

# Nambucca Coastline and Estuaries Coastal Management Program

## Stage 3: Options Assessment



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Hydrosphere Consulting Pty Ltd  
Suite 6, 26-54 River Street  
PO Box 7059, BALLINA NSW 2478  
www.hydrosphere.com.au

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<b>18- 019 – NAMBUCCA COASTLINE AND ESTUARIES CMP- STAGE 3 OPTIONS ASSESSMENT</b>						
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## EXECUTIVE SUMMARY

Nambucca Valley Council (NVC) has received funding through the NSW Government Coastal and Estuary Grants Program to prepare the Nambucca Coastal Management Program (CMP) which will document the integrated and sustainable management of the coastline and estuaries of the Nambucca Valley LGA. Stage 3 (this document) is an Options Assessment which provides an assessment of potential coastal management options that address issues, reduce exposure to coastal hazards, and take advantage of opportunities, consistent with provisions in Section 14 and 15 of the *Coastal Management Act 2016* (CM Act). This assessment will assist the Nambucca community to decide the priority of identified coastal management actions and proposed integrated and strategic delivery pathways.

This Stage 3 report confirms the strategic direction of the CMP and identifies and evaluates potential management options. Results of the multi-criteria assessment are presented as ranked management options recommended for implementation as part of the Nambucca CMP.

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## INTRODUCTION

Nambucca Valley Council (NVC) has received funding through the NSW Government Coastal and Estuary Grants Program to prepare the Nambucca Coastal Management Program (CMP) which will document the integrated and sustainable management of the coastline and estuaries of the Nambucca Valley LGA. The *NSW Coastal Management Manual* (OEH, 2018, the Manual) outlines the mandatory requirements and provides guidance on the preparation, development, adoption and content of a CMP. It includes a process for councils to follow when identifying and assessing the vulnerability of coastal environmental, social, and economic values and evaluating management actions.

The manual outlines a five-stage process for developing and implementing a CMP (Figure 1). The first two stages are complete:

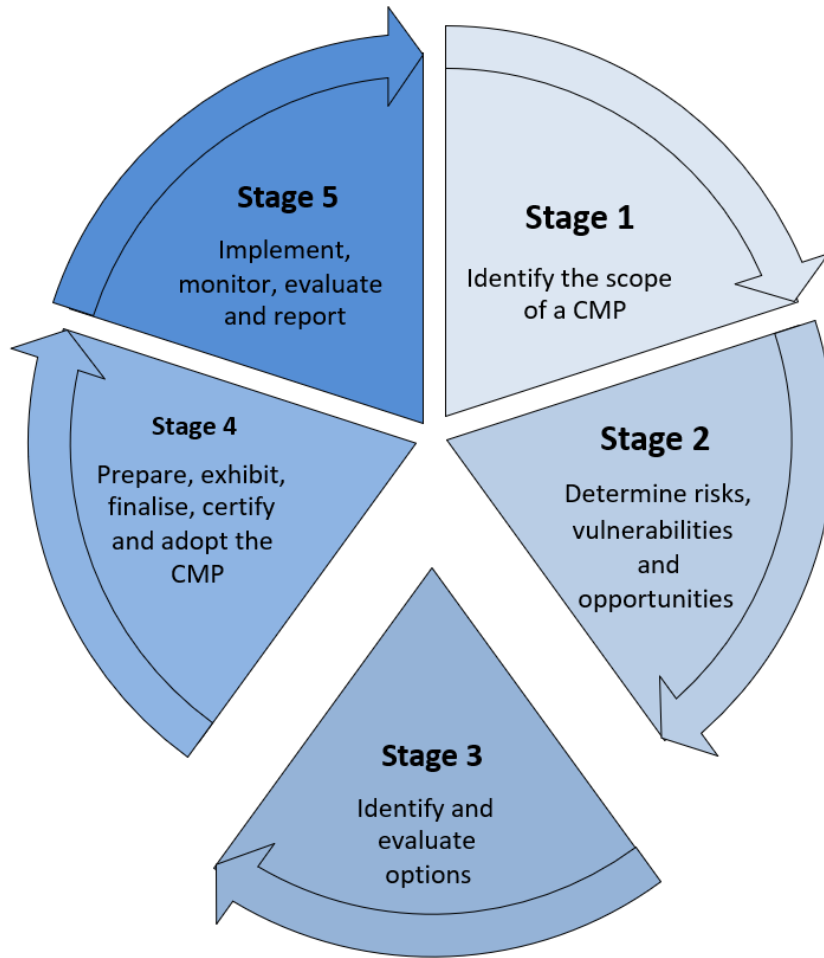
- The *Stage 1 CMP Scoping Study* (Hydrosphere Consulting, 2020a) sets the scene for the coastal planning process for all areas of the open coast and all coastal creeks and estuaries in the Nambucca Valley LGA including Nambucca River, Deep Creek, Swimming Creek and Oyster Creek estuaries.
- The *Stage 2 CMP Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2020b) provided additional information on bank stability and riparian condition mapping. This work assists the community to better understand these issues and to analyse and evaluate coastal risks and opportunities. The Stage 2 report also provided a preliminary screening of potential management options to address the key issues and threats identified. This preliminary assessment of management options identified 55 options for further consideration and assessment.

Stage 3 (this document) of the CMP is an Options Assessment which identifies actions to address coastal management issues identified in Stage 1 and 2 (Hydrosphere Consulting, 2020a; 2020b) in an integrated and strategic manner.

The Manual Stage 3 (OEH, 2019) outlines the following steps in completing Stage 3 of a CMP:

- Step 1 - Confirm the strategic direction.
- Step 2 - Identify potential options for integrated management of all relevant coastal management areas.
- Step 3 - Evaluate potential actions.
- Step 4 - Putting it together.

These steps are documented in the following sections.



**Figure 1: Five stage process for developing a coastal management program**

Source: Adapted from OEH (2018b)

## STEP 1 – CONFIRM THE STRATEGIC DIRECTION

The purpose of a CMP is to set the long-term strategy for the coordinated management of land within the coastal zone with a focus on achieving the objects of the CM Act. The long term strategic direction for the Nambucca coastline and estuaries is encapsulated by the vision statement for this CMP (Figure 2) and Coastal Management Area objectives adopted from the CM Act (Figure 2: Nambucca CMP vision statement

Table 1). The strategic direction has been confirmed through consideration of:

- Results of the Stage 1 community survey and submissions received from government agencies and other stakeholder regarding the Stage 1 Scoping Study and the development of the CMP (Appendix B of Hydrosphere Consulting, 2020a).
- The objectives of the *Nambucca Valley: Living at its best 2027 Community Strategic Plan* (NVC, undated). and *Nambucca Valley Local Strategic Planning Statement* (NVC, 2020).
- The relevant management objectives set out in the CM Act and the objects of the *Marine Estate Management Act 2014*.
- The values, threats and management priorities identified in the *Stage 1 Scoping Study* (Hydrosphere Consulting, 2020a) and *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2020b) incorporating the findings of stakeholder consultation.

- The objectives of the *Coastal Zone Management Plan for the Nambucca Shire Coastline* (Umwelt, 2012) and the *Nambucca River Estuary Management Plan* (BMT WBM, 2008).
- Other relevant local, regional, and state policies and plans considered in preparing the CMP.



**Figure 2: Nambucca CMP vision statement**

**Table 1: Coastal Management Area objectives adopted from the CM Act**

Coastal Management Area	Coastal Management Area Objectives
Coastal Wetlands and Littoral Rainforests Area (and proximity area)	<ol style="list-style-type: none"> <li>1. To protect coastal wetlands and littoral rainforests in their natural state, including their biological diversity and ecosystem integrity.</li> <li>2. To promote the rehabilitation and restoration of degraded coastal wetlands and littoral rainforests.</li> <li>3. To improve the resilience of coastal wetlands and littoral rainforests to the impacts of climate change, including opportunities for migration.</li> <li>4. To support the social and cultural values of coastal wetlands and littoral rainforests.</li> <li>5. To promote the objectives of State policies and programs for wetlands or littoral rainforest management.</li> </ol>

