



MIDCOAST
council



**MANNING
RIVER
ESTUARY &
CATCHMENT**



MANAGEMENT ACTIONS - PRACTICE NOTES 2021

Annexure J

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 Estuary ECMP Reference Group, the Technical Advisory Group, the Biripi community and our colleagues at Hunter Local Land Services.

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About this document

This document presents Management Actions from the Manning River Estuary and Catchment Management Program (EMP), with practice notes and resources to assist practitioners to implement the program on the ground.

The Management Actions and practice notes were designed to achieve the objectives identified for the ECMP by addressing identified risks. They were derived from several consultation inputs:

- Meetings with the Manning River ECMP 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, assess whether they belonged in the ECMP Action Program, complementary programs or could be amalgamated, and convert them to S.M.A.R.T format (Smart, Measurable, Achievable, Time-bound).
- One-on-one meetings with key stakeholders

During these steps, the management actions were revised through several iterations. In the Manning River ECMP document, only the S.M.A.R.T actions are shown to keep the document concise.

In this document full details from the original actions and workshop sessions have been captured as “practice notes” to ensure all parties involved in implementing the program understand the intent of the actions.

Key comments from agencies, community groups and individuals received during the consultation period have also been included in the final document.

Priority areas have been identified for several of the actions. These are derived from the references below, along with, in some cases, local knowledge and community input.

- Draft Manning River Floodplain Prioritisation Study (Rayner et al. 2021)
- Manning River Estuary and Catchment Spatial Risk Assessment (Swanson2020)
- Riparian and Shoreline Vegetation in the Manning, Great Lakes and Karuah Catchments: Report to Hunter Local Land Services (Pietsch et al. 2019)
- Mapping Hydrologic Refugia in the Manning River Catchment (Powell et al. 2021)

Background to the ECMP

MidCoast Council has worked together with stakeholders to develop the Manning River Estuary and Catchment Management Program 2021-2031 (Manning River ECMP). It sets out a long-term action program for Council, our community and partner organisations to improve the health and resilience of the Manning River and estuary. It will take a whole-of-catchment approach.

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.”

Why the Coastal Management Act?

The Manning River ECMP was prepared under the Coastal Management Act 2016. This requires Councils to prepare coastal management programs to achieve the objects of both the Coastal Management Act and the Marine Estate Management Act.

The NSW Government objectives for healthy coastal areas and a thriving marine estate require management actions in the catchment. For this reason, the Manning River ECMP is a whole-of-catchment program recognising that the fresh and saltwater systems are connected and what happens upstream impacts on the estuary and marine receiving waters. It will primarily address the impact of land-use on water quality and ecosystem health.

Following adoption by Council, the Manning River ECMP will be submitted for certification under the NSW Coastal Management Act. Certification will enable Council to seek co-investment from the NSW Government.

Where are the “coastal” areas in the Manning River?

The Coastal Management Act is concerned with the estuarine reaches of the Manning River, from the tidal limit upstream of Wingham to the dual entrances at Harrington and Farquhar Inlets. The estuary covers an area of approximately 32 km² and features 115 km of inter-connecting channels and islands.

The Manning River ECMP covers a Planning Area commencing 2 km inland from the open coast at both entrances and extending to the top of the catchment. It does not cover Harrington and the Farquhar Inlet entrances.

Concurrent to development of the Manning ECMP, Council is preparing the Old Bar - Manning Point Coastal Management Program (Old Bar – Manning Point CMP). The Old Bar – Manning Point CMP covers from the open coast two km inland. The Old Bar-Manning Point CMP will deal mostly with the influence of oceanic water on land

The NSW Coastal Management Act 2016, identifies four coastal management areas to be managed for social, cultural and economic well-being:

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

Except for the Coastal Vulnerability Area, these areas are mapped in the Coastal Management State Environmental Planning Policy (SEPP).

As the Manning River ECMP is a whole-of-catchment program, we have included two additional areas for the Manning River ECMP. These are:

The Manning Estuary Floodplain: the low-lying area downstream of Taree covering 2,060km².

The Manning River Catchment: The Manning River originates in the Barrington Tops and flows 261 km to the Tasman Sea. Its vast catchment covers an area of approximately 8,420km² with 16 major tributaries.

See Figures 1-4 in Appendix 1 for maps of the Coastal Management SEPP, the ECMP Planning Area, the estuary and the catchment.

Our most valuable natural assets are coastal wetlands and riverbank 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.

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 sustainable practices that contribute to improved catchment and estuarine health.
- Implementing key priority acid sulfate soil management actions from the Manning River Floodplain Prioritisation Study 2021
- Protecting and/or rehabilitating coastal wetlands
- Improving the condition and extent of riparian and estuarine shoreline vegetation

Working together with partners, stakeholders and our community to implement the Manning River ECMP 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.

Principles

Ecologically Sustainable Development: using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased. Since 1997 the Local Government Act has required Councils to implement the principles of Ecologically Sustainable Development into their operations and decision making.

Integrated Water Management: Coordinated land, water and natural resource management, with attention to maintaining ecosystem services for social and economic welfare (GWP 2000).

Strength-based Community development: An approach to development based on harnessing community skills and assets. The Manning River ECMP project team will seek inclusive engagement opportunities with an inclusive range of community participants including Aboriginal people, young people, elders, long-term landowners, newcomers and visitors.

Risk management: involves identifying, assessing and managing risks that will create uncertain outcomes for program objectives.

Systems Thinking: an approach to problem solving which recognises complexity. Solutions seek to address multiple interactions in the system.

Total Catchment Management: The coordinated and sustainable use and management of land, water, vegetation and other natural resources, on a water catchment basis, to balance resource use and conservation.

Regenerative farming: The principle of regenerative is to enhance natural ecosystem services, resulting in sustainable production, an improved natural resource base, healthy nutrient cycling, increased biodiversity and resilience to change.¹

Rehydration of the landscape: This involves reinstating more natural biophysical landscape functions and processes, to improve water reliability and soil organic content while reducing reliance on high-cost artificial inputs.²

Nara: This is a Gathang word meaning “listen to learn.” It means listening and learning from elders, and for this program extends to Aboriginal and non-Aboriginal community walking together to manage the river we love.

Adaptive Management: a systematic approach to improving natural resource management by learning from management outcomes and making changes to improve the ecological response and reduce stressors.

¹ (WA Department of Primary Industries and Regional Development, 2019)

² (Hurditch, 2015)

Key issues

A snapshot of issues derived from the Threat and Risk Assessment for the Manning is provided in the Manning River ECMP main document. If you want to dive deeper to understand these issues, see Annexure I: The Manning River ECMP Issue Analysis Report 2021 available on our web page at www.midcoast.nsw.gov.au/ourmanningriver

Management actions are designed to address the issues shown in Table 1 below. Table 1 shows which of our six management areas are affected by each issue.

ISSUE	Catchment	Floodplain & estuary	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						
Modified freshwater flows						
Entrance modifications						
Flood, coastal & tidal inundation						
Urban stormwater, litter, marine debris						
Biodiversity Loss						
Sewage effluent and septic runoff						
Erosion and sedimentation						

Table 1: CMP and Coastal Management Areas impacted by each issue

Systems thinking: the interactions 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 River ECMP presents issues and actions focussing 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 River ECMP 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 ECMP.

Themes and Objectives

The actions are organised into 8 themes, each with its own objective



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 conserve 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

Stewardship

“It’s the responsibility of everyone to respect and understand our iconic river system – its vast area and dual entrances. Appreciate it, utilise it, do their bit to keep it clean.

Sam Nicholson, Dairy Farmer, member ECMP Reference Group



Management Actions: Stewardship

Action 1.01	<p>Engage river users and the whole community in an engagement program to promote understanding and stewardship of the river:</p> <ul style="list-style-type: none"> a) Identify desired practices, undertake stakeholder analysis and needs assessment, develop an engagement program; b) Implement the engagement program to build understanding of ecosystem values and services and commitment to stewardship.
Issues addressed	<p>Floodplain drainage and ASS; Agricultural impacts; Stormwater and litter; Erosion and sediment; Biodiversity loss; Coastal wetlands loss; Riparian vegetation loss; Low and modified flows</p>
Practice notes	<p><i>“This is a people issue. A lot of people don’t get the impact of day-to-day decisions. Promote public education on the issues. Publicise issues affecting the river. Engage with landholders in the catchment. Improve decision-making.”</i></p> <p>This action involves developing a cohesive community engagement and education program.</p> <p>It aims to build understanding of ecosystem values and services, promote a stewardship ethic and build skills and commitment for sustainable behaviours to protect water quality and ecosystem health.</p> <p>Initially, a needs assessment of river and key target audiences will be completed. Key target audiences may include recreational river users, land managers and developers, residents of waterside villages, school and tertiary students and the Aboriginal community.</p> <p>This will be followed by the development of co-branded, multimedia engagement, training and education resources to build understanding and promote best management practice for the health of the River and Estuary under the "Our Manning River" banner.</p> <p>Topics will include (but not be limited to):</p> <ul style="list-style-type: none"> • Ecology and ecosystem services • Aboriginal cultural values • Biodiversity • OSSM management

- Responsible boating and fishing
- Erosion and sediment control for property earthworks such as dams and driveways
- Litter and stormwater
- Resilience training to prepare and recover from the impacts of drought, fire and flood.
- Compliance with regulations and how to report illegal activities

Training and education will be disseminated via a range of channels, including:

- Co-branded, multi-media training and education resources
- Community events, discovery tours, cultural experiences and other interactive activities.
- Interpretive signage at recreation facilities to promote understanding including cultural knowledge and encourage responsible recreational use of the waterway
- Grass roots events which promote community learning & support innovations such as landscape hydration -
- Stewardship payments and other financial incentives such as rate relief will also be investigated under this action.

Two programs that arose during consultation are:

- Adopting a set of significant flagship and indicator species to use in monitoring and community engagement programs. Species selection will be a collaborative process with input from agency stakeholders, the Biripi and wider community.
- Establish an annual citizen science BioBlitz through the Atlas of Living Australia to document aquatic and riparian biodiversity of the Manning river and estuary

The program will be delivered through partnerships between MCC, HLLS, MC2T Landcare, and community groups such as Gloucester Environment Group and the manning River Turtle Group. Working together in partnership to deliver the program will ensure the best use of engagement resources

For more information: see the *stewardship* chapter in Annexure I: The Manning River Estuary CMP Issue Analysis Report (2021)

**Community
input**

Mid Coast 2 Tops Landcare

- Use a priority sub-catchment approach to target focus within actions.
- Network with other active community groups including Young Farmers Connect and Forest Action Group.
- MCC and Landcare need to create a strategic stakeholder plan, being mindful of the work already being done
- BioBlitz program could be organised by the newly appointed Landcare supporting BCT Conservation Agreements
- Landcare are hoping to hold evening events
- Bring in experts to speak, host a series of talks

Women in Dairy

Noted issues to overcome associated with absentee farmers, new people to the area (no history or local contacts). Workshops would be required to share and spread BMP info.

Gloucester Environment Group

Key local issues include: Clearing of steep slopes, establishing a Landcare group, degraded riparian zone, platypus concerns, limited succession planting of shade trees in grazing paddocks, linking trees and farm production, importance of biodiversity 'stepping stones', need to work directly with farmers as majority of land is privately owned

**Lead
agency**

MCC and HLLS in partnership with MC2T Landcare and DPI

Action 1.02	<p>Promote whole-farm planning and Best Management Practice for catchment outcomes</p> <ul style="list-style-type: none"> a) Establish a Best Environmental Management Practice (BMP) framework for the Manning catchment including the estuary. b) Support landholders to develop whole farm planning approaches to decision making based on best management practices
Issues addressed	Floodplain drainage and ASS; Agricultural Impacts; coastal wetlands; loss of riparian vegetation; biodiversity
Practice notes	<p><i>“I want my farm to continue to be viable, but that means making sure we utilise all nutrients on the farm, they do not leave the farm, and the effluent system works properly.”</i></p> <p>During consultation for the Issue Analysis in Stage 2 of the Manning River ECMP, there was considerable discussion and agreement on what constitutes Best Management Practice to achieve productivity, biodiversity and catchment outcomes. This built on earlier work for the Great Lakes water Quality Improvement Program (2009), which included a cost-benefit analysis of various options.</p> <p>The BMP Framework will bring together this knowledge with additional industry information into a single, accessible, readily understood document to support practitioners and landholders transitioning to BMP.</p> <p>The framework will take a holistic approach to farm management and cover topics such as:</p> <ul style="list-style-type: none"> • foundational knowledge on catchment management and the water cycle; • the role of native vegetation in landscape hydration; • managing pasture cover and building soil carbon for productivity and environmental outcomes; • managing nutrients and erosion to reduce diffuse-source runoff; • improving the condition, extent and connectivity of riparian vegetation; • managing stock to protect groundcover, soils, coastal wetlands, riparian vegetation and riverbanks using tools such as stock exclusion fencing, off-stream watering, cell grazing, providing shade away from waterways;

- sustainable irrigation and water conservation;
- farm dam management;
- drainage and acid sulfate soil management;
- pest and weed management;
- management of acid sulfate soils;
- adapting to future climate change impacts;
- waste management including effluent, silage wrap, dead hens;
- restoring riparian vegetation, native terrestrial vegetation (e.g. “shelter breaks, corridors, stepping stones) and promoting biodiversity on the farm.

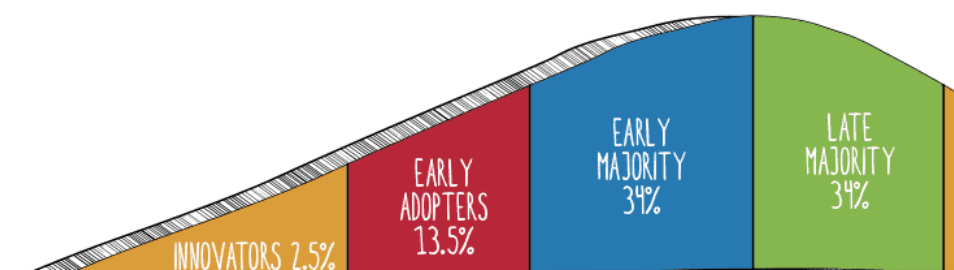
Best practice for a range of cohorts will be covered, including dairy, beef and poultry farmers, lifestyle farmers and market gardeners.

The BMP framework will also provide credible information on regenerative farming and landscape rehydration which are attracting strong interest from some cohorts amongst MidCoast landholders.

Diffusion of innovation is a theory that seeks to explain how, why, and at what rate new ideas and technology are taken up in the community. The categories of adopters are innovators, early adopters, early majority, late majority, and laggards.

The goal for engagement officers is to identify where on the bell curve a landholder sits, then focus support at an appropriate level to promote a transition towards more sustainable practices.

DIFFUSION OF INNOVATION MODEL



The BMP Framework will provide resources for Environmental Officers, Catchment Officers, Agricultural Extension Officers and Landcare Coordinators to support a transition to sustainable agriculture.

Agricultural Extension assists farmers to learn about and adopt improved technology from reliable sources.³ While traditionally the focus was on enhancing production efficiency, the same approach can be used to promote “triple bottom line” sustainable practices that improve social, economic and environmental outcomes. The general objectives of extension are to:

- Assist farmers to discover and analyse their problems and identify their felt needs.
- Develop leadership among farmers and help them organise groups and solve their problems.
- Disseminate research information of economic and practical importance in a way that farmers can understand and use it.
- Assist farmers to mobilise and utilise the resources they have and to identify what they need from outside.
- Collect and transmit feedback information for solving management problems.

