeing current investigations into possible works to open the entrance to the Manning River at Harrington.

Boating Now Program

The Maritime Infrastructure Plan notes that support will be provided to development of council owned infrastructure under the Boating Now Program. The Program is funded from boating license, registration, and other fees, and has delivered some 200 boating projects across the state since 2014. The most recent round of funding, (Round 3) announced in October 2019, included a \$28M investment for the period from July 2020 to June 2022 and 69 projects were funded. We have been advised that funding has been announced for a subsequent Round 4 of funding, which will open in 2021.

While the Manning is not identified as a “*key investment locations*” within the Maritime Infrastructure Plan, that plan does indicate that funding support would be available to councils to develop strategic plans for other locations. Those plans should identify the priority and longer-term infrastructure needs of local waterways to encourage a better planning and management approach to local boating facilities. Such a strategy could potentially have an area added to the list of key investment locations or make a location more attractive for funding.

⁵¹ https://maritimemanagement.transport.nsw.gov.au/documents/Maritime_Infrastructure_Plan.pdf, accessed 22/11/2020

TfNSW has advised that studies are more likely to be funded if they have a clear aim of improving local boat access and navigation. In other words, studies which aim to address multiple objectives, including environmental outcomes, may be judged as having less merit under this funding stream, when compared to those purely associated with environmental outcomes. Success would depend largely on whether a round of grants funding is oversubscribed or not.

It seems that projects which are not on the list of *key investment locations* would require a greater funding contribution from local councils.

However, according to guidelines for the most recent Round 3 grant guidelines, recipients of the grants may be eligible for up to 100% of the cost for repair or replacement costs of existing, publicly owned facilities (up to a total of \$500,000 per asset).

Boating Access Dredging Program

The NSW *Boating Access Dredging Program* has replaced the prior *Rescuing our Waterways* program. The program aims to allocate funding to councils for local dredging projects, particularly in regional waterways. Councils are expected to contribute at least 25% of the total project costs and to be responsible for developing and managing their projects.

At the time of writing, applications to a funding round are open but due to close imminently (30th April 2021). A pool of \$2M is available state-wide with a grant value limit of \$500,000.

Projects eligible for funding include actual dredging and pre-dredging activities, and supporting studies relating to sedimentation and hydrodynamics. Overall, projects should aim to deliver navigational benefits and to improve access to infrastructure such as wharves and boat ramps.

Marine Estate Management Authority

The Marine Estate Management Authority (MEMA) is responsible for development and delivery of the Marine Estate Management Strategy (MEMS), which was developed under the *Marine Estate Management Act 2014*. Membership of MEMA includes the four main agencies managing the marine estate from within the NSW Government:

- DPI: Including Fisheries (See Section 0).
- DPIE: EES (See Section 4).
- DPIE Planning and Assessment, which is responsible for the state's land use planning system, state significant developments and infrastructure.
- Transport for NSW (See Section 0).

Other agencies with interests include, for example, Local Land Services (LLS), DPIE Water, DPIE Crown Land and local councils.

The MEMS Implementation Plan⁵² tends to include specific councils as “partners” in the delivery of management actions.

⁵² https://www.marine.nsw.gov.au/data/assets/pdf_file/0020/1139042/Marine-Estate-Management-Strategy-Implementation-Plan.PDF, accessed 22/11/2020.

LLS is a lead agency on riparian vegetation improvements and wetland restoration. Furthermore, bank protection works and the improvement of roads and tracks within the catchment are also identified.

In recent years, funding for the MEMS has been determined on a yearly basis. However, it is expected that the funding will continue for the full term of the MEMS (i.e. to 2028) and it is reasonable to assume funding will continue at similar rates as experienced in the past couple of years.

Other

Federal Funding Sources

Federal funding sources tend to vary from year to year and cannot be relied upon for programming actions. These may present possibilities for opportunistic funding and should be kept in mind.