Coastal Management Area	Coastal Management Area Objectives
Coastal Vulnerability Area	<ol style="list-style-type: none"> <li>6. To ensure public safety and prevent risks to human life.</li> <li>7. To mitigate current and future risk from coastal hazards.</li> <li>8. To maintain the presence of beaches, dunes and the natural features of foreshores.</li> <li>9. To maintain public access, use and amenity of beaches and foreshores.</li> <li>10. To encourage land use that reduces exposure to coastal hazards over time.</li> <li>11. To adopt coastal management strategies that reduce exposure to coastal hazards by: <ul style="list-style-type: none"> <li>• Restoring or enhancing natural defences where possible; and</li> <li>• Taking other action to reduce exposure to those coastal hazards.</li> </ul> </li> <li>12. If taking other action to reduce exposure to coastal hazards; <ul style="list-style-type: none"> <li>• To avoid significant degradation of biological diversity and ecosystem integrity;</li> <li>• To avoid significant degradation of or disruption to ecological, biophysical, geological, and geomorphological coastal processes;</li> <li>• To avoid significant degradation of or disruption to beach and foreshore amenity and social and cultural values;</li> <li>• To avoid adverse impacts on adjoining land, resources or assets; and</li> <li>• To provide for the restoration of a beach, or land adjacent to the beach, if any increased erosion of the beach or adjacent land is caused by actions to reduce exposure to coastal hazards.</li> </ul> </li> <li>13. To prioritise actions that support the continued functionality of essential infrastructure during and immediately after a coastal hazard emergency.</li> <li>14. Improving the resilience of coastal communities.</li> </ol>
Coastal Environment Area	<ol style="list-style-type: none"> <li>15. To protect and enhance the coastal environmental values and natural processes of coastal waters, estuaries, coastal lakes and coastal lagoons.</li> <li>16. To enhance natural character, scenic value, biological diversity and ecosystem integrity.</li> <li>17. To reduce threats to, and improve the resilience of the coastal waters, estuaries, coastal lakes and coastal lagoons.</li> <li>18. To maintain and improve water quality and estuary health.</li> <li>19. To support the social and cultural values of coastal waters, estuaries, coastal lakes and coastal lagoons.</li> <li>20. To maintain the presence of beaches, dunes and the natural features of foreshores.</li> <li>21. To maintain and, where practicable, improve public access, amenity and use of beaches, foreshores, headlands and rock platforms.</li> </ol>



Coastal Management Area	Coastal Management Area Objectives
Coastal Use Area	22. To accommodate both urbanised and natural stretches of coastline. 23. To protect and enhance the scenic, social and cultural values of the study area through: <ul style="list-style-type: none"> <li>• appropriate type, size, and scale of development;</li> <li>• providing adequate public open space and associated public infrastructure;</li> <li>• incorporation of urban design, including water sensitive urban design into development activities;</li> <li>• avoiding adverse impacts of development on cultural and built environment heritage; and</li> <li>• consideration of the use of the surf zone.</li> </ul>

## STEP 2 – IDENTIFY POTENTIAL MANAGEMENT OPTIONS

The Scoping Study documented the threats to the CMP study area and corresponding risk levels as current and future risk (20-year, 50-year and 100-year). Threats were prioritised to assist in determining the importance of management action as part of subsequent stages of the CMP. High priority threats were identified as those presenting a high present-day risk to values and uses of the Nambucca coastline and estuaries.

Potential management options were identified to address the identified risks and threats in the *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2020b). The assessment incorporated management solutions proposed and/or implemented as part of previous studies and plans of management as well as additional actions to address key pressures and threats identified in the Scoping Study. A total of 285 individual actions from previous plans were assessed in terms of current status of actions, relevance to the study area and likelihood of success in addressing the key threats. A number of additional management options were also identified to address current and future threats. The preliminary assessment of management options identified 55 options for further consideration and assessment as part of Stage 3.

## STEP 3 – EVALUATE POTENTIAL OPTIONS

The identified coastal management options have been prioritised as part of Stage 3 (this report) through examining the feasibility, viability and acceptability of coastal management options. In doing this the following have been considered:

- Promoting and achieving the objects of the CM Act.
- Meeting the coastal management objectives within the coastal management areas.
- The environmental, social, cultural and economic context and potential impacts.
- The feasibility of coastal management actions: determined by effectiveness, technical viability, ecological sustainability and legal/approval risk of the management approach.
- Viability of implementation: determined by anticipated cost, availability of resources, time and commitment and anticipated benefits.
- The acceptability of the risks to the council, key stakeholders such as public authorities and the community, including willingness to contribute to the upfront and ongoing maintenance costs.

The options assessment involved examination of options which were subjected to a multi-criteria cost-benefit analysis. This analysis involved three parts as follows:

- Cumulative risk mitigation assessment – an assessment of the influence of the option on all threats in the study area, not just the direct threat addressed. This resulted in a Cumulative Threat Mitigation Score (CTMS).
- Cost benefit analysis considering several key criteria related to feasibility viability, and acceptability of the option. This resulted in a Cost Benefit Analysis Score (CBAS).
- Scores from the above two parts were combined to determine if the option should be recommended for implementation in the CMP.

Each component of the assessment is detailed below.

### Step 3.1 Cumulative risk mitigation assessment

The cumulative risk mitigation assessment involved considering the direct and indirect impact of the option on each threat identified for the study area as part of the risk assessment documented in the CMP Scoping Study (Hydrosphere Consulting, 2020a). The direct or indirect impact can be positive or negative and scores were assigned on this basis (Table 2). For example, riparian restoration will have a direct positive influence on estuarine bank erosion and is assigned a score of 2 for this threat. It will also address threats to biodiversity and improve riparian vegetation and weed management and therefore is given a score of 1 for each of these threats. It will have no influence on the threat from ocean shoreline recession and so is scored a 0 against this threat.

**Table 2: Risk mitigation scoring**

Impact	Score
Direct negative	-2
Indirect negative	-1
No Influence	0
Indirect positive	1
Direct positive	2

The influence of each management option was scored against each of the 86 threats and individual scores weighted according to the risk level of each risk as assigned during the Stage 1 risk assessment.

Cumulative risk mitigation scores for the 55 options ranged from 323 (Option O52: NVC Coastline and Estuary Educational Program) which was anticipated to have indirect positive influence on most study area threats to a score of 7 (Option O41: Swimming Creek debris removal) which had a direct positive influence on a defined location only. The cumulative risk mitigation score provides a clear overview of the likely influence of the various options on risks relative to the Nambucca coastline and estuaries. The influence scores and cumulative risk mitigation score given to each option is provided in Appendix 1.

### Step 3.2 Cost benefit analysis

The options were then assessed for their costs and benefits against nine different criteria:

1. Effectiveness - being the ability of the option to reduce the risk for which the option has been designed or targeted, or alternatively, the provision of important data or knowledge about the target risk by the option.

2. Technical viability - to highlight where certain options may or may not be technically feasible or would require significant engineering (or other) investigations and construction / implementation capabilities.
3. Ecological sustainability – to identify options with potential for negative or positive environmental impacts in either the short or long term.
4. Legal / approval risk - to highlight the legislative and approval requirements (or impediments) to implementing an option within the current legal framework.
5. Capital costs to implement the option initially.
6. Ongoing costs per annum.
7. Cost-benefit distribution (private vs public benefit).
8. Community/stakeholder acceptability – based upon general feedback from the local community and stakeholders received so far.
9. Meeting Coastal Management Objectives - promoting and achieving the objects of the CM Act and meeting the coastal management objectives.

The scoring system for the above criteria is outlined in Table 3. Each of the criteria were given equal weighting. The total score for each option was therefore based on a direct addition of scores against each criterion. Scores for the options ranged from 9 (e.g. Option O27: OSSM Strategy implementation is considered to be highly feasible, viable and acceptable) to a score of 2 (Option O9: Dredging of marine sands at identified hotspots is considered to be expensive, have some ecological sustainability risk and doubts over long-term effectiveness). The high CBA scores were generally assigned to options with a high chance of success, low technical difficulty, relatively low cost and a high level of community and stakeholder support.

The outcomes of the cost benefit analysis for each option against each criterion is provided in Appendix 1.

**Table 3: Cost benefit analysis criteria scoring system**

Score:		-1	0	1
Feasibility	Effectiveness (in addressing direct risks)	Option is unlikely to be effective / substantially reduce targeted risks	Option will not necessarily reduce targeted risk(s) but will provide important knowledge / data about the risk OR Option will bring a minor reduction in the targeted risk(s)	Option will be very effective in eliminating/ reducing/ remediating its target risk(s)
	Technical Viability	Is unlikely to be technically viable without substantial engineering (or other) design investigation and capabilities for implementation	Is likely to be technically viable at the site, but would require further investigations to clarify	Is technically viable at the site / location
	Ecological sustainability	Option is likely to have a negative impact on environmental values either directly or indirectly or impacts are unknown	Not expected to have any influence on environmental values	Expected to have a net positive impact on environmental values
	Legal/ Approval Risk	Will require an EIS to implement; There is a residual risk that approval will not be obtainable for the proposed works / strategy	Will require government approvals (e.g. REF) to be implemented	No or minimal government approvals required to implement
Viability	Capital Costs	Very expensive (>\$300,000)	Moderately expensive (\$100,000 - \$300,000)	Limited cost (<\$100,000)
	On-going costs	Very expensive (>\$150,000 p.a.)	Moderately expensive (\$25,000 - \$150,000 p.a.)	Limited cost (<\$25,000 p.a.)
	Cost-benefit distribution (public vs. private)	100% private benefit	50% public, 50% private benefit	100% public benefit
Acceptability	Community/ Stakeholder Acceptability	Unlikely to be acceptable to community and politically unpalatable; Extensive community education, endorsement by Minister(s) and Council required	Would be palatable to some, not others (~50/50 response); Briefing to Councillors, GM and community education required	Is very politically palatable, acceptable to community; Minimal education required
	Meeting CM objectives	Does not meet any CM objectives	Meets one of the CM objectives	Meets multiple (>1) CM objectives

### Step 3.3 Multi-criteria assessment outcomes

The cumulative risk mitigation score (Step 3.1) indicates each option's capacity to mitigate multiple threats, either directly or indirectly. The cost-benefit analysis (Step 3.2) indicates the feasibility, viability and acceptability of each option considering their associated constraints and opportunities.