A range of engagement tools will be used including incentive programs, demonstration sites, case studies and field days to demonstrate and promote best practice management strategies; supporting Sustainable Farming Groups and peer-to-peer learning.

Farming on the floodplain

There have been numerous trials of management practices to improve environmental and agricultural outcomes on the floodplain. There is a need to further investigate practices that could assist with adaptation to Sea Level Rise and evaluate the benefits of previous trials. It is recommended that trials continue in partnership with farmers, such as liming, re-flooding, wetland rehabilitation, wet pasture and shallow drains.

Monitoring and evaluation should be undertaken to investigate the financial viability and environmental effectiveness, along with a retrospective cost-benefit analysis of previous projects to inform future floodplain farming activities.

For more information: see Appendix 4 and 5 and Annexure D: The Manning River ECMP Farmers Consultation (NBA Consulting 2019)

³ (Famuyiwa, Olaniyi, & Adesoji, 2016)

Community input	<p>Mid Coast 2 Tops Landcare</p> <ul style="list-style-type: none"> • Create of jointly branded materials • Build skills and promote whole farm planning • Old Rivercare plans had great methodology in that they were very targeted, walked the river, provided great diagrams and suggestions for on ground works, people had specifics <p>Women in Dairy</p> <ul style="list-style-type: none"> • Will need to focus on needs of farmers from the bottom-up. • Note new and absentee farmers in the community and their different needs. • Minimal community spaces these days – need to meet ‘on farm’. • Use recent disaster recovery focus as a first step in developing whole farm planning. Disaster management/resilience needs to be part of whole farm plan. • Build on existing industry body models (eg Food Authority’s food safe program exists – but with a focus on effluent management).
Priority areas	<p>Coopernook, Kundle Kundle, Ghinni Ghinni, Cundletown, Mitchell Is; Oxley Is; Dumaresq Is. Glenthorne, Pampoolah.</p>
Lead agency	<p>MCC (1.02a) and HLLS (1.02b) in partnership with MC2T Landcare and DPI</p>

Action 1.03	Promote and facilitate establishment of 30 private conservation agreements covering 1500 ha in the Manning catchment by 2030, through Land for Wildlife and Biodiversity Conservation Trust.
Issues addressed	Agricultural impacts; Biodiversity loss; Riparian vegetation loss
Practice notes	This action will broker private conservation agreements by identifying willing landholders with suitable properties and either facilitating covenants under the Land For Wildlife scheme or referring them to the Biodiversity Conservation Trust for more formal stewardship agreements. LLS, MCC and Midcoast-to-Tops Landcare have suitably trained personnel to deliver outcomes with private conservation agreements, and there may be scope for these agencies to assist in the BCT site assessment process.
Community input	Mid Coast 2 Tops Landcare <ul style="list-style-type: none"> Conservation Agreements support officer to assist this action
Lead agency	Biodiversity Conservation Trust, MidCoast-to-Tops Landcare; MidCoast Council (LFW)
Action 1.04	Develop a litter and stormwater pollution source control program: <ul style="list-style-type: none"> c) Monitor and report annually on the volume, type and location of litter collected during GPT maintenance and clean-up days. d) Utilise this data for targeted education and engagement campaigns. e) Develop source control plans for identified hot spot locations. f) 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

Practice notes	MCC will record the volume, type and location of litter collected as a part of regular maintenance of stormwater gross pollutant traps and as an activity during clean up days. Monitoring data can be used (i) to set reduction targets and to monitor the impact of interventions at specific locations and (ii) to provide data that can be used as part of community education/ engagement strategies which encourage behaviour modification and thus reduce litter at the source. Consider feasibility and effectiveness of containment fencing around commercial premises adjoining waterways.
Priority areas	Taree, Browns Creek, Wingham and Wingham Wetlands
Lead agency	MidCoast Council
Action 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
Practice notes	Within rural lands, earthworks associated with driveways, dams and batter slopes on roadways require ongoing maintenance to prevent the export of sediment into waterways. This management action will build the capacity of rural landowners and the contractors that undertake works on rural property to better manage erosion and sediment control on-site.
Priority areas	Dingo Creek, Lansdowne River, Cedar Party Creek, Barrington River, Barnard River, Upper Manning River
Lead agency	MidCoast Council

Action 1.06	Improve erosion and sediment control (ESC): <ul style="list-style-type: none"> 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 2025
Issues addressed	Stormwater; Erosion and Sediment
Practice notes	<p>MCC will undertake an internal review of their approach to ESC. Existing policies and procedures will be revised to include any identified areas of improvement; benchmarks for future performance and regular audits. An Environmental Management System piloted by Great Lakes Council will be used as input to program design. Funding has been identified to seek expert input on developing new systems (as required), independent auditing and Council staff capacity building.</p> <p>Council will also develop a capacity building program to help support designers, builders, engineering consultants and developers in proper implementation of ESC measures. Priority areas: Brimbin and Figtree developments</p>
Lead agency	MidCoast Council

Water Quality and Ecosystem Health

“We need to maintain ecosystem services; those services that we get from the river for free and the benefits they provide – drinking water, food, recreational spots, the geomorphic regeneration of the river through accretion of silts for agriculture, it supports forests, recharges groundwater and sustains fisheries”

Tony Wales, member ECMP Reference Group



Management Actions: Water Quality and Ecosystem Health

Action 2.01	<p>Implement key priority acid sulfate soil management actions from the Manning River Floodplain Prioritisation Study 2021 including:</p> <ul style="list-style-type: none"> a) Reinstate 1550 ha of coastal wetlands on public and private land subject to landholder agreement. 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
Issues addressed	Floodplain Drainage and ASS, loss and degradation of coastal wetlands
Practice notes	<p>MidCoast Council commissioned the University of NSW's Water Research Laboratory to produce the Lower Manning River Drainage Remediation Plan in 2016. Revised by DPI in 2021, the plan recommends on-ground works to reduce or eliminate acid drainage from 15 subcatchments (Appendix 1, Figure 6). This strategic approach ensures the ASS drainage sites with the greatest potential for adverse impact are prioritised and investment provides the best value-for-money and environmental outcomes. On private land, implementing the Action Plans requires landholder consultation, training and incentives. For land owned or purchased by MCC and other agencies, large scale remediation can be undertaken yielding benefits calculated at \$7 for every \$1 spent.</p> <p>If remediation action is proposed for Crown land, works may require a form of authorisation under the <i>Crown Land Management Act 2016</i>.</p> <p>Actions must also comply with any <i>Native Title Act 1993</i> or <i>Aboriginal Land Rights Act 1983</i> requirements and obligations.</p>
Lead agency	MidCoast Council (lead); DPI-Fisheries, DPIE-Crown Lands, MC2T Landcare

Action 2.02	Investigate options with landholders to restore 100 ha of coastal wetlands on both public and private land by 2031, for example by managing stock and reinstating tidal flushing.
Issues addressed	Agricultural impacts, Coastal Wetlands loss, Biodiversity
Practice notes	<p>A fine-scale coastal wetland mapping study was completed during Stage 2 of the Manning CMP. The percentage of wetlands lost to the floodplain from the legacy of land-clearing and drainage has not been estimated but it would be extensive.</p> <p>While most of the remaining coastal wetlands in the study area were found to be in good condition, around 30% are in fair, poor or very poor condition. Pressures include agricultural and urban land use; modified hydrology; clearing and fragmentation of vegetation; stock access; climate change; weed and pest invasion; increased nutrients and sediment loads; inappropriate fire regimes and general ignorance of wetlands values.</p> <p>If remediation action is proposed for Crown land, works may require a form of authorisation under the <i>Crown Land Management Act 2016</i>.</p> <p>Actions must also comply with any <i>Native Title Act 1993</i> or <i>Aboriginal Land Rights Act 1983</i> requirements and obligations.</p> <p>Pelican Bay</p> <p>In order to mitigate water pollution risks to oyster leases, HLLS commissioned the University of NSW to undertake a desktop study on protection and restoration of coastal wetlands in Pelican Bay (Rayner et. al. 2020). The study identified several on-ground management actions and considered the need for coastal wetlands to migrate upslope if they are to remain viable during future sea level rise scenarios.</p> <p>Field investigations and landholder agreements are required prior to implementation. The Identified works are broken into three sites with works including:</p> <p>Site 1: Fencing of two areas and the optimisation of a culvert to improve connectivity, plus investigation of connectivity under Beale Avenue and Pelican Bay Road, Mitchell Island.</p>

Site 2: Opening of Floodgates on Millers Creek (Manning Point Road) to increase extent of tidal inundation.

Site 3: Fencing of an existing 4.7ha wetland finger extending north from Sheather Creek and under Manning Point Road including construction of an adjacent pathway for stock. The Cost Benefit Analysis for the Manning River ECMP found that a culvert extension as recommended in the WRL report is not cost effective and alternative methods should be employed.

This work is expected to benefit local oyster farmers, primarily by excluding stock from some areas of nearby wetlands and reducing the pathogen load entering the waterway locally. Conservation Agreements with BCT are being explored as a funding stream.

A reasonably robust environmental assessment is indicated alongside final design of the works, given that all key areas are located within the CM SEPP Coastal Wetland Area. However, the works constitute suitable environmental protection works, meaning that development consent and preparation of an Environmental Impact Statement should not be necessary.

Jones Island

There is a parcel of land on Jones Island owned by Transport for NSW. The site is being investigated for acquisition by the NSW Coastal Lands Protection Scheme.

The Jones island site has been identified as a priority site for remediation in the Lower Manning River Drainage Remediation Action Plan (WRL, 2016) due to the presence of high risk acid sulfate soils and the effects of over drainage evidenced by significant areas of acid scalding.

The Plan states that “Jones Island features some of the lowest-lying topography on the entire Manning River floodplain. This area is likely to be increasingly affected by reduced drainage with large areas remaining inundated by 2050 due to increases in low tide levels. Without additional infrastructure the agricultural productivity of the Jones Island is likely to become increasingly reduced and options for full rehabilitation of poorly drained land to wet pastures (freshwater), or wetland (saline) should be investigated.”

As a result, Council is very interested in exploring the options to conserve and rehabilitate this land including the possibility of transferring the ownership of this property to Council for ongoing management. Council has significant experience in managing and rehabilitating acid

	<p>sulfate soil hotspots including the award-winning Big Swamp Project north of Coopernook, which is still in progress.</p> <p>Additional 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.</p> <p>For more information: see the preliminary report at Appendix 6.</p> <p>Other areas</p> <p>In addition to the Pelican Bay project led by HLLS, this action will include ongoing remediation on public land (e.g. Dawson Wetlands) and use incentive schemes and landholder partnerships for on-ground projects on private land such as stock exclusion fencing, restoring tidal flushing and weed control to improve the condition, extent, resilience and ecosystem services of coastal wetlands.</p> <p>A range of co-benefits will be yielded such as fish and aquaculture production, water quality, carbon sequestration and flood mitigation.</p> <p>Appendix 1, Figure 7 maps the priority areas for coastal wetland restoration.</p>
Priority areas	CM SEPP-listed wetlands at Mitchells Island (Pelican Bay), Oxley Island, Cabbage Tree Is. Bohnock, Pampoolah, lower Lansdowne River (Jones and Mamboo islands), Dawson Wetlands.
Lead agency	Hunter Local Land Services
Action 2.03	Improve the condition, extent and connectivity of riparian and estuarine bank vegetation on private and public land by protecting and/or restoring 50 km of buffer vegetation by 2031.
Issues addressed	Riparian vegetation loss; Agricultural impacts
Practice notes	It is well established that healthy riparian zones provide benefits associated with soil conservation, habitat diversity, cooling of the watercourse and provision of shelter. The first step in appropriately

	<p>managing the riparian zones of the system is to undertake more detailed studies including field investigations to prioritise those riparian areas that need to be targeted.</p> <ul style="list-style-type: none"> • Investigate opportunities to establish conservation reserves, including ownership of adjacent land. • Use historic records and intact remnants to identify reference sites and the target distribution of vegetation communities for restoration • Utilise the Riparian and Foreshore Vegetation Report (Pietsch 2019) and the spatial risk assessment (Swanson 2020) to prioritise reaches for field investigation. Prioritise sites for protection and rehabilitation. <p>If remediation action is proposed for Crown land, works may require a form of authorisation under the <i>Crown Land Management Act 2016</i>.</p> <p>Actions must also comply with any <i>Native Title Act 1993</i> or <i>Aboriginal Land Rights Act 1983</i> requirements and obligations.</p> <p>Appendix 1, Figure 8 maps the priority areas for riparian restoration.</p>
Priority areas	<p>Subcatchments with proximity to the estuary: Manning River, Scotts Creek, South Arm. Priority subcatchments for natural regeneration: Ghinni Ghinni Creek, Killabakh Creek, Lansdowne River, Dingo Creek, Moorah Creek, Cedar Party Creek.</p> <p>Subcatchments in the upper catchment: Barnard River, Gloucester River, Barrington River.</p>
Lead agency	Hunter Local Land Services
Action 2.04	<p>Promote good catchment management practice on public land:</p> <ul style="list-style-type: none"> 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
Practice notes	<p>The use of public land which could be flourishing intertidal wetland for cattle grazing is an enduring problem. Cattle tend to feed on salt marsh species, trampling vegetation and compacting the ground at the fringes of the intertidal zone.</p> <p>The purpose of this action is for Crown Lands to support the objectives of the CM Act and Manning CMP ensuring stock on grazing tenures are well managed. Appropriate controls will be put in place when grazing tenures are renewed, and compliance will be undertaken.</p> <p>If funding and support can be identified through partner agencies, there may be opportunity to work in partnership with landholders to remediate wetlands and riparian vegetation.</p>
Lead agency	DPIE-Crown Lands
Action 2.05	<p>Implement the Manning River Taskforce Recommendation 1:</p> <p>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.</p>
Issues addressed	Entrance modifications; Coastal wetlands loss; Biodiversity loss; Climate change; Coastal inundation

Practice notes

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 review options for providing a permanent entrance to the Manning River. The Taskforce considered economic impacts and options to improve navigability of the Manning River via a permanent entrance opening in the north and possibly south channel, within the context of the Coastal Management Act 2016. In November 2020 the taskforce released a Report, which presents the most viable entrance opening options to take forward for further analysis. Recommendation 1 of the taskforce Report has been included as an action here in the CMP to formalise the connection between ongoing Taskforce investigations and implementation of the Manning CMP.

The Taskforce report notes: "given that there is likely to be a significant investment cost in a permanent solution and a lengthy planning and approvals process, particularly in relation to the protection of endangered species and management of coastal industries (including oyster farms), detailed economic and financial analysis should be undertaken to properly understand the full range of benefits that investment in the Manning River Entrance Project (MREP) is likely to yield."

The NSW Marine Estate Management Strategy 2018 – 2020 states that estuarine entrance modification, harbour maintenance, drainage, and other works are the highest threats to species, populations and communities that are listed as protected or threatened under the Fisheries Management Act 1994 (FMA) and the Biodiversity Conservation Act 2016 (BCA).

Council's analysis of this issue for the Manning River Estuary CMP noted a range of risks to the Manning River Estuary. These can be found in full in the Issue Snapshot in this document, with more detail provided in the Issue Analysis supporting document. There are a range of environmental risks to be assessed as part of a cost-benefit analysis.