Non-Government Funding Sources

There are a range of other options for non-government and private funding of projects. One current example is the *Reef Builder* partnership between the Australian Government and the Nature Conservancy, a global non-profit NGO, working at conserving land and water. The partnership will develop a \$20 million investment to rebuild shellfish reefs around the Australian coastline. Shellfish reefs, which have been decimated in Australia since 1788, provide multiple benefits including filtering and cleansing sea water and providing habitat.

Similar to federal funding sources, the opportunities for funding through these sources may be variable over time.



Photo: Kalani Minns

Appendix 6 Monitoring template for the CMP

Monitoring and reporting for progress against Manning Estuary CMP action targets will be done using the template shown in Table 12 below. Results will be reported to the Community Reference Group on an annual basis, and percentage completion will be reported against the CMP action in Council's Delivery Program and Operating Plan.

Project Tracking Template

Action #	Action	Project measure	FY23 Target	FY23 Actual	Fy24 Target	FY24 Actual	FY25 Target	FY25 Actual	FY26 Target	FY26 Actual	FY27 Target	FY27 Actual	Y 1-5 TOTAL TARGET	Yr 1-5 TOTAL ACTUAL
THEME 1 STEWARDSHIP														
MA_1.01	Develop and Deliver an Engagement Program	Number of education resources produced	6		6		6		6		6		30	
		Number of engagement events	2		4		4		4		4		18	
		Number of individuals engaged			80		80		80		80		320	
MA_1.02	Promote Whole Farm Planning & NRM	Number of education resources produced	2										2	
		Number of individuals engaged												
MA_1.03	Promote and Facilitate Establishment of Private Conservation Agreements	Number of conservation agreements established	3		3		3		3		3		15	
		Area protected under conservation agreements	150		150		150		150		150		750	
MA_1.04	Litter and Stormwater Pollution Source Control Program	Number of source control plans developed	1		1								2	
		Number of engagement events	2		2		2		2		2		10	
MA_1.05	Develop and Distribute Education Material and Guidelines for ESC	Number of education products/resources produced					1						1	
MA_1.06	Improve Erosion and Sediment Control	Number of individuals engaged			20				20				40	
THEME 2 WATER QUALITY AND ECOSYSTEM HEALTH														
MA_2.02, 2.03, 2.10,	On-ground remediation	Number individuals engaged	15		15		15		15		15		75	
MA_2.01	Implement Key Priority ASS Management Actions	Number of Ha of priority ASS remediated			775		775						1550	

Action #	Action	Project measure	FY23 Target	FY23 Actual	Fy24 Target	FY24 Actual	FY25 Target	FY25 Actual	FY26 Target	FY26 Actual	FY27 Target	FY27 Actual	Y 1-5 TOTAL TARGET	Yr 1-5 TOTAL ACTUAL
MA_2.02	Protect and/or Rehabilitate Coastal Wetlands	Number of ha coastal wetlands remediated	15		15		15		15		15		75	
MA_2.03	Improve Riparian and Estuarine Bank Vegetation	Number of km riparian buffer vegetation restored	5		5		5		5		5		25	
MA_2.04	Promote Good Catchment Management Practice on public land	Number of Management Plans produced			1									
		Number of ha with improved practices			10		10		10		10		40	
MA_2.05	Enter the Manning River Entrance Project into the NSW Investor Assurance and Business Case Process	Strategic Business case complete Final business case	1		1								2	
MA_2.06	Ensure Manning River Entrance Process includes Extensive Stakeholder Consultation	Number of engagement events												
		Number of individuals engaged												
MA_2.07	Implement a Systematic Approach to Maintaining SQIDs	Number of SQIDs refurbished	2		3								5	
		Upgrade of Wingham Wetlands complete							1				1	
MA_2.08	Review, Revise and Supplement MCC's Current Stormwater Guidance	Revision complete					1						1	
MA_2.09	Revise and Implement the Greater Taree Urban Stormwater Management Plan	Number of stormwater management plans revised/completed			1		1		1				3	
MA_2.10	Prioritise Sensitive Estuarine Riverbank Areas and Implement Stabilisation	Number of studies completed	1										1	
		Number of m of bank land stabilised by installing erosion control measures	750		750		750		750		750		3750	
MA_2.11	Prioritise Unsealed Road Sediment Hotspots and Undertake Remediation	Number of sites remediated	2		2		2		2				8	
MA_2.12	Onsite Sewerage Management System Audit and Compliance Strategy. Implement Audit Program	Development of audit and compliance strategy complete	1										1	
MA_2.13	MER for Ecosystem Health	Annual MER report complete	1		1		1		1		1		5	