Based upon the results of the multi criteria assessment (cumulative risk mitigation (CTMS) combined with cost benefit (CBAS), the options were assigned a final score and ranked accordingly. Options that are considered critical for successful implementation of the CMP and important for long-term effective management all scored highly in the assessment. These options have been separated out as "Fundamental" options as shown in Table 4 below. The remaining options are targeted actions or on-ground works to address a specific threat or focus on a specific location. These are provided in Table 5 and are ranked according to their final score. Details of the scoring are provided in Appendix 1.

Table 4: Fundamental management options recommended for implementation as part of the CMP

Option ID	Management Option	Description	Final Score (CTMS <sup>1</sup> + CBA <sup>2</sup> )
O55	Environmental Levy funding for implementing the CMP	Specific allocation from NVC's Environmental Levy provides funds for implementing the coast and estuary program. Continue as key funding source. Review adequacy of funding amounts and recommend changes as appropriate.	17.44
O52	NVC Coastline and Estuary Educational Program	Design and implement an integrated Coastline and Estuary Educational Program to educate and promote understanding of the natural attributes of the coastline and estuaries, sensitivities and key issues and encouraging low-impact use/practices to protect key sites. May involve installation/ replacement of attractive and engaging signage at key locations, leaflets/flyers, webpage, posters, information days/activities, school programs, educational videos etc. Target groups could include: local construction industry (erosion and sediment controls), boating users, agricultural industry, oyster industry, tourists/tourism sector, foreshore Crown land managers (e.g. caravan parks), school groups, general public, residents close to sensitive systems (e.g. swimming creek) etc.	16.00
O23	Water Quality Monitoring Program	Development of a targeted and integrated water quality monitoring program consistent with other CMP actions as relevant and existing monitoring (e.g. Ecohealth program). Design of program will involve determination of aims and objectives, selecting key sites, appropriate monitoring methods, frequencies and reporting of results. Monitoring will aim to assess the impact of both point source and diffuse source pollution on estuary water quality. Establish an integrated water quality database as central storage location for data. Include consideration of runoff from intensive horticultural uses, faecal coliforms in recreational areas and aquaculture industries.	11.77
O48	Consultation with local Indigenous community	Ongoing consultation with the local indigenous community on a long-term basis regarding coastline and estuary values/ indigenous knowledge of ecology, seasonal cycles etc. / identifying threats and issues to be addressed and greater involvement of indigenous community in coastline and estuary management.	11.00
O49	Nambucca Rivers Creeks Estuaries and Coastline Management Committee to oversee CMP implementation	Continue oversight of CMP by Committee. Ensure adequate representation of all key local stakeholder groups in management of study area. Consider formalising a regular meeting frequency (e.g. quarterly) during CMP implementation and more regularly as needed to discuss implementation milestones, funding, and emerging issues etc.	8.53

<sup>1</sup> CTMS - Cumulative Threat Mitigation Score; <sup>2</sup> CBA – Cost Benefit Analysis Score

Table 5: Targeted management options and on-ground works recommended for implementation as part of the CMP

Rank	Option ID	Management Option	Description	Final Score (CTMS <sup>1</sup> + CBA <sup>2</sup> )
1	O1	Coastal hazard planning and development controls	Revised Nambucca DCP incorporates a chapter on coastal hazards (e.g. development restrictions and planning controls for both new and existing buildings in line with coastal hazard risks etc.).	11.10
2	O14	Nambucca Bank Management Strategy	Develop an estuary-wide Bank Management Strategy consistent with Initiative 2 of the Marine Estate Management Strategy and any tool/ guidance provided. Bank Condition Assessment - Nambucca River and Deep Creek (Hydrosphere Consulting, 2020) maps current areas of concern and priority sites for rehabilitation works.	10.46
3	O27	On-site Sewage Management (OSSM) Strategy implementation	Continue implementation of NVC's OSSM Plan. Incorporate sites to assess known OSSM problem areas into Water Quality Monitoring Program.	10.39
4	O6	Coastal Hazard Monitoring Program	Design and implement a Coastal Hazard Monitoring Program to underpin Council's adaptive management of coastal risks. The strategy would incorporate assessment of condition and effectiveness of coastal protection infrastructure, public access, coastal event response etc. and guide management action.	10.01
5	O15	Review and Update the Nambucca River Estuary Riverbank Restoration Guide (2010)	A guideline on riverbank protection works was prepared by Council and other Agencies in 2010. It requires updating to reflect current/ new legislation. Infrastructure SEPP, Coastal SEPP, and Fisheries Management Act control riverbank works through various processes. Also review and ensure alignment with Environmentally Friendly Seawalls Guide (OEH, 2009).	9.93
6	O2	Updated coastal erosion hazard assessment and mapping	Update coastal erosion hazard assessment and mapping from SMEC (2009). Consider new knowledge about coastal processes, climate change, sea level rise, community aspirations and coastal ecosystems. Determine whether trigger points for changing coastal risk management approaches have been reached.	9.93
7	O5	Local planning provisions	Nambucca LEP to incorporate open space zones along the coastline as appropriate and wherever possible to reduce development in the coastal zones at risk of current or future coastal hazards.	9.67
8	O16	Weed management /bushland regeneration activities	Coastal weed management in co-operation with North Coast Weeds Advisory Committee, Landcare groups and other stakeholders. Weed management may include weed removal, assisted bushland regeneration, planting, fencing out stock or human access etc. May also be combined with other works including dune management/ coastal protection/ bank protection works.	9.62

Rank	Option ID	Management Option	Description	Final Score (CTMS <sup>1</sup> + CBA <sup>2</sup> )
9	O46	Protect Aboriginal and European cultural heritage items and places	Council to undertake appropriate consultation with relevant bodies when designing work/ projects in the lower estuary. Recommendations of the <i>Nambucca Valley Council Aboriginal Cultural Heritage Management Plan</i> to be addressed in any future works or projects in areas of significance	9.55
10	O56	Sustainable tourism	Promote the natural values of the estuary and sustainable use and support the valuable tourism industry of the Nambucca Shire.	9.50
11	O42	DPI Fisheries education program	DPI Fisheries undertake community educational program on current threats and impacts to fish/fish habitat and current fish management practices targeted to Nambucca LGA.	9.49
12	O13	Estuarine vegetation response assessment	Assessment of potential for estuarine vegetation migration with sea level rise based on vegetation types, topography, land use and possible future tidal range. Include mapping and assign management priority classification.	9.45
13	O32	Public Recreational Use Strategy	Prepare a strategy that builds on previously successful plans. The strategy would include assessment of suitability of current infrastructure, consideration of growth potential, disability needs, identification of public land that could be used for public recreation, and a suggested allocation of funds for facility improvements, provision of coastal pathways etc. The aim will be to provide strategic master planning for additional areas that support placemaking, facility improvement, open space/ environmental management and having better linked coastal – coastal villages, towns and communities.	9.31
14	O19	Habitat condition monitoring	Monitor condition of habitats of high ecological and/or conservation value e.g. saltmarsh, wetlands, littoral rainforests, riparian zone, and floodplain wetlands. Monitoring program to track the health and condition of key habitats. Targeted to areas of previous works (e.g. Stuart Island, Watt Creek, Deep Creek, Macksville, Sand Island, Lower Nambucca, Wirrimbi, and various coastal wetlands and Riparian areas). Mapping of condition required.	9.27
15	O59	Investigate and remove illegal connections of stormwater to sewer	Assess urban residential areas to identify properties with illegal stormwater to sewer connections. Smoke testing can be used to quickly identify illegal connections.	9.24
16	O28	Lower Nambucca Estuary Water Quality Study: Management Strategy and Newee Creek Study remaining site-specific works	Incorporates all remaining actions from the strategy considered to be relevant and suitable today, and addresses current issues affecting the study area. Action to include review and rationalisation of proposed works to determine those of most benefit.	9.23