A continually open entrance has potential to increase tidal ranges and scour the estuary bed and riverbanks. Interactions between tides, waves, currents, sediment movement and freshwater flooding could cause shoaling of the river and entrance and exacerbate down drift beach erosion. Increased tidal ranges are expected to cause drying and flooding of acid sulfate soils on the floodplain, increasing the threat of acid events and altering coastal wetlands. Potential impacts on biodiversity include loss of breeding grounds for threatened migratory

	birds; significant alteration of aquatic flora and fauna assemblages at the inlet.
Lead agency	Transport for NSW
Action 2.06	<p>Implement the Manning River Taskforce Recommendation 2:</p> <p>any future process should be supported by 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.</p>
Issues addressed	Entrance modifications; Fragmented governance
Practice notes	This action is Recommendation 2 of the Manning River taskforce report. Broader stakeholder consultation will enable greater understanding of the potential economic, social and environmental benefits and risks of a permanent entrance. This action also requires consideration of this CMP and its supporting documents as inputs into decision-making related to entrance modifications.
Lead agency	Transport for NSW

Action 2.07	<p>Implement a systematic approach to maintaining stormwater quality improvement devices:</p> <ul style="list-style-type: none"> • Refurbish 5 proprietary Stormwater Quality Improvement Devices to achieve their full working capacity by 2022. • Incorporate Water Sensitive Design devices in the MCC asset management program by 2023 and implement the monitoring, maintenance and renewal program. • Complete a report on the upgrade of Wingham Wetland, including feasibility, budget and scope of works. Implement resulting actions by 2025.
Issue	Stormwater and litter
Practice notes	<p>Stormwater Quality Improvement Devices (SQIDs) may be propriety devices fitted into the stormwater infrastructure, or biological systems such as constructed wetlands. Council has a network of SQIDs which have not been registered in Council's Asset Management System which guides a rolling program of maintenance works. SQID's have therefore historically fallen into disrepair and/or not been maintained as regularly as best practice would dictate.</p> <p>A system audit with management recommendations to monitor, maintain, upgrade or decommission these devices has been developed and will be applied across the Manning Catchment. Some of the proprietary devices were upgraded and refurbished in FY21. Biological controls such as the constructed wetland at Wingham have not yet been addressed.</p> <p>This action involves adding the SQIDs to MCCs Asset Management program to ensure they are appropriately maintained; refurbishing the remaining 5 SQIDs in Taree and restoring function to Wingham Wetlands. Consultation with the Biripi community called for culturally significant plants to be incorporated into the design and upgrade of biological controls such as constructed wetlands.</p>
Priority area	Proprietary devices identified in audit; Wingham constructed wetland
Lead agency	MidCoast Council

Action 2.08	Review, revise and supplement MCC's current stormwater, policies, procedures and guidance in order to create opportunities to incorporate Water Sensitive Urban Design into MCC's new and upgraded capital infrastructure.
Issue	Stormwater and litter
Practice notes	The CMP has an overarching aim to reduce nutrient and sediment inputs to the Estuary. The opportunity has been identified to economically incorporate stormwater quality controls during the installation, upgrade and maintenance of MCC's infrastructure such as roads and public buildings. MCC's stormwater policy will be revised to incorporate requirements for management of water quality treatment on new public capital infrastructure projects and capital infrastructure improvements. This project will determine the supporting technical guidance required to achieve the policy and update or develop the guidance required e (e.g. AUSPEC, road design briefs, technical drawings) should be revised to allow water sensitive urban design to be incorporated into capital infrastructure improvements. Engagement across departments within Council will be required to develop the scope of the policy and garner ongoing support for incorporating water quality treatment in Council's capital projects.
Lead agency	MidCoast Council
Action 2.09	Revise the Greater Taree urban stormwater Management Plan (2000) by 2025, adding the township of Gloucester. Implement resulting Actions.
Issue	Stormwater and litter
Practice notes	The current plans for Taree and Wingham are outdated and will be revised, with Taree as the priority. Plans will include both water quality and quantity controls and identify and prioritise actions. Extensive work will be required to prepare these plans including stormwater infrastructure quality assessments.
Priority areas	Gloucester, Taree including Browns Creek, Wingham

Lead agency	MidCoast Council
Action 2.10	Complete a study to prioritise sensitive estuarine riverbank areas for management. Follow up by stabilising 5 km of estuarine streambanks in priority areas using best practice that promotes native vegetation by 2031.
Issues addressed	Erosion and sediment; Riparian vegetation loss; Recreational boating
Practice notes	<p>The “Manning Riverbank Management Study” (WMA 1997) attributed riverbank movement erosion primarily to natural processes including wind wave attack, current scour, water logging and tree collapse. Man-made influences on riverbank erosion in the estuary were noted as vegetation clearing, entrance opening, channel dredging, extractive industries and wake impacts from passing power boats, which at that time were considered to have a minor impact on erosion.</p> <p>Landholders in the Lansdowne have reported loss of previously fenced and restored riparian vegetation in the Lansdowne due to bank erosion caused by boatwash. The Dawson River was noted as high priority for further investigation in the 1997 report. Pampoolah has been identified as a hot spot by the Hunter Local Land Services. Flood damage in 2021 is focussed on the constrained Manning Channel from Taree to the tidal limit above Wingham.</p> <p>A follow-up study will be completed to thoroughly audit riverbanks using a tool being developed by the Department of Primary Industries – Fisheries. (Development of the riverbank audit tool has been assisted with funding from Transport for NSW). The audit will prioritise sensitive riverbank areas to guide bank protection works in a strategic manner. It will consider a broad range of factors, including:</p> <ul style="list-style-type: none"> • the locations of ongoing erosion • assets threatened by ongoing erosion • presence or otherwise of a riparian vegetation buffer • cause of erosion locations of enhanced boating activity, particularly relating to water skiing / wake boarding

	<ul style="list-style-type: none"> • height of riverbank, rate and length of recession (combined, these aspects indicate the delivery of sediment to the waterway) • ownership of adjacent land (Council, State or Private). <p>Application of the DPI tool results in a map with prioritised reaches and recommended best management practice solutions. Follow up works may be readily achievable in some locations, but in others, management strategies may require consultation with landowners and or state government agencies before works can be implemented. In some instances, robust development of an engineered solution may be required, where erosion is severe and consequential loss of assets through erosion is of concern.</p>
Priority areas	<p>Subcatchments: Manning estuary, Lansdowne River, Dawson River and Scotts Creek to the tidal limit.</p> <p>Flood damage: Gloucester River; Abbots Falls to Dumaresq Island</p>
Submission comments	<p>Transport for NSW (13/07/2021)</p> <p>Supports bank erosion studies and recommends that such studies must be site specific and evidence based. Fund will need to be confirmed for any actions arising from a study.</p> <p>When feasible, financially viable and appropriate to the site, fallen timber will be used instead of rock to promote fish habitat as per DPI best-practice.</p>
Lead agency	Hunter Local Land Services with MidCoast Council
Action 2.11	Identify, assess and prioritise sediment hotspots from unsealed roads. Remediate 5 sites by 2026.
Issues addressed	Erosion and sediment
Practice notes	Rectifying erosion and sediment control on unsealed roads and creek crossing were identified in the statewide MEMS Threat and Risk Assessment and is being delivered under MEMS Action 1.3. MCC will continue its work program improving runoff from unpaved rural roads and intersections and managing stream crossings and drainage (i.e.

	culverts). An assessment tool provided by the Soil Conservation Service will be used to assess candidate sites. The tool quantifies scores for risk factors including ecological function and habitat of the watercourse; geology, slope, and other factors. Undertaking sediment improvement works on the unsealed road network enables MCC to model demonstrate best practice in erosion and sediment control. Funding is presently provided through the Marine Estate Management Strategy, (via LLS) at an approximate budget of \$88K per site. Implementation of this action is dependent on continued funding through the DPI MEMS program.
Priority areas	Subcatchments: Dingo Creek, Lansdowne River, Cedar Party Creek
Lead agency	MidCoast Council
Action 2.12	Complete MCC's Onsite Sewerage Management System (OSSM) Audit and Compliance Strategy by 2022 and implement with a proactive inspection program in identified high-risk locations.
Issues addressed	Pathogens (Sewerage and Septic)
Practice notes	<p>There are more than 12,500 OSSM systems in the MidCoast Region. MCC has obligations under the Local Government Act 1993 and the Local Government (General) Regulation 2005 to ensure that onsite sewage management systems are appropriately approved, installed and managed. MCC will complete and implement an On-site Sewage Management Strategy for the entire MidCoast Council region. All OSSM and pump-to-sewer systems within 500m of oyster leases were mapped in 2019-20, with audits completed on all pump-to-sewer connections in Pelican Bay. OSSM systems that have the potential to threaten sensitive receiving environments, such as estuaries and, in particular, areas containing oyster leases will be prioritised for inspection and compliance. This will ensure that Council has a robust inspection and monitoring program in place for existing OSSM systems operating within the catchment.</p> <p>Priority areas: Areas within proximity of oyster harvest leases with slow tidal exchange and potable water offtakes</p>

Lead agency	MidCoast Council
Action 2.13	Undertake monitoring, evaluation and reporting of ecosystem health to guide adaptive management: <ul style="list-style-type: none"> a) Implement the Manning River ECMP MER Program - Ecosystem Health; b) Establish a platform for data sharing between agencies.
Issues addressed	Monitoring and Evaluation
Practice notes	<p>This action involves implementing the Manning CMP Monitoring, Evaluation and Reporting program for water quality and ecosystem health based on existing monitoring programs (Phase 1) and data sharing (Phase 2). For full details see the MERI program.</p> <p>Additional monitoring sites added to the estuary for water quality report card monitoring include Browns Creek, Lansdown River and Ghinni Ghinni Creek.</p>
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.
Issues addressed	All
Practice notes	<p>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.</p>

	<p>During development of the ECMP, numerous knowledge gaps were identified which will inform the development of research projects during the life of the ECMP.</p> <p>For more information: Proposed studies can be found in Section 11.3 of the Manning River ECMP and Annexure I: Manning River ECMP Issue Analysis Report 2021.</p>
Lead agency	MidCoast Council (Lead) with Hunter LLS, academic institutions



The Manning River estuary

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



Management Actions: Climate Change

Action 3.01	Use research data identifying 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.
Issues addressed	Coastal wetlands loss
Practice notes	Several research projects are underway to model inundation of coastal wetlands and littoral rainforest under climate change scenarios. Agencies and institutions involved include the University of New South Wales, DPI-Fisheries and DPIE-EES. This action will use research results to underpin a forward plan identifying migration pathway to retain the ecosystem services and biodiversity values of these natural assets.
Lead agency	MidCoast Council in partnership with Hunter Local Land Services
Action 3.02	Develop forward plans in Council's Asset Management Program for upgrade and replacement of Council assets at risk from SLR and extreme storm events (e.g. roads, stormwater systems, and river access facilities).
Issues addressed	Impact on infrastructure
Practice notes	<p>Modelling forecasts that Sea Level Rise will commence impacting on Council infrastructure including roads, stormwater and river access systems in approximately 40—50 years' time. MCC adopted its Climate Change Adaptation Strategy in mid-2021.</p> <p>Councils assets that will be impacted by SLR as part of the Asset Management Plan have been identified. This action will be completed in house and involves:</p> <ul style="list-style-type: none"> -Using sea level rise inundation layers (and potentially additional inundation modelling at lower levels of sea level rise, using the existing flood model) to identify assets threatened at imminent, medium term

	<p>and long-term timeframes.</p> <ul style="list-style-type: none"> -Establishing a database showing critical elevations and existing asset condition to inform the Asset Management Plan. -Developing appropriate standards for the upgrade or replacement of assets, including preliminary cost estimates for assets needing work over the next 10 years. - Integrating forward financing of the replacement or upgrading of the assets to standard within Council's Asset Management Plan.
Lead agency	MidCoast Council
Action 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.
Issues addressed	Floodplain drainage and ASS
Practice notes	<p>Council and Hunter Local Land Services have co-funded a doctoral thesis investigating the impacts of sea level rise on the floodplain. Brad Henderson is the PhD candidate, supervised by Will Glamore from the Water Research Laboratory at the University of NSW.</p> <p>The thesis is modelling the effects of sea level rise (SLR) on both agricultural land and coastal wetlands. Over the next 50 - 100 years, how will SLR impact farm productivity? Which parcels of land will remain suitable for farming? What farming techniques will be most effective?</p> <p>At the same time, SLR will inundate coastal wetlands, causing them to retreat landward. Do we have enough buffer land available to maintain the important ecosystem services provided by saltmarsh? At what point will land become more valuable for ecosystem services than production? How will our community transition and who will pay?</p> <p>These are some of the questions that will be addressed in the PhD. This action involves starting conversations with farmers on the floodplain, considering these issues and preparing a long-term plan to adapt to climate impacts.</p>

Community comment	<p>Women in Dairy</p> <p>We need to build understanding of climate change impacts on farming techniques eg what pasture mix will be best in a changing climate?</p>
Lead agency	<p>MidCoast Council in partnership with Hunter Local Land Services</p>



Photo: refuge pools will become even more important as dry periods extend under climate change scenarios

Biodiversity

“There are not too many systems coming out of a World Heritage Area with the ice age diversity of the Gondwana flora. It’s an important piece of dirt!”