Action #	Action	Project measure	FY23 Target	FY23 Actual	Fy24 Target	FY24 Actual	FY25 Target	FY25 Actual	FY26 Target	FY26 Actual	FY27 Target	FY27 Actual	Y 1-5 TOTAL TARGET	Yr 1-5 TOTAL ACTUAL
		Platform for data sharing established					1						1	
		Number of organisations involved in data sharing agreements					4						4	
THEME 3 CLIMATE CHANGE														
MA_3.01	Develop Forward Plan to Retain Retreat Zones for Coastal Wetlands in Partnership with Land Owners	Forward plan complete					1				1			
MA_3.02	Forward plan for Council Assets at Risk from Sea Level Rise	Plan complete									1		1	
MA_3.03	Examine Future Effectiveness of Coastal Inundation Emergency Strategies	Action complete			1								1	
MA_3.04	Long Term Adaptation Plan for Manning Floodplain in Collaboration with Landowners	Number of engagement events			1		1		1		1		4	
		Number individuals engaged			20		20		20		20		80	
THEME 4 BIODIVERSITY														
MA_4.01	Address Barriers to Fish Passage	Number of barriers remediated					1				1		2	
		KM of fish passage restored					70				70		140	
MA_4.02	Develop and Implement Integrated Pest and Weed Control Plans for Local Priorities	Local weed action plan complete			1								1	
		Local pest animal control plan complete			1								1	
		Ha weeds treated within a 200m buffer of the river												
THEME 5 ABORIGINAL CUSTODIANSHIP														
MA_5.01	Involve Aboriginal Community in Management of the River, Catchment and Estuary	Number of Aboriginal people engaged	15		15		15		15		15		75	
MA_5.02	Install Interpretive Signage and Facilitate Cultural Activities	Interpretive signage project complete			1								1	
MA_5.03	Engage Aboriginal People in Water Quality Monitoring	Number of Aboriginal people engaged	10		10		10		10		10		50	
MA_5.04	Appoint Two Aboriginal Members to the Reference Group	Number of Aboriginal people engaged	2		2		2		2		2		2	

Action #	Action	Project measure	FY23 Target	FY23 Actual	Fy24 Target	FY24 Actual	FY25 Target	FY25 Actual	FY26 Target	FY26 Actual	FY27 Target	FY27 Actual	Y 1-5 TOTAL TARGET	Yr 1-5 TOTAL ACTUAL
THEME 6 SOCIAL AND ECONMIC VALUES														
MA_6.01	Investigate & Implement Site-Specific Pathogen Source Control measures	Number of source control investigation complete					1						1	
		Number of sites remediated							5				5	
THEME 7 LAND USE PLANNING														
MA_7.01	Submit a Planning Proposal for CM SEPP	Planning Proposal submitted												
MA_7.02	Preparing Mapping of Coastal Vulnerability Area for Tidal Inundation	CVA mapping complete												
MA_7.03	Identify Water Quality Objectives and Management Targets	Study report complete	1										1	
THEME 8 GOVERNANCE														
MA_8.01	Establish Multi-Stakeholder Management Committee	Number of engagement events	1										1	
MA_8.03	Build the Capacity of Compliance Programs													

Table 17: Project tracking template