Rank	Option ID	Management Option	Description	Final Score (CTMS <sup>1</sup> + CBA <sup>2</sup> )
17	O41	Swimming Creek debris removal	Remove debris from swimming Creek (e.g. concrete, bricks, tyres, timber).	9.20
18	O33	Improve safety at V-Wall and along break wall	Improve the quantity and accessibility of safety and rescue equipment near the v-wall and along the break wall.	9.02
19	O10	Review of Deep Creek ICOLL entrance management policy	Review efficacy of the existing Deep Creek Entrance Management Strategy since its implementation in 2012 (e.g. effect on flooding, water quality, inundation of EECs such as Swamp Oak forest etc.). Update as appropriate based on review.	8.98
20	O18	Support improvements in agricultural land management	Programs focussed on improving agricultural land management to reduce export of pollutants (e.g. sediment, nutrients/fertilisers, bacteria, pesticides etc.). Potential examples include: on-farm property scale plans and actions to improve drainage, fertiliser management, exclude stock access to natural waterways, manage run-off from dirt roads, maintain grass cover and buffer zones etc.); Target areas identified by DPIE EES Estuary Health Risk Dataset, Ecohealth Monitoring and local strategies (e.g. sub catchments of Deep Creek, North Arm, Buckra Bendinni Creek, Gumma Gumma Swamp, Newee Creek etc.).	8.95
21	O12	Tidal inundation assessment	Detailed local tidal inundation assessment of the estuaries for a variety of future sea level rise scenarios, with a risk assessment to estuary assets and infrastructure.	8.94
22	O58	Best practice erosion and sediment control guidelines for construction sites	More effective sediment controls where soil disturbance occurs, for example, during early phases of land development or construction. Education, promotion and compliance with best practice erosion and sediment control guidelines for construction sites,	8.81
23	O30	Management of water extraction	Consult with NRAR and DPIE-Water regarding management of water extraction under the Nambucca Water Sharing Plan (2016). Consultation will aim to highlight the threat and implications of increased water extraction on estuary health and seek to ensure adequate oversight and enforcement of water sharing plan rules and regulations.	8.76
24	O43	Support sustainable aquaculture industries within the Nambucca River estuary	Application of the highest levels of catchment and waterway management to ensure that the estuary's water quality is sufficient to maintain this industry, in clearly identified areas	8.73

Rank	Option ID	Management Option	Description	Final Score (CTMS <sup>1</sup> + CBA <sup>2</sup> )
25	O3	Coastal hazard assessment and mapping for areas of Nambucca study area not currently covered by existing coastal hazard mapping (i.e. areas managed by stakeholders other than NVC)	Agencies/authorities other than Council to undertake coastal hazard mapping in areas under their control (present day, and relevant long-term planning scenarios) to fill in the gaps (DPIE - Crown Lands, DPIE - NPWS, State Rail in Oyster Creek etc.).	8.68
26	O47	Cultural heritage education and awareness	Education regarding cultural heritage significance of study area (e.g. Signposting to identify and explain areas that have cultural significance, school programs etc.)	8.55
27	O17	Riparian Restoration/ River Reach Plans	Provide funding for greater roll out of River Reach Plans in the study area. Plan would cover aspects based on site-specific assessments which may include bank erosion controls, weed management, riparian fencing instalment/ improvement to exclude stock and allow for protection of estuarine macrophytes, recovery of native riparian vegetation, manage run-off from dirt roads and reduced faecal matter in waterways.	8.51
28	O36	Traffic Study at key locations	Traffic study of beach parking areas at Scotts Head to identify opportunities for improved layout. Options to be considered include changed turn around areas for the boat ramp, limiting parking beyond the surf club. Traffic study of beach parking areas at Main Beach Nambucca Heads - consider alternative access arrangements.	8.46
29	O35	Companion animal management	Continue to regulate and monitor performance of existing actions and management relating to the use of off-leash and on-leash areas by the public and their pets.	8.41
30	O53	Estuary shoaling education	Raise community awareness of coastal/estuary processes to increase the level of understanding of shoaling mechanisms and associated implications as well as the consequences of intervention measures.	8.41
31	O37	Monitor success of current/ previous 4WD management actions	Monitor performance of existing actions and management relating to the use of 4WDs and motorbikes on beaches.	8.36
32	O20	Targeted restoration in high value habitats identified as degraded.	Based on the results of monitoring program, target priority areas for works. Management priorities should be based on the area and condition of remnant vegetation and adjacent land uses, restoration potential and overall values.	8.16

Rank	Option ID	Management Option	Description	Final Score (CTMS <sup>1</sup> + CBA <sup>2</sup> )
33	O4	Section 149 certificates identify coastal hazard risk	Section 149 certificates identify coastal hazard risk for affected properties (2050 and 2100 limits of the Stable Foundation Zone) (ongoing implementation). S149 certificates to be updated as required by legislative changes.	8.05
34	O29	Fish passage and wetland connectivity review	Review current status of wetland connectivity and fish passage barriers including the discussions between DPI Fisheries, Council, landholders (and any drainage boards) RE location of structures and management practices; and mapping of impediments to connectivity; and prioritisation of barriers for removal/ modification (DPI Fisheries as responsible agency).	7.96
35	O24	Stormwater management	Develop catchment-based stormwater plan to investigate issues and determine management actions required. Key locations identified previously include Scotts Head Main Beach, Beilby's Beach, Shelly Beach and Main Beach northern carpark, Swimming Creek catchment. Implement stormwater management actions to address issues.	7.95
36	O51	MoU between NVC and NPWS	Develop a memorandum of understanding (MoU) between NSC and NPWS to document and agree on roles and responsibilities in areas where this overlap	7.90
37	O31	Floodplain drainage mapping	Accurately map the drainage system on the floodplain.	7.90
38	O21	Improve protection of high value habitats particularly riparian vegetation	A potential future project may be shire-wide stewardship site feasibility assessment, highlighting properties in the shire that may have significant natural resource value if protected into perpetuity. Potential to provide funding for Land for Wildlife conservation agreements in cooperation with NV Landcare	7.88
39	O22	Review environmental mapping and ensure consistency with NLEP and DCP	Desktop GIS assessment: Review environmental mapping (e.g. CMAs, EECs, marine vegetation). Overlay with NLEP zoning. Consider future likely areas for migration of estuarine vegetation with sea level rise (refer Tidal Inundation Assessment). Consider provisions of NLEP and DCP to ensure it reflects appropriate protection of these sensitive environments, aid community awareness and assist in ease of the development application processes.	7.74
40	O54	Improve recognition of Crown Land areas	Improve recognition of Crown Land areas in the lower estuary, particularly those around existing facilities that may promote greater connectivity and tourist related usage of the area	7.62
41	O39	Access for passive recreational craft	Investigate the need for future boat ramps and associated recreational activities at Tewinga or Wirrimibi, Henstock Reserve (Warrell Creek), Welshes Park (Talarm)	7.23

Rank	Option ID	Management Option	Description	Final Score (CTMS <sup>1</sup> + CBA <sup>2</sup> )
42	O38	Boating and waterway usage strategy	To maintain and enhance safe, responsible, and ecologically sustainable recreational boating and water sports activities. The strategy would incorporate several elements including rationalise and improve access points, boat ramps and associated facilities, signage and education etc.	6.82
43	O25	Wastewater management	Continue to work with EPA to develop Pollution Reduction Programs. Identify risk and impact of sewage spill from existing pump stations/pipes with a view to upgrading priority systems. Investigate upgrade of Macksville STP including assessment of feasibility of removing effluent discharge to river.	6.75
44	O40	Nambucca River Master Plan remaining site-specific works	Incorporates all remaining actions from the River Master Plan considered to be relevant and suitable today, and addresses current issues affecting the study area. Action to include review and rationalisation of proposed works to determine those of most benefit. Also consider recommendations of the Nambucca Aboriginal and Cultural Heritage Study McIntyre-Tamwoy (2003) and any other relevant information when reviewing proposed actions.	6.68
45	O7	Maintain and/or upgrade existing coastal protection infrastructure	Continue maintenance/ replacement works for areas currently identified and either currently in progress or not yet addressed (refer status of actions Appendix D Scoping Study). CMP to identify where additional funds are required to carry out works. Undertake maintenance, redesign/reconstruction as informed by the Coastal Hazard Monitoring Strategy (Option O4) into the future.	6.09
46	O26	Buy back of Gumma Swamp ASS areas and remediation	Investigate the purchase of land identified previously and feasibility of restoration works to remediate ASS. Engagement with landholders required.	5.40
47	O34	Alternative safe swimming areas	Consider the creation of alternative safe swimming locations in the lower estuary; including enclosing a swimming area and protect from sharks and/or other shark management options (e.g. monitoring, tagging, smart drum lines etc.)	4.85
48	O8	Periodic beach scraping	Review previous beach scraping works and determine achievements/ outcomes. Design beach scraping works. Gain pre-emptive approval and funding for beach scraping. Carry out beach scraping works as needed to assist beach recovery after erosion events and informed by the Coastal Hazard Monitoring Strategy (coastal event response).	4.05
49	O9	Dredging of marine sands at identified hotspots	Dredging at key locations to improve navigation, boating safety. Hotspot areas were identified and prioritised in the Shoaling Investigation and Dredging Strategy (GHD, 2016).	3.27