Peter Bignell, Grazier, Member ECMP Reference Group



Photo: Platypus Conservation Initiative

Management Actions: Biodiversity

Action 4.01	Address 3 priority sites and/or re-connect 70 km of fish passage by removing or re-designing priority barriers identified in the audit by DPI-Fisheries.
Issues addressed	Biodiversity loss; social and economic values
Practice notes	<p>Barriers to fish passage such as causeways and weirs impact on the abundance and diversity of fish in the estuary and catchment. Reconnecting fish passage is a sub-action under Action 2.4 of the Marine Estate Management Strategy, which will re-establish resilient coastal floodplains and connectivity within coastal catchments.</p> <p>An audit of barriers to fish passage in the Manning catchment was conducted by DPI in 2006, which identified and prioritised 237 constructed barriers in the Manning catchment with 120 prioritised for remediation. Structures included road crossings, floodgates and weirs. Of these, 23 have been rectified to restore fish passage, including weirs on the Lansdowne River and Cedar Party Creek, although early remediation attempts at some sites warrant revisiting as components have moved or deteriorated over time or no longer meet current best practice.</p> <p>Restoring fish passage through road crossings can sometimes be carried out during unsealed road improvements identified in Action 2.13. Achieving the MEMS target to remove fish barriers is led by DPI Fisheries, according to their policy, research and regulations. MidCoast Council would be the project manager on structures owned by Council, while opportunities to work with private landholders will also be explored.</p>
Priority areas	<p>Estuary: barriers on mainstem and tributaries of the Manning with proximity to the estuary.</p> <p>Freshwater subcatchments: Brett Trail Road causeway on the Barnard River; Hicks Lane on the Cooplacurripa River; Duffys Forest Road and Cells River Road on Rowleys River</p>

Lead agency	Department of Primary Industries - fisheries in partnership with MidCoast Council
Action 4.02	Develop and implement cross-tenure integrated pest and weed control plans to protect priority natural assets within the Manning River and its catchment.
Issues addressed	Biodiversity loss
Practice notes	<p>This action includes developing both weed and feral pest control plans for the estuary and catchment, targeting protection of priority natural assets such as threatened species, threatened ecological communities, coastal wetlands and the riparian zone. Lasting change will depend on effective partnerships. Programs will be multi-agency and cross-tenure and provide guidance to coordinate activities of all stakeholders involved in biosecurity.</p> <p>For weeds, the plan will prioritise biosecurity control actions set out in the Hunter Regional Weed Management Strategy and the NSW Biosecurity Strategy that meet the biodiversity and ecosystem health objectives of the Manning River Estuary CMP.</p> <p>The feral pest control plan will be guided by the Hunter Region Pest Control Plan and focus on protecting aquatic fauna species vulnerable to predation such as the Manning River Helmeted Turtle during nesting season, and Platypus during drought.</p> <p>Hunter Local Land Services will provide advice to ensure the local plans meet regulatory requirements.</p>
Lead agency	Hunter Local Land Services (lead) with supporting agencies MCC, NPWS, Forestry Corporation

Action 4.03	Implement recommendations of the Manning Catchment Refugia Study 2021, working in partnership with private landholders to assess, protect, restore and monitor hydrological refugia in 10 priority reaches in the Barnard and Dingo Creek subcatchments.
Issues addressed	Biodiversity loss
Practice notes	<p>In the Manning catchment, freshwater aquatic species include the threatened Manning River Helmeted Turtle, Australian bass and the platypus. Refuge pools are crucial to support these species particularly during drought, and are also used for drinking water by semi-aquatic species.</p> <p>In 2021 DPIE completed a pilot study for MCC modelling the distribution of refuge pools in two priority sub-catchments of the Manning catchment: Barnard River and Dingo Creek. The Barnard River subcatchment is known to have high ecological value including confirmed habitat for threatened species with water dependencies and has a range of land use threats (agriculture, vegetation clearing) impacting aquatic habitats. Dingo Creek subcatchment has greater native vegetation cover, enters the Manning River upstream of the potable water offtake and was fire-affected in 2020. Both were severely drought affected in 2019-20.</p> <p>Study outputs include predictive modelling and mapping of priority reaches within both subcatchments, assessment of connectivity and recommendations. These will be used to prioritise, assess, protect and restore key reaches containing refuges by engaging with landholders and agencies to undertake remediation, protection, awareness and monitoring. Figure 9 in Appendix 1 maps the priority river reaches for refuge pool restoration. This figure shows areas found to have a significant increase in probability of occurrence in the drought model relative to the all-time model are interpreted as areas of priority refugia.</p> <p>On-ground works will include site assessment, stock exclusion, bank stabilisation, assisted natural regeneration or revegetation, and pest and weed control. Community and landholder engagement including citizen science monitoring will promote understanding and stewardship as well as providing data to monitor change and guide adaptive management. Support will be provided for landholders who are interested in further protection of refuge areas and surrounding</p>

	habitats through private conservation agreements. The program will be implemented through the Manning River Helmeted Turtle Steering Group, which is convened by Hunter Local Land Services.
Priority	Subcatchments: Dingo Creek, Barnard River, Nowendoc
Lead agency	MidCoast Council



The Manning River Helmeted Turtle is a flagship species for river management

(Photo: Gary Stephenson)

Aboriginal Custodianship

“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. Medicine and food for our people and ceremonies depend on the health of the river system”

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



Photo: Brett Dolson

Management Actions: Aboriginal Custodianship

Action 5.01	<p>Involve Aboriginal traditional knowledge and personnel in management of the river, catchment and estuary:</p> <ul style="list-style-type: none"> 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
Practice notes	<p>HLLS is coordinating delivery of a 3-year accredited Conservation and Ecosystem Management course to train Aboriginal Rangers in the MidCoast region. MCC will support the course by providing guest speakers to develop relationships with trainees, promote career pathways and build the trainees' knowledge on issues affecting the Manning system and Council's management activities. Cultural Burning to Certificate 3 level will be offered as part of the program, and Firestick Alliance is being engaged by Council to do a cultural burn at Cattai wetlands.</p> <p>Meanwhile the Taree Indigenous Development Enterprise (TIDE) is tendering for a 7-year contract through NIAA for a working on country program. If successful, this will offer more opportunities for Aboriginal Ranger roles. Council will engage Aboriginal teams and support capacity building for field activities such as weed control and cultural burning, especially on grant projects funded by the NSW Government, which sets procurement targets for Aboriginal employment and suppliers.</p>
Lead agency	MidCoast Council

Action 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
Practice notes	This action was recommended by the Birrbay Voices consultation report, and links with the stewardship program (Action 1.01). The action will have the dual purpose of promoting Aboriginal culture and ecological knowledge to the wider community and honouring the living connection of local Aboriginal people with the river, making them feel welcome on country.
Lead agency	MidCoast Council
Action 5.03	Involve Aboriginal people in monitoring of the river: <ul style="list-style-type: none"> 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
Practice notes	<p>The first part of this action relates to feedback in the Birrbay Voices consultation report. There was concern about lack of engagement leading to lack of trust: <i>"It is important and our responsibility for our children to have a clear connection to country, to know who they are as Birrbay people and to understand their responsibility to care for country. To know their culture and what our country offers."</i></p> <p>Getting involved in education for Aboriginal school students was suggested as a way to build relationships with children that will support reconciliation in the long term. Waterwatch is an ideal vehicle for this as it is an ongoing, well established program.</p> <p>The second part of this action comes from concerns expressed in the Birrbay Voices consultation about water pollution, contaminated sediment and failure to identify and prosecute polluters. <i>"Our connection to country, to the water of the</i></p>

	<p><i>river and the salt of the sea is important to who we are. If our river dies our culture dies."</i></p> <p>This action will involve the Aboriginal community in reporting pollution incidents through a single Council contact officer, who can refer matters to the appropriate compliance agency for follow-up. Information will be provided to interested Biripi people on types of pollution, regulations, reporting and compliance.</p>
Lead agency	MidCoast Council
Action 5.04	Increase involvement of Aboriginal people in the Manning ECMP by appointing two Aboriginal representatives to the ECMP Reference Group (See Action 8.01) and inviting Council's Aboriginal Community Development Officer to attend meetings.
Issues addressed	Governance
Practice notes	Currently the CEO of the Purfleet-Taree Local Aboriginal Land Council is a member of the ECMP Reference Group. This action seeks to increase Aboriginal representation on the committee.
Lead agency	MidCoast Council

Social and Economic Values

“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



Photo: Jordan Reed

Management Actions: Social and Economic Values

Action 6.01	Investigate and implement pathogen source control measures as required for high-risk areas.
Issues addressed	Pathogens
Practice notes	<p>This action allocates some funds to investigating and implementing source controls in high risk areas.</p> <p>Substantial work is being completed relating to identifying high risk areas for the impact of pathogens on the oyster industry and (to a lesser extent) recreational use including:</p> <ul style="list-style-type: none"> • The installation of permanent data collection instrumentation near oyster leases • Genomic tracing to characterise the source of pathogen contamination Investigation of potential on-ground management actions to address perceived risks (e.g. Pelican Bay). • Risk assessment as part of the "Development Assessment Framework" <p>Information flow is good in relation to this issue, with active networks across agencies, research organisations and industry, and good continuity of personnel.</p>
Priority Areas	Proximity to oyster harvest leases, potable water offtakes and aquatic recreation areas
Lead agency	MidCoast Council

Land Use Planning

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

Kirsty Hughes, Community Representative and Member ECMP Reference Group



Photo Credit Hamilton Lund

Management Actions: Land Use Planning

Action 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.
Issues addressed	Coastal Wetlands
Practice notes	<p>MCC is planning to go through the gateway process to modify maps in the Coastal Management SEPP. Fine-scale coastal wetland mapping was undertaken in 2019 and evidence was documented in 2021 to support a recommendation to amend the CM SEPP maps for coastal wetlands.</p> <p>MCC's intention is to go through the entire planning proposal process once, covering the entire LGA and forthcoming CMP/s for Old bar Manning Point, the remaining open coast, Karuah, Myall, Smiths Lake and Wallis Lake catchments. Further mapping studies are programmed for 2021-22. Prior submitting a planning proposal, MCC will undertake consultation with any affected landholders.</p>
Lead agency	MidCoast Council
Action 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

Practice notes	<p>Council will, in future, prepare an LGA wide planning proposal to modify mapping within the Coastal Management SEPP. A preliminary assessment of the scale of coastal inundation vulnerability, relating to tides under SLR scenarios, has been documented in the Climate Change Issues Paper informing the CMP.</p> <p>More rigorous assessment of coastal vulnerability relating to tidal inundation will be undertaken in the future when an appropriate methodology for CVA mapping has been accepted.</p> <p>A key consideration will be the influence of sea level rise on tidal inundation around riverfront areas and the appropriate location of foreshore building lines. Some analysis will need to be done on the impact of climate change and sea level rise specifically. Council have a pre-existing flood model which should be fit for purpose to undertake the underpinning assessment. The model may need to be recalibrated to ensure that it is adequately representing tidally-driven hydrodynamics. Alternatively, a numerical model presently being developed by UNSW may be fit for purpose.</p>
Lead agency	MidCoast Council
Action 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 LEP and DCP.
Issues	Stormwater, Erosion and Sediment
Practice notes	<p>The NSW Government developed a ‘Risk-based framework for considering waterway health outcomes in strategic land use planning decisions’ for implementation of the Marine Estate Management Strategy 2018-2028. The Risk-based Framework is a protocol that decision makers such as NRM Managers, planners and environmental regulators can use to help manage the impacts of land-use activities on the health of waterways.</p> <p>This action will determine the water quality requirements of receiving waters, and how this relates to the way land is managed. It will build on the work completed to develop the former Great Lakes DCP relating to water quality impacts of urban and other development types. It is</p>

	envisaged that findings will be based on the NSW Government's Risk Based Framework.
Lead agency	MidCoast Council

Governance

“Look at the whole picture and manage holistically”.

Peter Neal, Dairy Farmer, Member ECMP Reference Group



Management Actions: Governance

Action 8.01	Establish a CMP Working Group to coordinate operational implementation of the Manning River CMP, with representation from all government agencies involved in project delivery.
Issues addressed	Fragmented Governance
Practice notes	<p>The Manning CMP Reference Group includes representatives from local and state government, the Local Aboriginal Land Council, community and industry groups.</p> <p>Following the Council election in September 2021, all current committees of Council will fold. At this point there will be a review of the structure.</p> <p>Two options are being considered.</p> <p>Option 1: a single multi-stakeholder Reference Group with a mix of government agencies and community representatives</p> <p>Option 2: a community reference group to provide input and oversight, and a working group consisting of delivery partners involved in the operational implementation of the ECMP.</p>
Lead agency	MidCoast Council

Action 8.03	<p>Implement a holistic, interagency approach to compliance and regulation focussing on identified ECMP risks and issues.</p> <ul style="list-style-type: none"> 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
Practice notes	<p>Lack of compliance and enforcement was raised as a concern during many of discussion groups held for the issue analysis in Stage 3 of CMP development. Concerns included vegetation clearing (especially riparian and littoral vegetation); compliance with permit conditions on Crown Land; reducing erosion and sediment from construction sites and earthworks on rural properties (e.g. dam batters, driveways); and water extraction. It was also raised in the Birrbay Voices consultation report, with Aboriginal people expressing concerns about lack of compliance relating to pollution and extraction: "Keeping the river flowing and healthy is important to all of us both black and white." This action aligns with Action 9.4 in the MEMS to build capacity for compliance through interagency collaboration and includes promotion of regulations and how to report infringements.</p>
Lead agency	MidCoast Council, Hunter Local Land Services, DPIE - Crown Lands

References

- 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 Hunter Local Land Services. Precision Erosion & Sediment Management Research Group, Griffith University
- Powell, M., Wen, L. and Scanes, S., 2021. Mapping Hydrologic Refugia in the Manning River Catchment: a pilot study to develop methods and assist prioritisation of areas for protection, prepared for MidCoast Council, Department of Planning, Industry and Environment, Sydney.
- 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
- Swanson, R. (2020). *Manning River Estuary and Catchment Spatial Risk Assessment*. NSW Department of Planning, Industry and Environment.

Appendices

Appendix 1: Maps and Priority Areas

Figure 1 shows the three Coastal Management Program planning areas proposed for the Manning catchment. The rationale for selection of the planning areas is provided in the Manning River ECMP (Section 1.3). The Manning River ECMP planning area extends to cover the remainder of the catchment.