Rank	Option ID	Management Option	Description	Final Score (CTMS <sup>1</sup> + CBA <sup>2</sup> )
50	O11	Consider alternative location for Marine Rescue facilities or purchase of alternative (shallow-hulled) boating equipment	Undertake an assessment of the suitability of alternative marine rescue equipment and the possibility of relocation of marine rescue assets and infrastructure	3.27

<sup>1</sup> CTMS - Cumulative Threat Mitigation Score; <sup>2</sup> CBA – Cost Benefit Analysis Score

## REFERENCES

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- Mika, S., Vincent, B., Ryder, D., Lewis, S., Baker, A., and Schmidt, J (2018) *Nambucca Ecohealth Project 2016-2017: Assessment of River and Estuarine Condition*. Final Technical Report. University of New England, Armidale.
- NSC (2013a) *Deep Creek Entrance Management Policy*.
- NSC (2015) *Gumma Gumma Wetland Restoration Plan*.
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- NVC (2020). *Nambucca Valley Local Strategic Planning Statement*.
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- RDM, Hunter, K., Smyth, G., Bennet, F., Harrison, A., Amos, J., Eco-Logical, Appleton, J. (2010) *Nambucca Master Plan and Compendium*. Prepared for Nambucca Shire Council.
- Umwelt (2012). *Coastal Zone Management Plan for the Nambucca Shire Coastline*. Prepared on behalf of the Nambucca Shire Council.

## GLOSSARY AND ABBREVIATIONS

4WD	Four Wheel Drive/ing
Acid sulfate soils (ASS)	Acid sulfate soils are the common name given to soils containing iron sulfides. In Australia, the acid sulfate soils of most concern are those which formed within the past 10,000 years, after the last major sea level rise. When the iron sulfides are exposed to air and produce sulfuric acid, they are known as actual acid sulfate soils. The soil itself can neutralise some of the sulfuric acid. The remaining acid moves through the soil, acidifying soil water, groundwater and, eventually, surface waters.
Amenity	A desirable or useful feature or facility of a building or place
CMA	Coastal Management Area
CM Act	Coastal Management Act 2016 – the legislation under which this Scoping Study has been prepared.
CMP	Coastal Management Program
CZMP	Coastal Zone Management Plan
DCP	Development Controls Plans
DPI	(NSW) Department of Primary Industries
DPIE	Department of Planning, Industry & Environment
DPI Fisheries	NSW Department of Primary Industries – Fisheries
Ecosystem	Refers to all the biological and physical parts of a biological unit (e.g. an estuary, forest, or planet) and their interconnections.
Estuarine	Part of the river channel with a mix of fresh water and salt (tidal) water
FM Act	<i>Fisheries Management Act 1994</i>
Foreshore	That part of the shore that lies between the mean high tide mark and the mean low tide mark
GIS	Geographic Information System
Hydrology	The study of water and its properties, including precipitation onto land and returning to oceans
ICOLL	Intermittently Closed and Open Lakes and Lagoons
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Area
MEMA	Marine Estate Management Authority
MEMS	Marine Estate Management Strategy
NPWS	National Parks and Wildlife Service
NSC	Nambucca Shire Council (now known as Nambucca Valley Council)
NVC	Nambucca Valley Council (previously Nambucca Shire Council)
NSW	New South Wales
PoM	Plan of Management
Riparian	Of, on or relating to the banks of a watercourse

Salinity	The level of salt dissolved in the water
Sedimentation	The deposition or accumulation of sediment
SEPP	State Environmental Planning Policy
SLSC	Surf Life Saving Club
STP	Sewerage Treatment Plant
TARA	Threat And Risk Assessment
Terrestrial	Living or growing on land (not aquatic)



**Appendix 1. CUMULATIVE RISK MITIGATION SCORE**









Influence Score	
Direct positive	2
Indirect positive	1
No influence	0
Indirect negative	-1
Direct negative	-2

ID	Option	Rating	Recreational and commercial fishing and aquaculture										Water Quality										Hydrology, connectivity and water extraction			Governance, education and compliance			Political risk	Cultural Heritage		Cumulative Threat Mitigation Score		
			Mod	Mod	Mod	Mod	Mod	Low	Low	Mod	High	High	High	Mod	Low	Mod	High	High	High	High	Mod	Low	High	High	High	High	High	Mod	Low	Low	Mod		High	Mod
O1	Coastal hazard planning and development controls		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	2	2	2	2	100
O2	Updated coastal erosion hazard assessment and mapping		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2	0	95
O3	Coastal hazard assessment and mapping for areas of Nambucca study area not currently covered by existing coastal hazard mapping (i.e. areas managed by stakeholders other than NVC)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	54	
O4	Section 149 certificates identify coastal hazard risk		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	0	0	0	0	66	
O5	Local planning provisions		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	1	1	1	1	86	
O6	Coastal Hazard Monitoring Program		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	1	1	1	1	1	97	
O7	Maintain and/or upgrade existing coastal protection infrastructure		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	132	
O8	Periodic beach scraping		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34	
O9	Dredging of marine sands at identified hotspots		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	1	0	0	0	41
O10	Review of Deep Creek ICOLL entrance management policy		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	2	1	1	1	0	0	0	96	
O11	Consider alternative location for Marine Rescue facilities or purchase of alternative (shallow-hulled) boating equipment		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	9	
O12	Tidal inundation assessment		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	1	2	1	1	1	63	
O13	Estuarine vegetation response assessment		0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	2	2	1	1	1	0	79	
O14	Nambucca Bank Management Strategy		0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	2	0	0	0	0	0	2	2	2	1	0	0	0	176	
O15	Review and Update the Nambucca River Estuary Riverbank Restoration Guide (2010)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	2	2	1	1	1	1	95	
O16	Weed management /bushland regeneration activities		0	0	0	0	0	0	0	1	1	0	0	1	1	1	1	0	1	2	0	0	0	0	0	1	1	1	1	1	1	1	117	
O17	Riparian Restoration/ River Reach Plans		0	0	0	0	0	0	0	1	1	0	0	1	1	1	1	0	2	2	0	0	0	0	0	1	1	1	1	1	1	1	146	
O18	Support improvements in agricultural management		0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	1	2	1	0	2	2	2	2	2	2	2	2	1	1	1	160	
O19	Habitat condition monitoring		0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	2	0	0	0	2	2	0	1	1	1	1	106	
O20	Targeted restoration in high value habitats identified as degraded.		0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	1	0	2	0	2	2	2	2	2	1	1	1	0	167	

Influence Score	
Direct positive	2
Indirect positive	1
No influence	0
Indirect negative	-1
Direct negative	-2

ID	Option	Rating	T57	T58	T59	T60	T61	T62	T63	T64	T65	T66	T67	T68	T69	T70	T71	T72	T73	T74	T75	T76	T77	T78	T79	T80	T81	T82	T83	T84	T85	T86	Cumulative Threat Mitigation Score	
			Mod	Mod	Mod	Mod	Mod	Low	Low	Mod	High	High	High	Mod	Low	Mod	High	High	High	High	Mod	Low	High	High	High	High	Mod	Low	Low	Mod	High	Mod		
Threat			Recreational and commercial fishing and aquaculture									Water Quality										Hydrology, connectivity and water extraction				Governance, education and compliance			Political risk	Cultural Heritage				
O21	Improve protection of high value habitats particularly riparian vegetation		0	0	0	0	0	0	0	0	1	1	0	0	1	1	1	1	1	1	1	0	2	0	2	2	2	2	2	1	1	1	0	158
O22	Review environmental mapping and ensure consistency with NLEP and DCP		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	0	0	24	
O23	Water Quality Monitoring Program		0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	1	0	122		
O24	Stormwater management		0	0	0	0	0	1	0	0	2	0	0	2	0	2	1	1	0	0	0	0	0	0	0	2	1	2	1	0	0	63		
O25	Wastewater management		0	0	0	0	0	2	0	0	0	2	2	0	0	1	1	2	0	0	0	0	0	0	0	2	1	2	2	0	0	57		
O26	Buy back of Gumma Swamp ASS areas and remediation		0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2	2	1	1	1	2	1	77		
O27	On-site Sewage Management (OSSM) Strategy implementation		0	0	0	0	0	2	0	2	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	2	1	2	1	0	0	45		
O28	Lower Nambucca Estuary Water Quality Study: Management Strategy and Newee Creek Study remaining site-specific works		0	0	0	0	0	0	0	2	2	2	2	2	2	0	2	0	0	0	0	2	0	2	2	2	2	1	1	1	1	1	201	
O29	Fish passage and wetland connectivity review		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	1	1	1	1	0	31	
O30	Management of water extraction		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	2	2	1	0	0	25	
O31	Floodplain drainage mapping		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	1	1	0	0	29	
O32	Public recreational use strategy		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	1	2	2	2	2	171	
O33	Improve safety at V-Wall and along break wall		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	0	0	65		
O34	Alternative safe swimming areas		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	1	0	0	28		
O35	Companion animal management		0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	2	2	1	0	0	46		
O36	Traffic Study at key locations		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	1	0	0	47		
O37	Monitor success of current/previous 4WD management actions		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	0	0	44		
O38	Boating and waterway usage strategy		0	0	0	0	2	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	0	0	123		
O39	Access for passive recreational craft		0	0	0	0	2	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	1	1	0	0	72		
O40	Nambucca River Master Plan remaining site-specific works		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2	2	119	
O41	Swimming Creek debris removal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7		
O42	DPI Fisheries education program		1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	0	0	1	0	0	0	1	2	1	2	1	1	80	