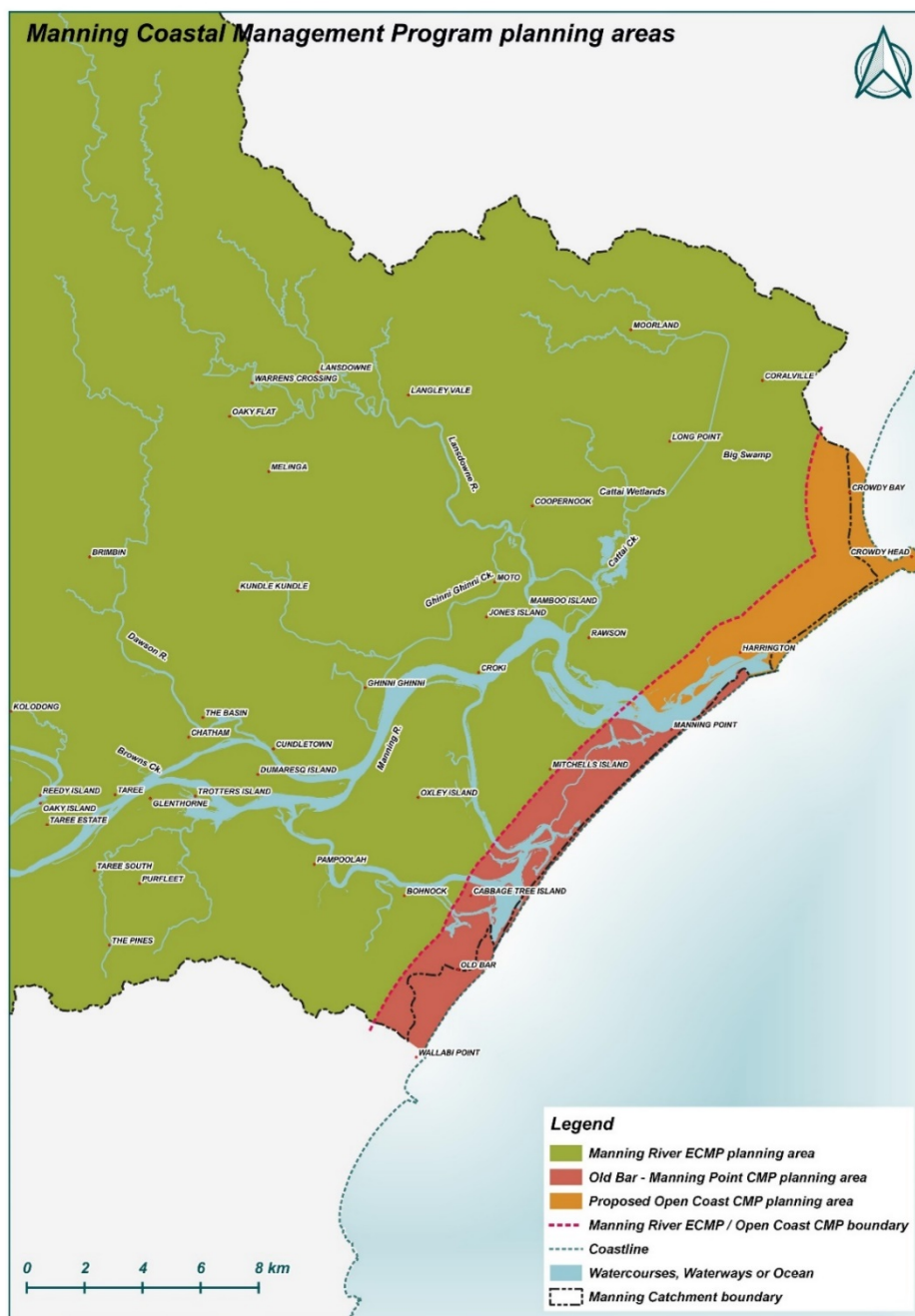


Figure 1: Proposed Manning Coastal Management Program planning areas

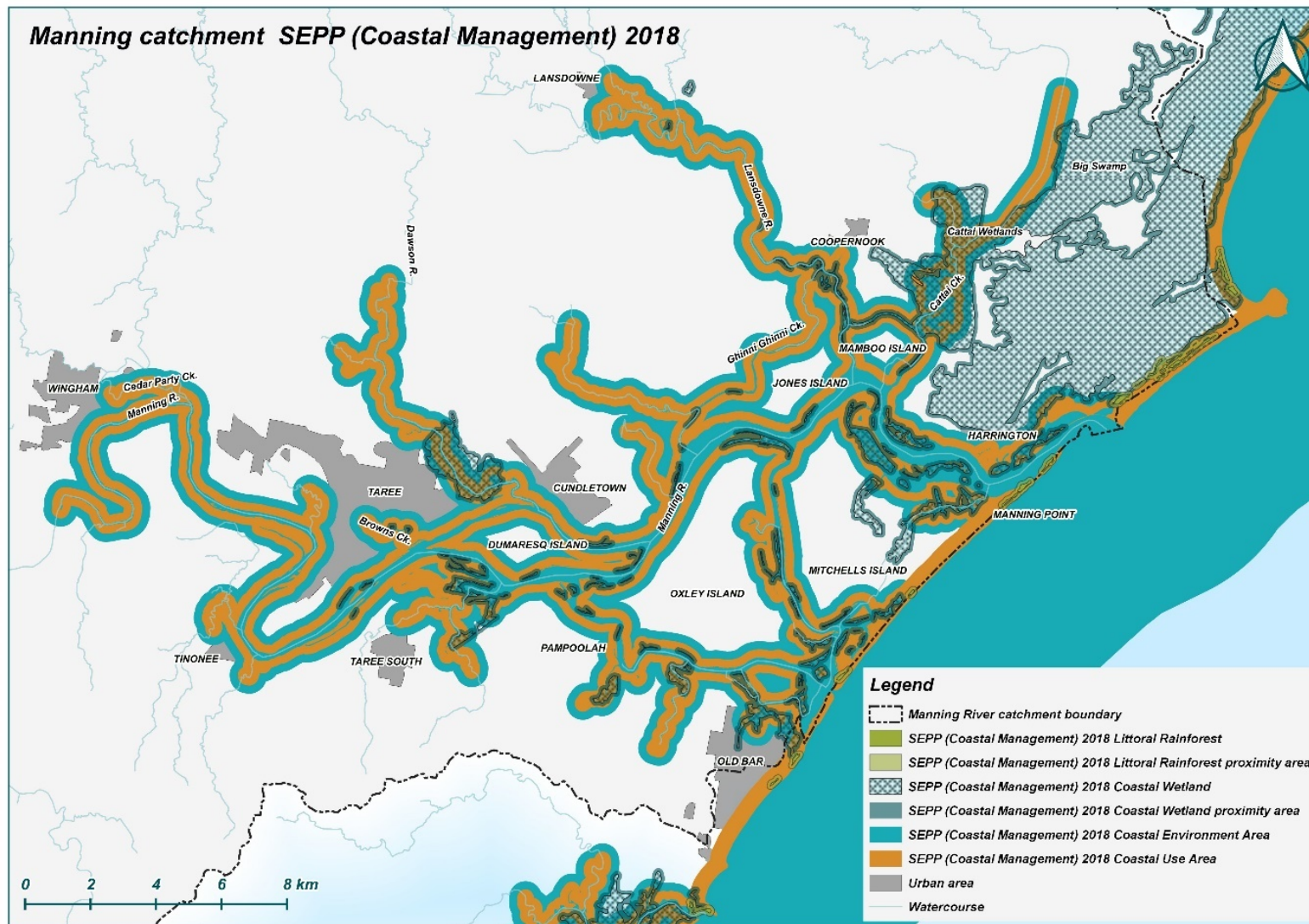


Figure 2: Coastal Management Areas, State Environmental Planning Policy (Coastal Management) 2018

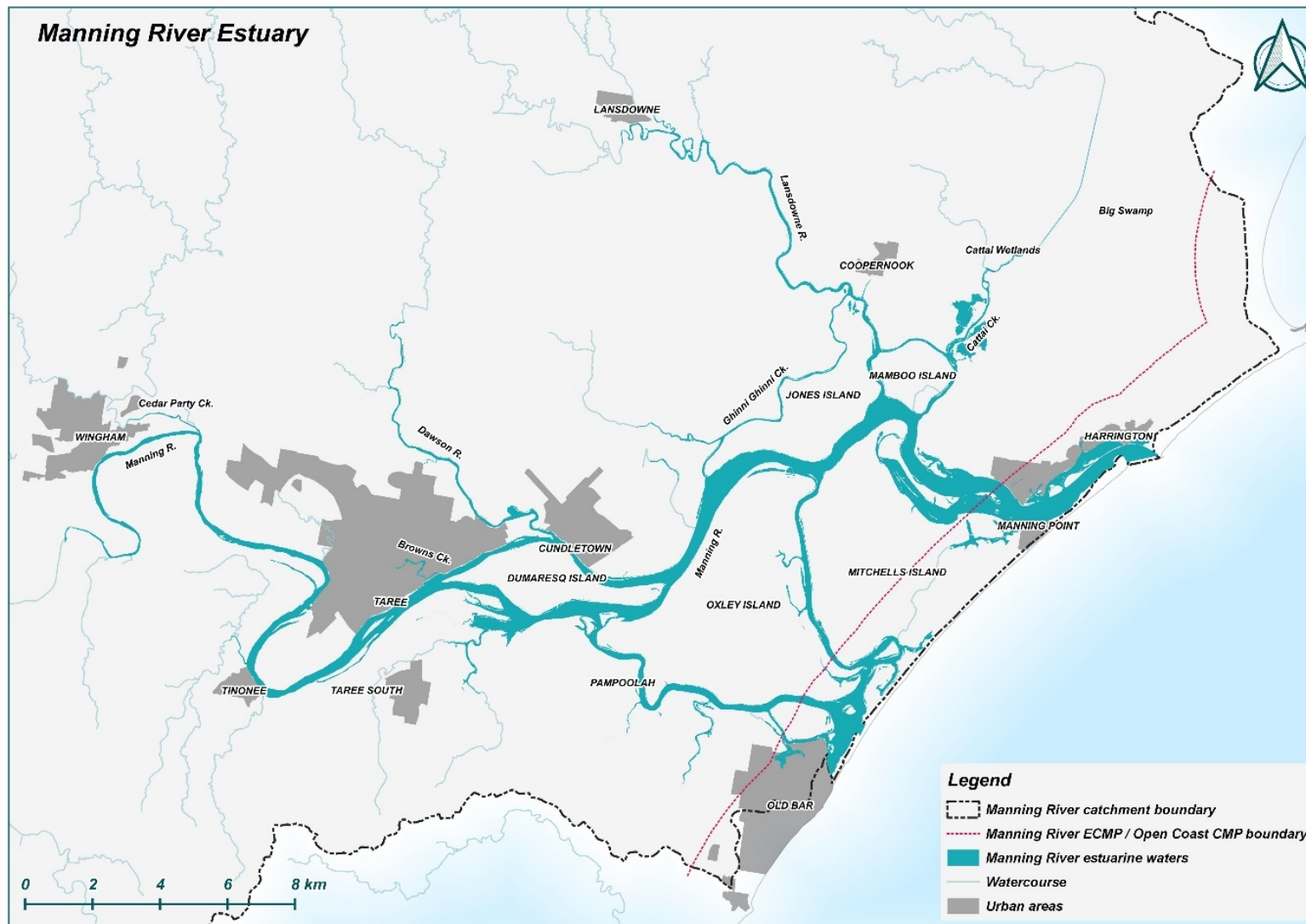


Figure 3: The Manning River Estuary

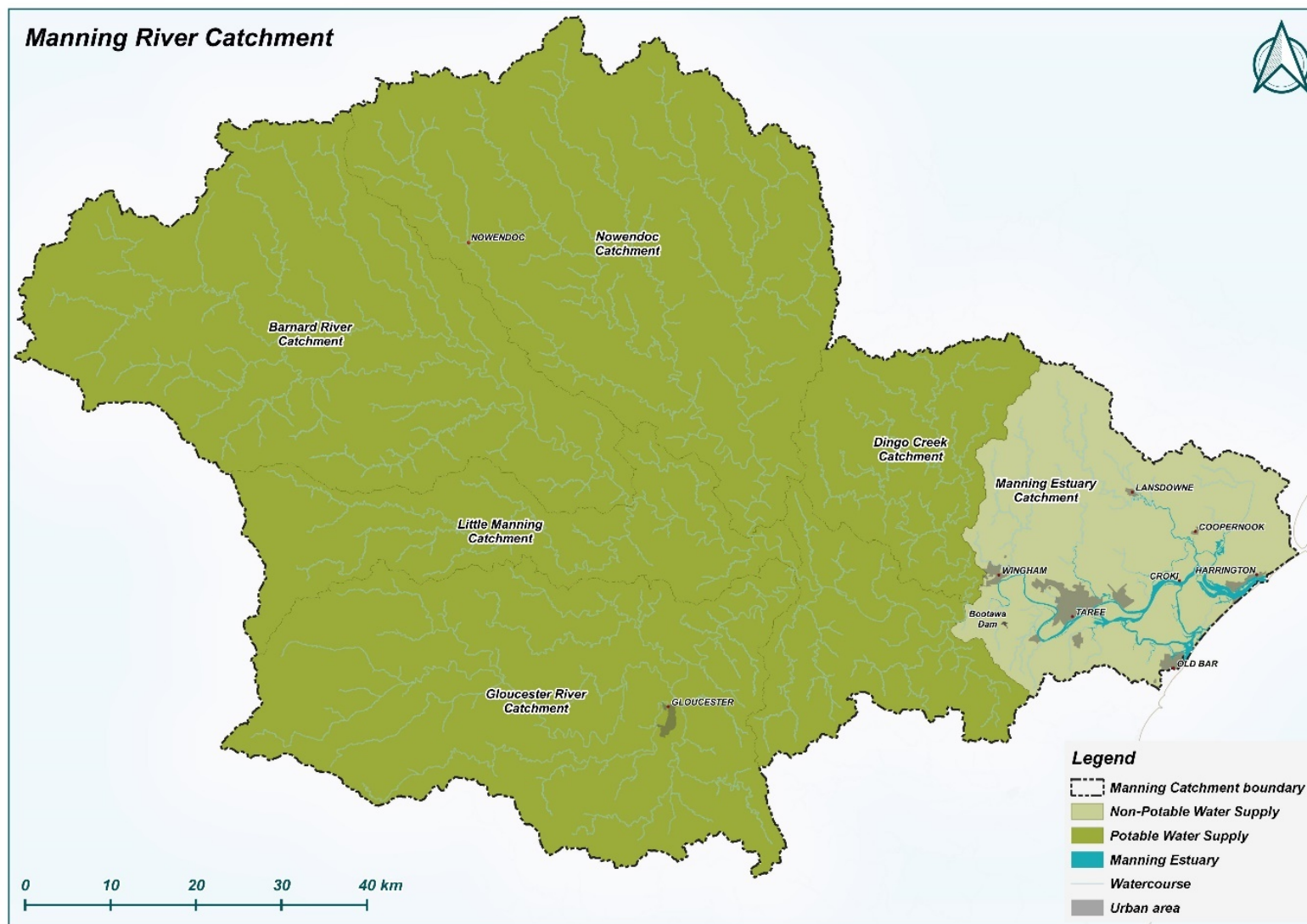


Figure 4: The Manning River Catchment

Figure 5 shows the risk ratings for sediment and nutrient loading in each subcatchment from the Manning River Estuary and Catchment Spatial Risk Assessment (Swanson 2020). The high and moderate subcatchments are priorities for Management Action 1.02 – promoting best management practice and whole farm planning to reduce sediment and nutrients in diffuse source run-off.

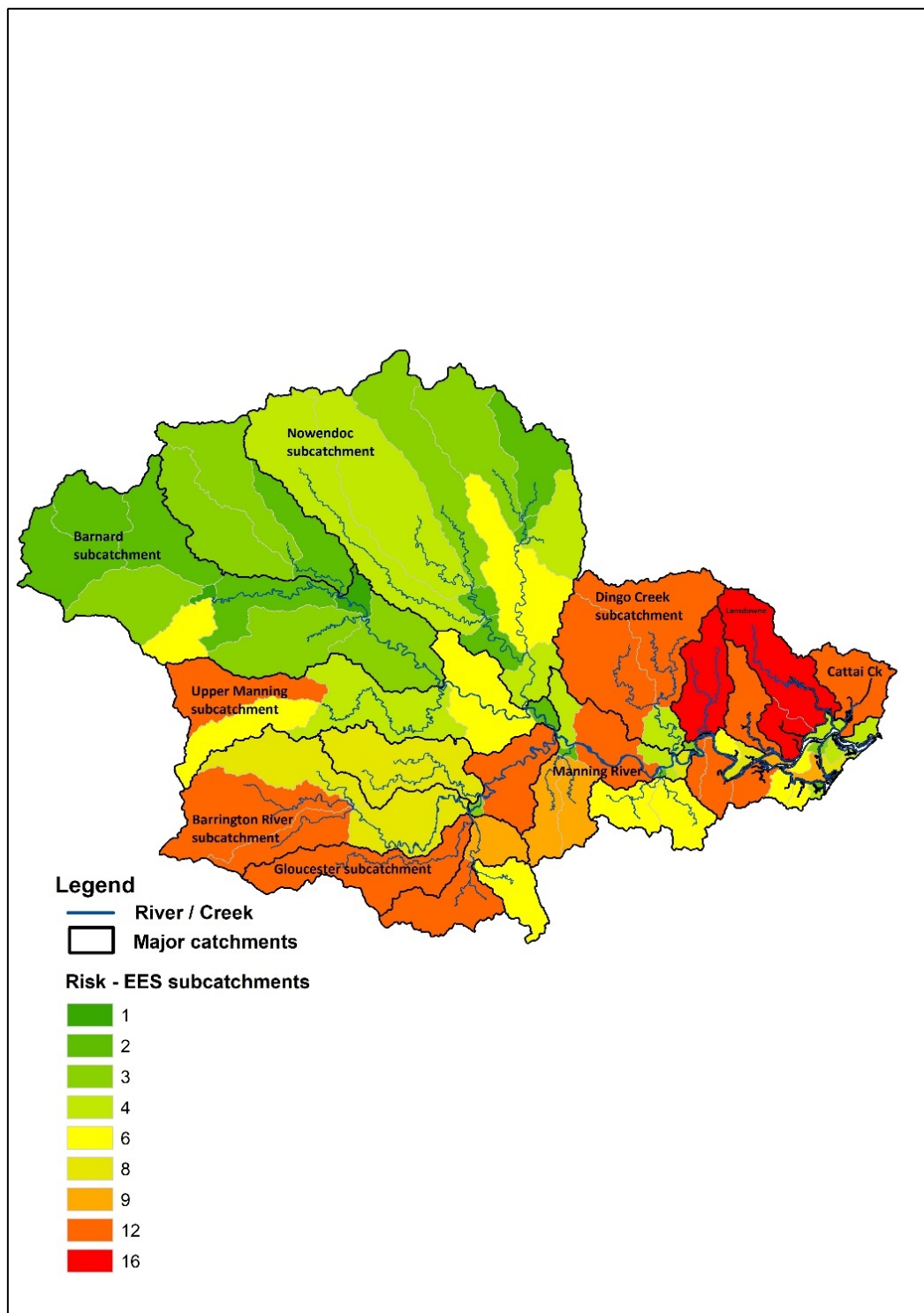


Figure 5: Estuary Health Risk Map

Figure 6 shows the risk rating for acid sulfate soils in the Manning River Estuary highlighting priority areas for restoration. The priorities are referred to in Management Action 2.01.

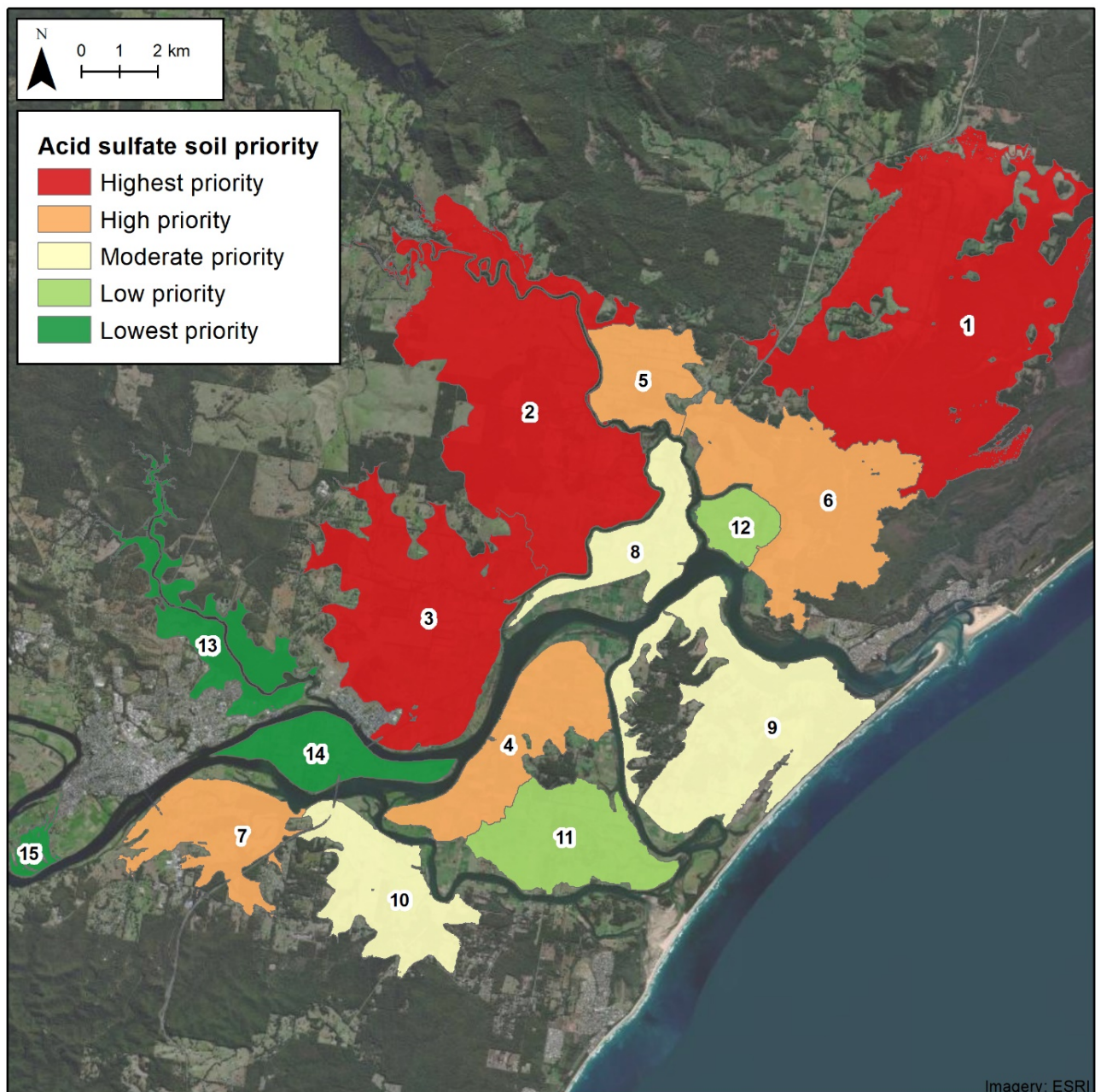


Figure 6: Priority areas - acid sulfate soil remediation

Reference: Rayner et. al. (2021)

Figure 7 shows the priority coastal wetlands for restoration referred to in Management Action 2.02. These are the coastal wetlands and their proximity areas (buffer zones) listed under the State Environmental Planning Policy (Coastal Management) 2018.

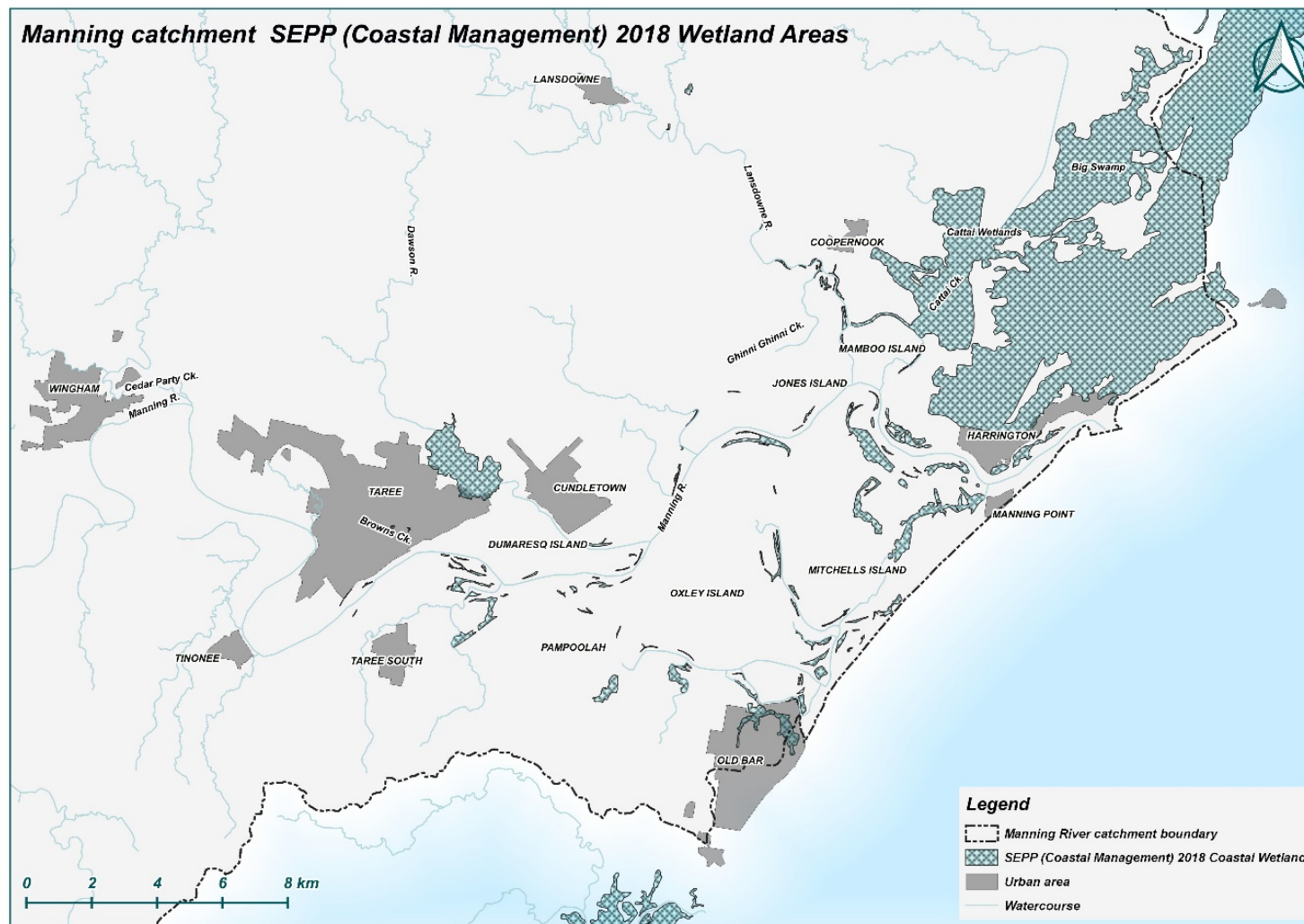


Figure 7: Priority areas - coastal wetlands restoration

Figure 8 (Swanson 2020) shows priority areas in red for Management Action 2.03: riparian restoration in the Manning River Catchment. The map uses data from Pietsch et al (2019). Those subcatchments with the lowest proportion of trees > 2m are a good starting point for field investigations to further prioritise restoration projects. Note that several alternate methodologies have been proposed Pietsch et al. (2019) for prioritising river reaches for riparian restoration. All priority areas proposed by Pietsch are listed in the text for Management Action 2.03.

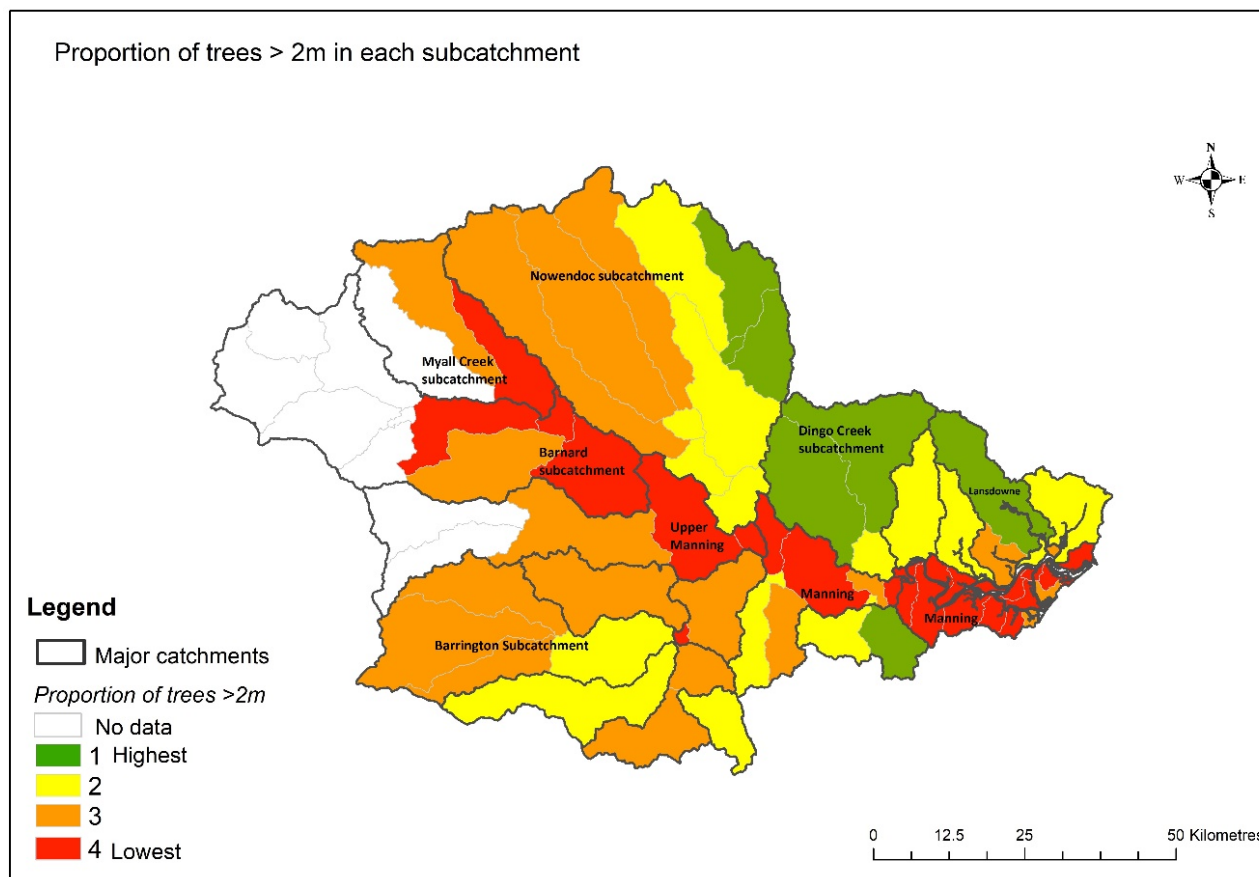


Figure 8: Priority areas - riparian restoration

Figure 9 shows river reaches in the Barnard and Dingo Creek Subcatchments with a significant probability of occurrence of priority refugia for *Myuchelys purvisi* (Manning River helmeted turtle) during drought. The priorities are referred to in Management Action 4.03. Additional priorities for platypus refuge pools are provided in the report (Powell et al. 2021), available from MidCoast Council.