Influence Score	
Direct positive	2
Indirect positive	1
No influence	0
Indirect negative	-1
Direct negative	-2

ID	Option	Rating	T57	T58	T59	T60	T61	T62	T63	T64	T65	T66	T67	T68	T69	T70	T71	T72	T73	T74	T75	T76	T77	T78	T79	T80	T81	T82	T83	T84	T85	T86	Cumulative Threat Mitigation Score	
			Commercial ocean trawl and ocean haul	Commercial trap and line	Estuary general fishing	Estuary prawn trawl	Recreational boat and shore-based line and trap fishing	Recreational hand gathering	Oyster aquaculture	Marine debris, including monofilament fishing line, bait	Agricultural diffuse source runoff (runoff from large areas)	Urban stormwater pollution and lack of management of	Sewer surcharge and STP overflows	On-site wastewater management (e.g. failing	Pet and wild fauna faeces	Logging on steep, highly erodible soils (i.e. of the	Urban development	Construction industries	Other licensed industrial sources	Pesticide and fertilizer runoff	Poor geomorphic condition (i.e. bed instability)	Poor flushing of ICOLLs	Acid Sulfate Soils	Water extraction	Hydrological modifications of wetlands and floodplain	Floodgate design, operation and maintenance	Insufficient governance	Lack of awareness, education and engagement	Compliance	Political risk	Threats to Aboriginal cultural practices and heritage	Threats to European cultural heritage		
			Recreational and commercial fishing and aquaculture									Water Quality										Hydrology, connectivity and water extraction				Governance, education and compliance			Political risk	Cultural Heritage				
			Mod	Mod	Mod	Mod	Mod	Low	Low	Mod	High	High	High	Mod	Low	Mod	High	High	High	High	Mod	Low	High	High	High	High	Mod	Low	Low	Mod	High	Mod		
O43	Support sustainable aquaculture industries within the Nambucca River estuary		0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	1	0	0	24
O46	Protect Aboriginal and European cultural heritage items and places		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2	2	50
O47	Cultural heritage education and awareness		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2	2	50
O48	Consultation with local Indigenous community		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	2	2	2	2	2	2	65
O49	Nambucca Rivers Creeks Estuaries and Coastline Management Committee to oversee CMP implementation		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	1	0	0	17	
O51	MoU between NVC and NPWS		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	1	2	2	29	
O52	NVC Coastline and Estuary Educational Program		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	323	
O53	Estuary shoaling education		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	1	1	0	0	46	
O54	Improve recognition of Crown Land areas		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	0	0	20	
O55	Environmental Levy funding for implementing the CMP		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	0	0	1	0	0	305	
O56	Sustainable tourism		0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	1	1	1	49	
O58	Best practice erosion and sediment control guidelines for construction sites		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	2	2	2	1	0	0	26	
O59	Investigate and remove illegal connections of stormwater to sewer		0	0	0	0	0	0	0	0	0	2	2	0	0	0	2	0	0	0	0	0	0	0	0	0	2	2	2	1	0	0	40	



## Appendix 2. COST-BENEFIT ANALYSIS

ID	Management Option	Description	Cumulative Threat Mitigation Score		Feasibility			Total Feasibility Score	Viability			Total Viability Score	Acceptability		Total Acceptability Score	Final CBA Score	Final Option Score	Final Option Rank	CMP Category	
			Raw CTMS (refer CTMS table)	Scaled CTMS (out of 10)	Effectiveness (in addressing direct threats)	Technical Viability	Ecological sustainability	Legal/ Approval Risk	(out of 4)	Capital Costs	On-going costs	Cost-benefit distribution (public vs. private)	(out of 3)	Community/ Stakeholder Acceptability	Meeting CM objectives	(out of 2)	CBA	(CTMS + CBA)		Rank
O55	Environmental Levy funding for implementing the CMP	Specific allocation from NVC's Environmental Levy provides funds for implementing the coast and estuary program. Continue as key funding source. Review adequacy of funding amounts and recommend changes as appropriate.	305	9	1	1	0	1	3	1	1	1	3	1	1	2	8	17.44	n/a	Fundamental
O52	NVC Coastline and Estuary Educational Program	Design and implement an integrated Coastline and Estuary Educational Program to educate and promote understanding of the natural attributes of the coastline and estuaries, sensitivities and key issues and encouraging low-impact use/practices to protect key sites. May involve installation/ replacement of attractive and engaging signage at key locations, leaflets/flyers, webpage, posters, information days/activities, school programs, educational videos etc. Target groups could include: local construction industry (erosion and sediment controls), boating users, agricultural industry, oyster industry, tourists/tourism sector, foreshore Crown land managers (e.g. caravan parks), school groups, general public, residents close to sensitive systems (e.g. swimming creek) etc.	323	10	0	1	1	1	3	0	0	1	1	1	1	2	6	16.00	n/a	Fundamental
O23	Water Quality Monitoring Program	Development of a targeted and integrated water quality monitoring program consistent with other CMP actions as relevant and existing monitoring (e.g. Ecohealth program). Design of program will involve determination of aims and objectives, selecting key sites, appropriate monitoring methods, frequencies and reporting of results. Monitoring will aim to assess the impact of both point source and diffuse source pollution on estuary water quality. Establish an integrated water quality database as central storage location for data. Include consideration of runoff from intensive horticultural uses, faecal coliforms in recreational areas and aquaculture industries.	122	4	0	1	1	1	3	1	1	1	3	1	1	2	8	11.77	n/a	Fundamental
O48	Consultation with local Indigenous community	Ongoing consultation with the local indigenous community on a long-term basis regarding coastline and estuary values/ indigenous knowledge of ecology, seasonal cycles etc. / identifying threats and issues to be addressed and greater involvement of indigenous community in coastline and estuary management.	65	2	1	1	1	1	4	1	1	1	3	1	1	2	9	11.00	n/a	Fundamental
O49	Nambucca Rivers Creeks Estuaries and Coastline Management Committee to oversee CMP implementation	Continue oversight of CMP by Committee. Ensure adequate representation of all key local stakeholder groups in management of study area. Consider formalising a regular meeting frequency (e.g. quarterly) during CMP implementation and more regularly as needed to discuss implementation milestones, funding, and emerging issues etc.	17	1	1	1	0	1	3	1	1	1	3	1	1	2	8	8.53	n/a	Fundamental