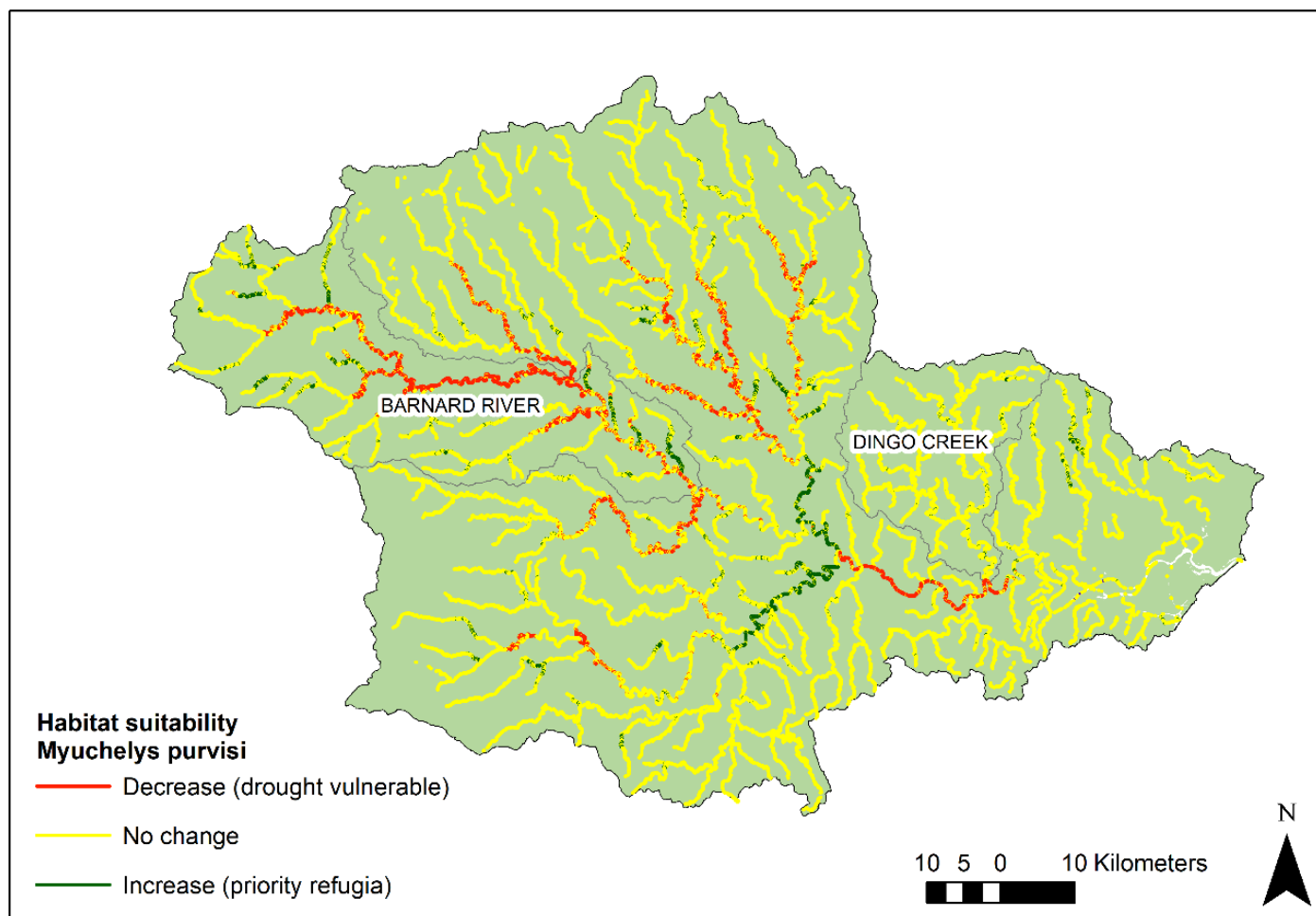


Figure 9: Priority reaches - refuge pool restoration

Appendix 2: Implementation Schedules

Actions led by MCC

Action #	Management Action	Lead agency	Supporting agencies	Impact Score*	SHORT TERM YEAR 1	MEDIUM TERM YEARS 2-5				LONG TERM - YEARS 6-10
					FY22	FY23	FY24	FY25	FY 26	FY27-31
1.01	Stewardship program	MCC	HLLS, MC2T Landcare, DPI, Community Groups, Schools	93						
1.02a	Develop n Best Environmental Management Practice framework for agriculture	MCC	HLLS, MC2T Landcare, DPI, Industry Groups	110						
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						

Action #	Management Action	Lead agency	Supporting agencies	Impact Score*	SHORT TERM YEAR 1	MEDIUM TERM YEARS 2-5				LONG TERM - YEARS 6-10
					FY22	FY23	FY24	FY25	FY 26	FY27-31
2.01	Implement Key Priority ASS Management Actions	MCC	Coastal Protection Acquisition Scheme; DPI-Fisheries; DPIE-Crown Lands	106						
2.07	Implement a Systematic Approach to Maintaining SQIDs	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						
2.11	Study Unsealed Road Sediment Hotspots and Remediate Hotspots	MCC	HLLS, DPI - Fisheries	31						
2.12	Complete and Implement Onsite Sewerage Management System Audit and Compliance Strategy	MCC		84						
2.13	MER for Ecosystem Health	MCC		91						
2.14	Scientific research program	MCC	Academic institutions, HLLS							

Action #	Management Action	Lead agency	Supporting agencies	Impact Score*	SHORT TERM YEAR 1	MEDIUM TERM YEARS 2-5				LONG TERM - YEARS 6-10
					FY22	FY23	FY24	FY25	FY 26	FY27-31
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 Barriers to Fish Passage	MCC	DPI-Fisheries	45						
4.03	Implement Recommendations of Refugia Study	MCC	MR Turtle Steering group	16						
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						

Action #	Management Action	Lead agency	Supporting agencies	Impact Score*	SHORT TERM YEAR 1	MEDIUM TERM YEARS 2-5				LONG TERM - YEARS 6-10
					FY22	FY23	FY24	FY25	FY 26	FY27-31
5.04	Involve Aboriginal People in Implementation of the Manning CMP	MCC	HLLS, TIDE, PT LALC	87						
6.01	Investigate & 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	Preparing 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						

* *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 Annexure K.*

Actions lead by other Agencies

Action #	Management Action	Lead agency	Supporting agencies	Impact Score	SHORT TERM YEAR 1	MEDIUM TERM YEARS 2-5					LONG TERM - YEARS 6-10
					FY22	FY23	FY24	FY25	FY 26	FY27-31	
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	HLLS, MC2T Landcare	76							
2.02	Protect and/or Rehabilitate Coastal Wetlands	HLLS	MCC, DPI-Fisheries, BCT, NPWS, DPIE-Crown Lands; Coastal Protection Acquisition Scheme, MC2T Landcare	104							
2.03	Improve Riparian and Estuarine Bank Vegetation	HLLS	MCC, DPIE – Crown Lands, MC2T Landcare	101							
2.04	Promote good catchment management practice on public land	DPIE-Crown Lands	MCC, HLLS, NPWS	32							
2.05	Enter the Manning River Entrance Project into the NSW Investor Assurance and Business Case Process	TfNSW		1							
2.06	Ensure Manning River Entrance Process includes Extensive Stakeholder Consultation	TfNSW		32							

Action #	Management Action	Lead agency	Supporting agencies	Impact Score	SHORT TERM YEAR 1	MEDIUM TERM YEARS 2-5				LONG TERM - YEARS 6-10
					FY22	FY23	FY24	FY25	FY 26	FY27-31
2.10	Study and Prioritise Sensitive Estuarine Riverbank Areas for Management and Stabilise 7.5 km	HLLS	MCC, DPI-Fisheries, NPWS	64						
4.02	Develop Integrated Pest and Weed Control Plans	HLLS	MCC, NPWS, Forestry Corp	76						
8.02	Holistic approach to Compliance Programs	DPIE-Crown Lands	MCC	71						

Appendix 3: Monitoring, Evaluation and Reporting Template

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

Action #	Action	Project measure	FY22 Target	FY22 Actual	Fy23 Target	FY23 Actual	FY24 Target	FY24 Actual	FY25 Target	FY25 Actual	FY26 Target	FY26 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	Best Management Practice for Whole Farm Planning	Number of education resources produced	2										2	
		Number of individuals engaged												

Action #	Action	Project measure	FY22 Target	FY22 Actual	Fy23 Target	FY23 Actual	FY24 Target	FY24 Actual	FY25 Target	FY25 Actual	FY26 Target	FY26 Actual	Y 1-5 TOTAL TARGET	Yr 1-5 TOTAL ACTUAL
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	Develop a 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	FY22 Target	FY22 Actual	Fy23 Target	FY23 Actual	FY24 Target	FY24 Actual	FY25 Target	FY25 Actual	FY26 Target	FY26 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	10		10		10		10		10		50	
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	

Action #	Action	Project measure	FY22 Target	FY22 Actual	Fy23 Target	FY23 Actual	FY24 Target	FY24 Actual	FY25 Target	FY25 Actual	FY26 Target	FY26 Actual	Y 1-5 TOTAL TARGET	Yr 1-5 TOTAL ACTUAL
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	
		Platform for data sharing established					1						1	

Action #	Action	Project measure	FY22 Target	FY22 Actual	Fy23 Target	FY23 Actual	FY24 Target	FY24 Actual	FY25 Target	FY25 Actual	FY26 Target	FY26 Actual	Y 1-5 TOTAL TARGET	Yr 1-5 TOTAL ACTUAL
		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	

Action #	Action	Project measure	FY22 Target	FY22 Actual	Fy23 Target	FY23 Actual	FY24 Target	FY24 Actual	FY25 Target	FY25 Actual	FY26 Target	FY26 Actual	Y 1-5 TOTAL TARGET	Yr 1-5 TOTAL ACTUAL
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												
MA_4.03	Implement Recommendations of Refugia Study	Number of sites restored	3		3		3		3		3		15	
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 ECMP Reference Group	Number of Aboriginal people engaged	2		2		2		2		2		2	

Action #	Action	Project measure	FY22 Target	FY22 Actual	Fy23 Target	FY23 Actual	FY24 Target	FY24 Actual	FY25 Target	FY25 Actual	FY26 Target	FY26 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													

Appendix 4: Budget Schedules

Total budget per year

Financial Year	Source of Funding			
	\$ MCC	\$ HLLS	\$ DPIE (C&E)	\$ TOTAL
2021/22	2,337,733	448,000	4,265,467	7,051,200
2022/23	874,408	559,000	1,368,815	2,802,223
2023/24	575,309	604,000	930,618	2,109,927
2024/25	299,400	516,000	368,800	1,184,200
2025/26	286,067	428,000	362,133	1,076,200
Mid 2026 onwards	1,523,667	1,590,000	1,937,333	5,051,000
Totals	\$5,896,583	\$4,145,000	\$9,233,167	\$19,274,750



Budget - Management Actions

Action #	Management Option	Total Cost	Funding and Delivery Program																	
			2021/2022			2022/2023			2023/2024			2024/2025			2025/2026			Mid 2026 onwards		
			\$ MCC	\$ HLLS	\$ DPIE (C&E)	\$ MCC	\$ HLLS	\$ DPIE (C&E)	\$ MCC	\$ HLLS	\$ DPIE (C&E)	\$ MCC	\$ HLLS	\$ DPIE (C&E)	\$ MCC	\$ HLLS	\$ DPIE (C&E)	\$ MCC	\$ HLLS	\$ DPIE (C&E)
MA_1.01	Develop and Deliver an Engagement Program	570,000	15,000	25,000	30,000	25,000	5,000	30,000	15,000	5,000	30,000	25,000	5,000	30,000	15,000	5,000	30,000	105,000	25,000	150,000
MA_1.02	Promote Whole Farm Planning and Best Management Practice**	200,000				15,000	5,000	30,000		50,000			50,000			50,000				
MA_1.03	Promote and Facilitate Establishment of Private Conservation Agreements	50,000	5,000			5,000			5,000			5,000			5,000			25,000		
MA_1.04	Develop a Litter and Stormwater Pollution Source Control Program	400,000	13,333		26,667	13,333		26,667	13,333		26,667	13,333		26,667	13,333		26,667	66,667		133,333
MA_1.05	Develop and Distribute Education Material and Guidelines for ESC on Private Land	5,000							5,000											
MA_1.06	Improve Erosion and Sediment Control for Council and Developers	300,000	10,000		20,000	10,000		20,000	10,000		20,000	10,000		20,000	10,000		20,000	50,000		100,000
MA_2.01	Implement Key Priority ASS Management Actions	6,341,250	1,753,667		3,507,333	353,417		706,833	3,333		6,667	3,333		6,667						
MA_2.02	Protect and/or Rehabilitate Coastal Wetlands**	490,000	12,000	13,000	24,000	12,000	13,000	24,000	12,000	13,000	24,000	12,000	13,000	24,000	12,000	13,000	24,000	60,000	65,000	120,000
MA_2.03	Improve Riparian and Estuarine Bank Vegetation	4,350,000	75,000	210,000	150,000	75,000	210,000	150,000	75,000	210,000	150,000	75,000	210,000	150,000	75,000	210,000	150,000	375,000	1,050,000	750,000
MA_2.04	Promote Good Catchment Management Practice on Public Land	0																		
MA_2.05	Manning River Entrance Project Business Case Process	0																		
MA_2.06	Ensure Manning River Entrance Process includes Extensive Stakeholder Consultation	0																		
MA_2.07	Implement a Systematic Approach to Maintaining SQIDs	1,640,000	130,000		60,000	116,667		33,333	266,667		333,333	100,000			100,000			500,000		
MA_2.08	Review, Revise and Supplement MCC's Current Stormwater Guidance	50,000				16,667		33,333												
MA_2.09	Revise and Implement the Greater Taree Urban Stormwater Management Plan	250,000	41,667		83,333	41,667		83,333												
MA_2.10	Sensitive Estuarine Riverbank Areas for Management and Implement Stabilisation	1,275,000	25,000	200,000			150,000			150,000			150,000			150,000			450,000	
MA_2.11	Prioritise Unsealed Road Sediment Hotspots and Undertake Remediation	440,000					176,000			176,000			88,000							
MA_2.12	Onsite Sewerage Management System Audit and Compliance Strategy	0																		
MA_2.13	MER for Ecosystem Health	1,681,000	98,733		197,467	45,733		91,467	45,733		91,467	45,733		91,467	45,733		91,467	278,667		557,333
MA_2.14	Implement a Scientific Research Program	150,000	5,000		10,000	5,000		10,000	5,000		10,000	5,000		10,000	5,000		10,000	25,000		50,000
MA_3.01	Develop Forward Plan to Retain Retreat Zones for Coastal Wetlands	0																		
MA_3.02	Develop Forward Plans for Council Assets at Risk from Sea Level Rise	0																		
MA_3.03	Long Term Adaptation Plan for Manning Floodplain in Collaboration with Landowners	0																		
MA_4.01	Address Barriers to Fish Passage	300,000				9,091		18,182	90,909		181,818									
MA_4.02	Develop and Implement Integrated Pest and Weed Control Plans for Local Priorities	120,000	40,000		80,000															
MA_4.03	Implement Recommendations of Refugia Study	150,000	75,000			75,000														
MA_5.01	Involve Aboriginal Community in Management of the River, Catchment and Estuary	150,000	5,000		10,000	5,000		10,000	5,000		10,000	5,000		10,000	5,000		10,000	25,000		50,000
MA_5.02	Install Interpretive Signage and Facilitate Cultural Activities	52,500				17,500		35,000												
MA_5.03	Engage Aboriginal People in Water Quality Monitoring	0																		
MA_5.04	Appoint Two Aboriginal Members to the ECMP Reference Group	0																		
MA_6.01	Investigate & Implement Site-Specific Pathogen Source Control measures	60,000							6,667		13,333							13,333		26,667
MA_7.01	Submit a Planning Proposal for CM SEPP	50,000							16,667		33,333									
MA_7.02	Preparing Mapping of Coastal Vulnerability Area for Tidal Inundation	100,000				33,333		66,667												
MA_7.03	Identify Water Quality Objectives and Management Targets	100,000	33,333		66,667															
MA_8.01	Establish Multi-Stakeholder Management Committee	0																		
MA_8.02	Holistic approach to Compliance Programs	0																		
** Action to be confirmed		Totals	\$2,337,733	\$448,000	\$4,265,467	\$874,408	\$559,000	\$1,368,815	\$575,309	\$604,000	\$930,618	\$299,400	\$516,000	\$368,800	\$286,067	\$428,000	\$362,133	\$1,523,667	\$1,590,000	\$1,937,333

Appendix 5: Findings of the ECMP Farmer's Consultation 2019

If it ain't broke there is no point in trying to fix it.

Farmers regard the MVB as being generally in good ecological health. Any measures to “fix” a problem which the stakeholders do not acknowledge as being a problem will not work.