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O1	Coastal hazard planning and development controls	Revised Nambucca DCP incorporates a chapter on coastal hazards (e.g. development restrictions and planning controls for both new and existing buildings in line with coastal hazard risks etc.).	100	3	1	1	0	1	3	1	1	1	3	1	1	2	8	11.10	1	Targeted action/ on-ground works
O14	Nambucca Bank Management Strategy	Develop an estuary-wide Bank Management Strategy consistent with Initiative 2 of the Marine Estate Management Strategy and any tool/ guidance provided. Bank Condition Assessment - Nambucca River and Deep Creek (Hydrosphere Consulting, 2020) maps current areas of concern and priority sites for rehabilitation works.	176	5	1	1	1	1	4	-1	-1	1	-1	1	1	2	5	10.46	2	Targeted action/ on-ground works
O27	On-site Sewage Management (OSSM) Strategy implementation	Continue implementation of NVC's OSSM Plan. Incorporate sites to assess known OSSM problem areas into Water Quality Monitoring Program.	45	1	1	1	1	1	4	1	1	1	3	1	1	2	9	10.39	3	Targeted action/ on-ground works
O6	Coastal Hazard Monitoring Program	Design and implement a Coastal Hazard Monitoring Program to underpin Council's adaptive management of coastal risks. The strategy would incorporate assessment of condition and effectiveness of coastal protection infrastructure, public access, coastal event response etc. and guide management action.	97	3	0	1	0	1	2	1	1	1	3	1	1	2	7	10.01	4	Targeted action/ on-ground works
O15	Review and Update the Nambucca River Estuary Riverbank Restoration Guide (2010)	A guideline on riverbank protection works was prepared by Council and other Agencies in 2010. It requires updating to reflect current/ new legislation. Infrastructure SEPP, Coastal SEPP, and Fisheries Management Act control riverbank works through various processes. Also review and ensure alignment with Environmentally Friendly Seawalls Guide (OEH, 2009).	95	3	0	1	0	1	2	1	1	1	3	1	1	2	7	9.93	5	Targeted action/ on-ground works
O2	Updated coastal erosion hazard assessment and mapping	Update coastal erosion hazard assessment and mapping from SMEC (2009). Consider new knowledge about coastal processes, climate change, sea level rise, community aspirations and coastal ecosystems. Determine whether trigger points for changing coastal risk management approaches have been reached.	95	3	0	1	0	1	2	1	1	1	3	1	1	2	7	9.93	6	Targeted action/ on-ground works
O5	Local planning provisions	Nambucca LEP to incorporate open space zones along the coastline as appropriate and wherever possible to reduce development in the coastal zones at risk of current or future coastal hazards.	86	3	0	1	1	0	2	1	1	1	3	1	1	2	7	9.67	7	Targeted action/ on-ground works
O16	Weed management /bushland regeneration activities	Coastal weed management in co-operation with North Coast Weeds Advisory Committee, Landcare groups and other stakeholders. Weed management may include weed removal, assisted bushland regeneration, planting, fencing out stock or human access etc. May also be combined with other works including dune management/ coastal protection/ bank protection works.	117	4	0	1	1	1	3	0	0	1	1	1	1	2	6	9.62	8	Targeted action/ on-ground works

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O46	Protect Aboriginal and European cultural heritage items and places	Council to undertake appropriate consultation with relevant bodies when designing work/ projects in the lower estuary. Recommendations of the Nambucca Valley Council Aboriginal Cultural Heritage Management Plan to be addressed in any future works or projects in areas of significance	50	2	1	1	0	1	3	1	1	1	3	1	1	2	8	9.55	9	Targeted action/ on-ground works
O56	Sustainable tourism	Promote the natural values of the estuary and sustainable use and support the valuable tourism industry of the Nambucca Shire.	49	2	0	1	1	1	3	1	1	1	3	1	1	2	8	9.50	10	Targeted action/ on-ground works
O42	DPI Fisheries education program	DPI Fisheries undertake community educational program on current threats and impacts to fish/fish habitat and current fish management practices targeted to Nambucca LGA.	80	2	0	1	0	1	2	1	1	1	3	1	1	2	7	9.49	11	Targeted action/ on-ground works
O13	Estuarine vegetation response assessment	Assessment of potential for estuarine vegetation migration with sea level rise based on vegetation types, topography, land use and possible future tidal range. Include mapping and assign management priority classification.	79	2	0	1	0	1	2	1	1	1	3	1	1	2	7	9.45	12	Targeted action/ on-ground works
O32	Public Recreational Use Strategy	Prepare a strategy that builds on previously successful plans. The strategy would include assessment of suitability of current infrastructure, consideration of growth potential, disability needs, identification of public land that could be used for public recreation, and a suggested allocation of funds for facility improvements, provision of coastal pathways etc. The aim will be to provide strategic master planning for additional areas that support placemaking, facility improvement, open space/ environmental management and having better linked coastal villages, towns and communities.	171	5	1	1	1	0	3	-1	-1	1	-1	1	1	2	4	9.31	13	Targeted action/ on-ground works
O19	Habitat condition monitoring	Monitor condition of habitats of high ecological and/or conservation value e.g. saltmarsh, wetlands, littoral rainforests, riparian zone, and floodplain wetlands. Monitoring program to track the health and condition of key habitats. Targeted to areas of previous works (e.g. Stuart Island, Watt Creek, Deep Creek, Macksville, Sand Island, Lower Nambucca, Wirrimbi, and various coastal wetlands and Riparian areas). Mapping of condition required.	106	3	0	1	0	1	2	1	0	1	2	1	1	2	6	9.27	14	Targeted action/ on-ground works
O59	Investigate and remove illegal connections of stormwater to sewer	Assess urban residential areas to identify properties with illegal stormwater to sewer connections. Smoke testing can be used to quickly identify illegal connections.	40	1	0	1	1	1	3	1	1	1	3	1	1	2	8	9.24	15	Targeted action/ on-ground works
O28	Lower Nambucca Estuary Water Quality Study: Management Strategy and Newee Creek Study remaining site-specific works	Incorporates all remaining actions from the strategy considered to be relevant and suitable today, and addresses current issues affecting the study area. Action to include review and rationalisation of proposed works to determine those of most benefit.	201	6	1	0	1	0	2	-1	-1	1	-1	1	1	2	3	9.23	16	Targeted action/ on-ground works

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O41	Swimming Creek debris removal	Remove debris from swimming Creek (e.g. concrete, bricks, tyres, timber).	7	0	1	1	1	1	4	1	1	1	3	1	1	2	9	9.20	17	Targeted action/ on-ground works
O33	Improve safety at V-Wall and along break wall	Improve the quantity and accessibility of safety and rescue equipment near the v-wall and along the break wall.	65	2	1	0	0	1	2	1	1	1	3	1	1	2	7	9.02	18	Targeted action/ on-ground works
O10	Review of Deep Creek ICOLL entrance management policy	Review efficacy of the existing Deep Creek Entrance Management Strategy since its implementation in 2012 (e.g. effect on flooding, water quality, inundation of EECs such as Swamp Oak forest etc.). Update as appropriate based on review.	96	3	0	1	0	1	2	1	1	0	2	1	1	2	6	8.98	19	Targeted action/ on-ground works
O18	Support improvements in agricultural land management	Programs focussed on improving agricultural land management to reduce export of pollutants (e.g. sediment, nutrients/fertilisers, bacteria, pesticides etc.). Potential examples include: on-farm property scale plans and actions to improve drainage, fertiliser management, exclude stock access to natural waterways, manage run-off from dirt roads, maintain grass cover and buffer zones etc.); Target areas identified by DPIE EES Estuary Health Risk Dataset, Ecohealth Monitoring and local strategies (e.g. sub catchments of Deep Creek, North Arm, Buckra Bendinni Creek, Gumma Gumma Swamp, Newee Creek etc.).	160	5	1	1	1	1	4	-1	-1	0	-2	1	1	2	4	8.95	20	Targeted action/ on-ground works
O12	Tidal inundation assessment	Detailed local tidal inundation assessment of the estuaries for a variety of future sea level rise scenarios, with a risk assessment to estuary assets and infrastructure.	63	2	0	1	0	1	2	1	1	1	3	1	1	2	7	8.94	21	Targeted action/ on-ground works
O58	Best practice erosion and sediment control guidelines for construction sites	More effective sediment controls where soil disturbance occurs, for example, during early phases of land development or construction. Education, promotion and compliance with best practice erosion and sediment control guidelines for construction sites.	26	1	0	1	1	1	3	1	1	1	3	1	1	2	8	8.81	22	Targeted action/ on-ground works
O30	Management of water extraction	Consult with NRAR and DPIE-Water regarding management of water extraction under the Nambucca Water Sharing Plan (2016). Consultation will aim to highlight the threat and implications of increased water extraction on estuary health and seek to ensure adequate oversight and enforcement of water sharing plan rules and regulations.	25	1	0	1	1	1	3	1	1	1	3	1	1	2	8	8.76	23	Targeted action/ on-ground works
O43	Support sustainable aquaculture industries within the Nambucca River estuary	Application of the highest levels of catchment and waterway management to ensure that the estuary's water quality is sufficient to maintain this industry, in clearly identified areas	24	1	0	1	1	1	3	1	1	1	3	1	1	2	8	8.73	24	Targeted action/ on-ground works

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O03	Coastal hazard assessment and mapping for areas of Nambucca study area not currently covered by existing coastal hazard mapping (i.e. areas managed by stakeholders other than NVC)	Agencies/authorities other than Council to undertake coastal hazard mapping in areas under their control (present day, and relevant long-term planning scenarios) to fill in the gaps (DPIE - Crown Lands, DPIE - NPWS, State Rail in Oyster Creek etc.).	54	2	0	1	0	1	2	1	1	1	3	1	1	2	7	8.68	25	Targeted action/ on-ground works
O47	Cultural heritage education and awareness	Education regarding cultural heritage significance of study area (e.g. Signposting to identify and explain areas that have cultural significance, school programs etc.)	50	2	0	1	0	1	2	1	1	1	3	1	1	2	7	8.55	26	Targeted action/ on-ground works
O17	Riparian Restoration/ River Reach Plans	Provide funding for greater roll out of River Reach Plans in the study area. Plan would cover aspects based on site-specific assessments which may include bank erosion controls, weed management, riparian fencing instalment/ improvement to exclude stock and allow for protection of estuarine macrophytes, recovery of native riparian vegetation, and reduced faecal matter in waterways.	146	5	1	1	1	1	4	-1	-1	0	-2	1	1	2	4	8.51	27	Targeted action/ on-ground works
O36	Traffic Study at key locations	Traffic study of beach parking areas at Scotts Head to identify opportunities for improved layout. Options to be considered include changed turn around areas for the boat ramp, limiting parking beyond the surf club. Traffic study of beach parking areas at Main Beach Nambucca Heads - consider alternative access arrangements.	47	1	0	1	0	1	2	1	1	1	3	1	1	2	7	8.46	28	Targeted action/ on-ground works
O35	Companion animal management	Continue to regulate and monitor performance of existing actions and management relating to the use of off-leash and on-leash areas by the public and their pets.	46	1	0	1	0	1	2	1	1	1	3	1	1	2	7	8.41	29	Targeted action/ on-ground works
O53	Estuary shoaling education	Raise community awareness of coastal/estuary processes to increase the level of understanding of shoaling mechanisms and associated implications as well as the consequences of intervention measures.	46	1	0	1	0	1	2	1	1	1	3	1	1	2	7	8.41	30	Targeted action/ on-ground works
O37	Monitor success of current/ previous 4WD management actions	Monitor performance of existing actions and management relating to the use of 4WDs and motorbikes on beaches.	44	1	0	1	0	1	2	1	1	1	3	1	1	2	7	8.36	31	Targeted action/ on-ground works
O20	Targeted restoration in high value habitats identified as degraded.	Based on the results of monitoring program, target priority areas for works. Management priorities should be based on the area and condition of remnant vegetation and adjacent land uses, restoration potential and overall values.	167	5	1	0	1	0	2	-1	-1	1	-1	1	1	2	3	8.16	32	Targeted action/ on-ground works
O4	Section 149 certificates identify coastal hazard risk	Section 149 certificates identify coastal hazard risk for affected properties (2050 and 2100 limits of the Stable Foundation Zone) (ongoing implementation). S149 certificates to be updated as required by legislative changes.	66	2	1	1	0	1	3	1	1	-1	1	1	1	2	6	8.05	33	Targeted action/ on-ground works

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O29	Fish passage and wetland connectivity review	Review current status of wetland connectivity and fish passage barriers including the discussions between DPI Fisheries, Council, landholders (and any drainage boards) RE location of structures and management practices; and mapping of impediments to connectivity; and prioritisation of barriers for removal/ modification (DPI Fisheries as responsible agency).	31	1	0	1	1	0	2	1	1	1	3	1	1	2	7	7.96	34	Targeted action/ on-ground works
O24	Stormwater management	Develop catchment-based stormwater plan to investigate issues and determine management actions required. Key locations identified previously include Scotts Head Main Beach, Beilby's Beach, Shelly Beach and Main Beach northern carpark, Swimming Creek catchment. Implement stormwater management actions to address issues.	63	2	1	1	1	1	4	-1	0	1	0	1	1	2	6	7.95	35	Targeted action/ on-ground works
O51	MoU between NVC and NPWS	Develop a memorandum of understanding (MoU) between NSC and NPWS to document and agree on roles and responsibilities in areas where this overlap	29	1	0	1	0	1	2	1	1	1	3	1	1	2	7	7.90	36	Targeted action/ on-ground works
O31	Floodplain drainage mapping	Accurately map the drainage system on the floodplain.	29	1	0	1	0	1	2	1	1	1	3	1	1	2	7	7.90	37	Targeted action/ on-ground works
O21	Improve protection of high value habitats particularly riparian vegetation	A potential future project may be shire-wide stewardship site feasibility assessment, highlighting properties in the shire that may have significant natural resource value if protected into perpetuity. Potential to provide funding for Land for Wildlife conservation agreements in cooperation with NV Landcare	158	5	1	0	1	1	3	-1	-1	1	-1	0	1	1	3	7.88	38	Targeted action/ on-ground works
O22	Review environmental mapping and ensure consistency with NLEP and DCP	Desktop GIS assessment: Review environmental mapping (e.g. CMAs, EECs, marine vegetation). Overlay with NLEP zoning. Consider future likely areas for migration of estuarine vegetation with sea level rise (refer Tidal Inundation Assessment). Consider provisions of NLEP and DCP to ensure it reflects appropriate protection of these sensitive environments, aid community awareness and assist in ease of the development application processes.	24	1	0	1	0	1	2	1	1	1	3	1	1	2	7	7.74	39	Targeted action/ on-ground works
O54	Improve recognition of Crown Land areas	Improve recognition of Crown Land areas in the lower estuary, particularly those around existing facilities that may promote greater connectivity and tourist related usage of the area	20	1	0	1	0	1	2	1	1	1	3	1	1	2	7	7.62	40	Targeted action/ on-ground works
O39	Access for passive recreational craft	Investigate the need for future boat ramps and associated recreational activities at Tewinga or Wirrimibi, Henstock Reserve (Warrell Creek), Welshes Park (Talarm)	72	2	0	1	-1	0	0	1	1	1	3	1	1	2	5	7.23	41	Targeted action/ on-ground works
O38	Boating and waterway usage strategy	To maintain and enhance safe, responsible, and ecologically sustainable recreational boating and water sports activities. The strategy would incorporate several elements including rationalise and improve access points, boat ramps and associated facilities, signage and education etc.	123	4	1	0	1	0	2	-1	-1	1	-1	1	1	2	3	6.82	42	Targeted action/ on-ground works

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O25	Wastewater management	Continue to work with EPA to develop Pollution Reduction Programs. Identify risk and impact of sewage spill from existing pump stations/pipes with a view to upgrading priority systems. Investigate upgrade of Macksville STP including assessment of feasibility of removing effluent discharge to river.	57	2	1	1	1	1	4	-1	-1	1	-1	1	1	2	5	6.75	43	Targeted action/ on-ground works
O40	Nambucca River Master Plan remaining site-specific works	Incorporates all remaining actions from the River Master Plan considered to be relevant and suitable today, and addresses current issues affecting the study area. Action to include review and rationalisation of proposed works to determine those of most benefit. Also consider recommendations of the Nambucca Aboriginal and Cultural Heritage Study McIntyre-Tamwoy (2003) and any other relevant information when reviewing proposed actions.	119	4	1	0	1	0	2	-1	-1	1	-1	1	1	2	3	6.68	44	Targeted action/ on-ground works
O7	Maintain and/or upgrade existing coastal protection infrastructure	Continue maintenance/ replacement works for areas currently identified and either currently in progress or not yet addressed (refer status of actions Appendix D Scoping Study). CMP to identify where additional funds are required to carry out works. Undertake maintenance, redesign/reconstruction as informed by the Coastal Hazard Monitoring Strategy (Option O4) into the future.	132	4	1	0	0	0	1	-1	-1	1	-1	1	1	2	2	6.09	45	Targeted action/ on-ground works
O26	Buy back of Gumma Swamp ASS areas and remediation	Investigate the purchase of land identified previously and feasibility of restoration works to remediate ASS. Engagement with landholders required.	77	2	1	1	1	0	3	-1	-1	0	-2	1	1	2	3	5.40	46	Targeted action/ on-ground works
O34	Alternative safe swimming areas	Consider the creation of alternative safe swimming locations in the lower estuary; including enclosing a swimming area and protect from sharks and/or other shark management options (e.g. monitoring, tagging, smart drum lines etc.)	28	1	0	0	0	1	1	-1	1	1	1	1	1	2	4	4.85	47	
O8	Periodic beach scraping	Review previous beach scraping works and determine achievements/ outcomes. Design beach scraping works. Gain pre-emptive approval and funding for beach scraping. Carry out beach scraping works as needed to assist beach recovery after erosion events and informed by the Coastal Hazard Monitoring Strategy (coastal event response).	34	1	1	0	-1	0	0	0	1	1	2	0	1	1	3	4.05	48	Targeted action/ on-ground works
O9	Dredging of marine sands at identified hotspots	Dredging at key locations to improve navigation, boating safety. Hotspot areas were identified and prioritised in the Shoaling Investigation and Dredging Strategy (GHD, 2016).	41	1	1	1	0	0	2	-1	-1	1	-1	0	1	1	2	3.27	49	Targeted action/ on-ground works
O11	Consider alternative location for Marine Rescue facilities or purchase of alternative (shallow-hulled) boating equipment	Undertake an assessment of the suitability of alternative marine rescue equipment and the possibility of relocation of marine rescue assets and infrastructure	9	0	1	0	0	0	1	-1	1	1	1	0	1	1	3	3.27	50	Targeted action/ on-ground works