A robust assessment of current catchment condition could provide a common understanding and credibility for MCC programs which addressed identified issues or priorities.

What is the problem?

Are we treating problems or the risk of problems? If problems at particular locations can be identified, then proposed solutions may be well received by farmers. If the program, or elements of the program, are about risk management in source catchments then an explanation of this approach to securing future water quality for the MRB may be needed to encourage farmer engagement.

Out of the fat and into the fire

While some management solutions (e.g. fencing off waterways) might have benefits acknowledged by the farmers, those solutions may themselves throw up new problems (e.g. ongoing high costs of maintenance and weed control) which reduce the uptake of long term implementation; and increase the divide between on the ground farmers and “academic” extension personnel.

To be effective, a proposed solution must be perceived to be effective in addressing the identified problem; and not create another set of problems. It should also consider the ongoing costs to the landholders for maintenance of the funded infrastructure.

There is more than one way of skinning a cat

Any proposed solution, such as waterway fencing, must also be seen by farmers to be the most effective way to address the problem. There is an opportunity to explore the benefits to water quality of a range of stock and grazing management which were suggested by participating farmers as being equally effective, and which may provide the relative advantage required for broad adoption.

Evidence suggests that riparian fencing and vegetation enhancement is effective if the issue is streambank erosion, but that otherwise maintaining pasture around first order streams and drainage lines is most effective in capturing nutrients and sediments, and farmers seem to know this.

One approach will not suit all – horses for courses

The farming community, while generally cohesive, is not homogenous. Motivators for change will need to resonate with the goals of individual farmers in order for strategies to succeed, but those goals differ depending on the life stage, values and aspirations of the farmer, the position of the farm within the catchment, their individual and industry specific husbandry practices and their own resource management. Any strategic objective must address each of the variations within the system and find a range of individual measures each appealing to the goals of individual farming ventures.

We learn from experience and observation

Seeing other farmers' practices and talking to neighbours about management issues were identified as being major sources of information for the interviewees. For those who did not consult widely, the views of other local farmers were important. Involving members of the farming community is an effective means of spreading knowledge about the adoption of new practices.

Do we speak the same language?

For some (a majority?) farmers, environmental values included production values – your perceptions are different from mine. When exploring options to address a problem, it is vital to understand the mental models which underpin perceptions and practices.

Do I have that tool in my toolbox?

Farmers may recognise solutions which they acknowledge will work but may not have the specialised knowledge and skills to make implementation fully effective. For example, successful shade tree planting, stock water reticulation or rotational grazing systems

Seeing beyond the fence

Many cattle farmers are unaware of the harvesting restrictions placed on the oyster farmers in the estuary of the catchment. Increased awareness of this could foster a willingness to undertake management strategies to benefit other farmers.

What's in it for me?

Are we asking farmers to fix our problems for our benefit? Farmers are not likely to adopt practices which do not advance their goals, and proposed solutions must provide a benefit to the farmers which is perceived as greater than the financial or management cost to them. Win-win solutions are more likely to be adopted.

Appendix 6: Great Lakes Council's Water Quality Improvement Program Recommendations

These recommendations for working with farmers to promote best practice were identified in Great lakes Council's Water Quality Improvement program (2012) and trialled during the Caring for Coastal Catchments Initiative funded by the Australian Government.

- Offer incentives, including financial incentives.
- Make a direct invitation to be involved in projects.
- Make direct contact with landholders in priority areas through door-knocking and one-to-one farm visits.
- Gain support from the industry being targeted.
- Arrange demonstration sites and field days to highlight best practice water quality management and associated production benefits.
- Supply information when people buy a property (e.g. through councils, rural supply stores and real estate agents).
- Achieve rapid and accountable on-ground success so that examples of the project can be shown to other interested landholders (case studies); if one person makes a change, it encourages others to follow.
- General information on the opportunities available through a brochure mail-out and media, responding to general landholder enquiries / interest generated by natural resource management workshops, fact sheets, videos for those who can't attend workshops.
- When one landholder signs up for riparian fencing or other project, visit landholders on surrounding properties to expand the program and increase landholder cooperation on a local scale.
- Undertake 'whole-catchment approach' to extension and implementing on ground works.
- Build the capacity of landholders to work with their neighbours providing advice and training on improving land management practices in relation to water quality (using a 'train the trainer' model).
- Promote the services provided by catchment management practitioners, so that landholders know what kind of assistance is available and where to source assistance.

Appendix 7: Jones Island TfNSW Land: Preliminary Site Assessment Report

Assessment of Remediation Options, Risks and Costs – TfNSW Jones Island Property, Manning Estuary

Preliminary Site Assessment and Key Elements for Further
Investigation (Stage 1)

NSW DEPARTMENT OF PRIMARY INDUSTRIES



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1 INTRODUCTION

1.1 Background

DPI Fisheries, MidCoast Council (MCC) and Hunter Local Land Services are collaborating on a *Wetland Rehabilitation – On Ground Works* Marine Estate Management Strategy (MEMS) program. Outcomes of the program include improvement of water quality within the marine estate by hydrologic restoration and habitat rehabilitation at priority sites.

DPI Fisheries has engaged Elder Enviro Pty Ltd to undertake further assessment to assist in determining whether the Jones Island site (the project area) satisfies NSW Fisheries criteria for inclusion within the MEMS Wetland Rehabilitation Program.

Assessment of the project area will be undertaken in two stages:

- Stage 1 - preliminary assessment of the project area and identification of site elements and threats and risks that require more detailed investigations.
- Stage 2 – completion of further investigations proposed in the Stage 1 report

1.2 Purpose

The purpose of this project is to assist in determining whether the Jones Island site (the project area) satisfies NSW Fisheries criteria for inclusion within the MEMS Wetland Rehabilitation Program by undertaking a two-stage assessment identifying:

- threats and risks to the marine estate from the project area
- opportunities and costs for targeted environmental rehabilitation interventions that can be undertaken to reduce the impact of those threats and risks within the project area, and on downstream values
- the priority for implementation of the proposed environmental rehabilitation interventions based on:
 - the significance of the proposed interventions in addressing one or more of the key threats and risks
 - the on-ground outcomes that could be achieved at the site
 - residual management risk to a future public authority landowner and how these could be successfully managed.

This report documents the findings of the Stage 1 assessment for the project area; and identifies areas requiring further investigation under Stage 2 assessment.

1.3 Scope

The work scope addressed within this report includes:

- Stage 1 preliminary assessment of the project area
- Identification of site elements, threats and risks requiring more detailed investigations

2 LOCATION AND HISTORY

2.1 Location

The project area is located on Jones Island, approximately 15 km northeast of Taree. Jones Island is approximately 950 ha, with the project area being approximately 85 ha. Jones Island is bisected by the Pacific Highway and bounded by the Lansdowne and Manning Rivers and Ghinni Ghinni Creek (Figure 1).

The project area comprises Lots 10, 11, 12, 13 & 15 in DP1011397; Lot 2 in DP612368; Lot 1 in DP43978; and Lot 52 DP 654950.

2.2 History

A discussion of the history of the area is included in the document 'A River in Time – following the course of influences on Manning River history' (Nutley, undated). This document includes the following discussion:

'The 1820's marked the arrival of European settlers within the Manning Valley and subsequent immense changes to its vegetation and wildlife. The landscape that had developed during many thousands of years of Aboriginal custodianship altered rapidly and dramatically.

Clearing of land begun in 1829. Cedar was the main timber initially sought, with ironbark, blackbutt and flooded gum also felled in quantity. By the time cedar stocks had been significantly depleted in the 1850's, the extent of cleared land made possible the introduction of agricultural activities, with dairying beginning to take over in the 1890's.'

2.3 Land use

The majority of the project area is currently utilised for grazing of cattle. Although some areas have been fenced to exclude stock, fencing is in a state of disrepair and in need of maintenance.

The project area has been extensively modified through construction of excavated drainage channels to facilitate surface water drainage and pasture establishment.

The adjoining reach of the Lansdowne River is largely unfenced (or fencing in disrepair). Recreational boat traffic is frequent.

The upgraded section of the Pacific Highway bisecting Jones Island was opened in 2006, including new bridges and raised embankments above the surrounding floodplain.



Figure 1. Map of location of project area (Google Earth 2020)

3 SITE CHARACTERISTICS

3.1 Vegetation

Wetland mapping of the Manning River Estuary, including the project area, was undertaken in 2019 (Eco Logical Australia 2019). Mapping is considered accurate at a 1:5,000 scale and identified the following wetland types present within the project area (Figure 2):

- Saltmarsh
- Swamp Oak
- Melaleuca Thicket
- Grey Mangrove

Under the Biodiversity Conservation Act Saltmarsh, Swamp Oak and Melaleuca Thicket are considered Endangered Ecological Communities. Grey Mangrove and Saltmarsh are protected under the Fisheries Management Act.

This total area of mapped wetland within the project area, as identified by Eco Logical, represents approximately 30 % of the project area. The remaining 70 % is comprised of grasses (dominantly couch), bare areas, drainage channels and discontinuous wetland species (at a finer scale than currently mapped).

3.2 Soil

Soil classification

Soil profile information for the project area obtained from eSPADE (State of NSW and Department of Planning, Industry and Environment 2020a) is summarised within Table 1.

Table 1. Soil Classification

Classification system	Classification description
Australian soil classification	Hydrosols
Great soil group	humic gleys
Land and soil capability	7. Extremely severe limitations
Inherent soil fertility	moderately low
Hydrologic soil group	very low infiltration
Acid Sulfate Soil Risk	high probability of occurrence

Soil landscapes

Soil landscape mapping has been undertaken at a 1:100,000 scale (State of NSW Department of Planning Industry and Environment 2020b). Characteristics of the Soil Landscapes identified within the project area are provided within Table 2.

Table 2. Soil Landscapes

Soil Landscape	Landscape characteristics	Soil characteristics	Qualities and Limitations
Moto swamp (msw)	Level plain comprised of closed depressions, coastal lagoon floors, estuarine deltaic backswamps Slope <1%, local relief <1 m, elevation <1 m. Extensively cleared swamp complexes	Deep to very deep (100 - 500 cm), poorly to very poorly drained Sulfidic/Sulfuric Oxyaquic/Redoxic/Extratidal Hydrosols (Humic Gleys) and Sulfidic/Sulfuric Hemic Organosols (Acid Peats)	Widespread foundation hazard, widespread discharge zone, widespread wind erosion hazard, localised wave erosion hazard, localised high run-on, widespread poor drainage, widespread permanently high watertables, widespread permanent waterlogging, widespread seasonal waterlogging, widespread flood hazard.
Jones Island (jix)	Level plain on Holocene estuarine and alluvial sediments Slopes <1%, local relief <1 m, elevation 1 - 5 m. Extensively cleared open-woodland	Deep (100 - <150 cm), poorly drained Redoxic /Oxyaquic Hydrosols (Humic Gleys)	Widespread soil fire hazard, widespread foundation hazard, localised discharge zone localised high run-on, widespread poor drainage, widespread permanently high watertables, widespread permanent waterlogging, widespread seasonal waterlogging, widespread flood hazard

3.3 Hydrology

The contributing catchment of the project area is localised, and primarily comprised of pasture, wetland vegetation and road drainage (Pacific Highway and Bridge Road). Extensive excavation of channels and drains has occurred to facilitate freshwater drainage from paddock areas into the Lansdowne River. Floodgates within drainage channels (where functional) have been located to control tidal inflows into upstream areas managed for pasture.

Permanently high watertables, waterlogging, poor drainage and flood hazard are widespread.

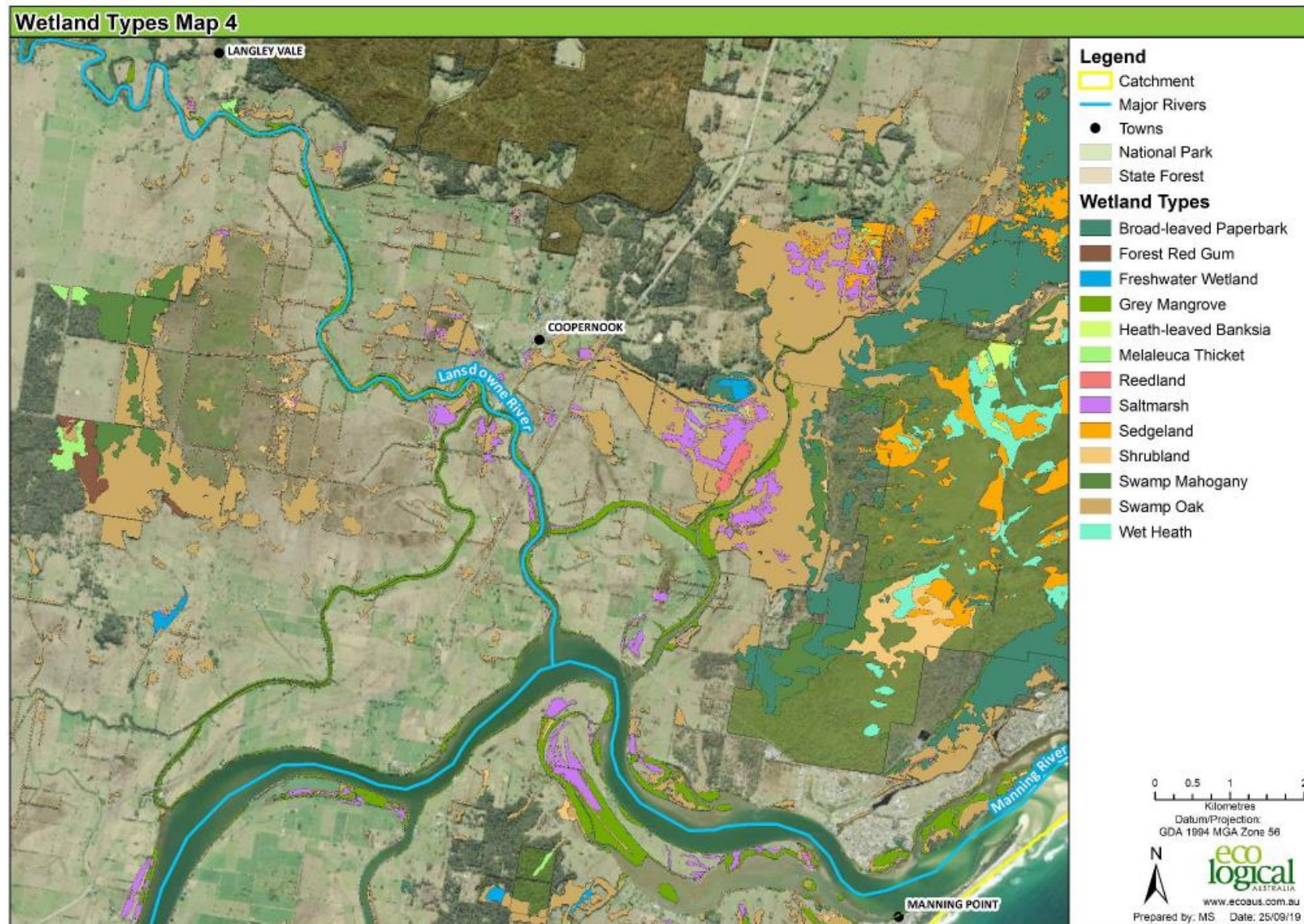


Figure 2. Wetland Types (Eco Logical 2019)