Clarence Valley Open Coast

Coastal Management Program

Final for certification

October 2024

Clarence Valley Council has prepared this document with financial assistance from the NSW Government through the Department of Climate Change, Energy, the Environment and Water (DCCEEW). This document does not necessarily represent the opinions of the NSW Government or DCCEEW.

Acknowledgement of Country:

Clarence Valley Council acknowledges the Bundjalung, Gumbaynggirr and Yaegl people as the Traditional Owners of the land on which we live and work. We honour the First Nations people's culture and connection to land, sea and community. We pay our respects to their Elders past, present and emerging.

Cover photos (clockwise from top left): Yamba Main Beach, estuary fishing and kayaking, Wooli Beach.

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22-009 CLARENCE VALLEY OPEN COAST COASTAL MANAGEMENT PROGRAM STAGE 4 CMP

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EXECUTIVE SUMMARY

Clarence Valley Council (CVC) has prepared the Clarence Valley Open Coast Coastal Management Program (CMP) to set the long-term strategy for the coordinated management of the Clarence Valley Open Coast. The coastal zone within this CMP includes the open beaches, foreshores and coastal waters of the Clarence Valley including Woody Head, Iluka beaches, Yamba, Angourie, Brooms Head, Sandon, Minnie Water, Diggers Camp and Wooli. The study area also includes the estuaries and lagoons of Lake Cakora, Lake Arragan, Sandon River and Wooli Wooli River. The coastal zone covered in this CMP comprises the whole coastal zone within the Clarence Valley LGA apart from the Clarence River estuary and its catchment.

The Clarence Valley coastline is the traditional land of the Yaegl People. The core environmental values of the study area are associated with its landscape amenity (i.e. geographical features, scenic amenity and views), healthy and diverse natural environments and biodiversity values. The open coast and estuaries are dynamic and diverse encompassing a broad range of natural features including sandy beaches, coastal dunes, rocky headlands, marine areas, lakes, estuary entrances, littoral rainforest, wetlands/ heathlands and estuarine environments. For many community members, interaction with the coast and estuaries is a highly valued part of life. The beaches and waterways provide a place for social interaction, recreation, relaxation, nature appreciation, connection, exercise and commercial activities.

Along the Clarence coastline many beaches are vulnerable to coastal erosion/ recession (including Woody Bay, Whiting Beach, Yamba Main Beach, Brooms Head beach and Wooli Beach). Hickey Island, and areas within close proximity to estuary entrances (Brooms Head/ Lake Cakora and Wooli/ Wooli Wooli River) are most vulnerable to inundation. Slope instability is a critical issue for the Yamba coastline particularly the areas backing Yamba Main Beach and Convent Beach. Bank erosion and the poor condition of the riparian zone is a key issue in the Wooli Wooli River. Conflicts between waterway uses and values can impact the amenity of the area, and these conflicts are exacerbated by coastal hazards and the popularity of the area.

The CMP includes strategies and actions to manage these key threats from coastal hazards including coastal protection works, coastal hazard monitoring, emergency response measures and the development of adaptation strategies. The CMP also includes actions to address coastal management issues such as coastal development, weeds, litter, beach-cast kelp, vehicles on beaches, dogs on beaches and damage to beach access points due to coastal erosion. Poor water quality is also an issue in the estuaries, particularly Lake Cakora, as well as the Angourie pools. Water quality and estuary health monitoring will be undertaken to inform the development of strategies to improve the health of Lake Cakora, Sandon River and Wooli Wooli River. Recreational water quality monitoring through the Beachwatch program and algal monitoring at the Angourie pools will be reinstated to provide information on the suitability of the beaches and waterways for swimming.

This CMP incorporates management actions and strategies to address the key threats and support the diversity of natural values and human uses within the coastal zone. Management actions have been developed for the next ten years to balance and manage uses so that they are compatible with the environmental, social and economic values of the Clarence Valley coastal zone. Long-term pressures such as climate change, sea level rise and population growth have been considered in the formulation of management actions to ensure resilience against future threats and the conservation of coastal values for future generations. Throughout the development of the CMP, CVC has collaborated with land managers,

state government agencies, traditional owners and community representatives to provide effective and integrated coastal management approaches.

The management strategies and CMP actions for each management zone consist of a combination of studies, investigations and on-ground works. Some actions require additional investigation prior to implementation of on-ground works. This is to ensure the appropriate effort and geographical focus of on-ground works are identified and sufficient funding is obtained to properly implement the works. An adaptive management approach has been developed for each management zone including identification of potential triggers and thresholds. It is recognised that coastal processes will impact on the natural landscape over time and that intervention may not be able to stop 'nature taking its course'. However, there is uncertainty with the extent and timing of the coastal hazards. This uncertainty and the need to be adaptive to changing circumstances was acknowledged in the selection of management actions. To achieve the best outcomes for the study area, a combination of management approaches will be implemented over time utilising an adaptive management approach.

The CMP includes actions to be implemented by CVC which are expected to be funded through CVC and state government contributions, monetary grants, private landholder funding and volunteer works by community members and organisations. Some actions will be funded under CVC's normal operating budgets or through existing programs and grants, particularly within the current Delivery Program. CVC's current coastal budget is insufficient to successfully fund and implement all CMP actions and CVC will need to access other potential funding mechanisms for implementation of the CMP actions. Several CMP actions will be implemented by NSW National Parks and Wildlife Service (within the national parks estate), Department of Primary Industries and Regional Development-Fisheries (fish habitat management, riverbank and riparian condition assessment and seagrass investigations) and Transport for NSW–Maritime (marine infrastructure and safety). A summary of the proposed expenditure under this CMP is provided in Table 1.

Table 1: Summary of the total proposed CMP expenditure over the ten-year period

CMP action category	Components	Responsibility			
		Clarence Valley Council (CVC, funded through CVC revenue and external grants and contributions)	NSW National Parks and Wildlife Service (NPWS)	NSW Department of Primary Industries and Regional Development (DPIRD)	Transport for NSW (TfNSW)
Cultural heritage	Consultation with traditional owners, planning, assessment and implementation of cultural heritage protection measures, community education	$200,000 + CVC staff time	NPWS staff time	-	-
Coastal habitat restoration	Weed management, revegetation, fencing, signage and reserve access improvements	$4,070,000 + CVC staff time	$600,000 + NPWS staff time	DPIRD staff time	-
Coastal hazard adaptation	Monitoring, strategic planning, implementation of adaptation measures	$1,930,000 + CVC staff time	$1,235,000 + NPWS staff time	-	-
Emergency response	Management of coastal emergency events relating to coastal erosion and cliff instability including interim coastal protection works	$200,000 + CVC staff time	$50,000 + NPWS staff time	-	-
Beach nourishment	Planning, assessment and implementation of beach nourishment measures	$2,960,000 + CVC staff time	-	-	To be funded from TfNSW operating budget subject to Maritime's assessed infrastructure and dredging priorities across NSW
Coastal protection works	Planning, assessment, implementation and maintenance of coastal protection works	$6,620,000 + CVC staff time	$3,172,000 + NPWS staff time	-	-

CMP action category	Components	Responsibility			
		Clarence Valley Council (CVC, funded through CVC revenue and external grants and contributions)	NSW National Parks and Wildlife Service (NPWS)	NSW Department of Primary Industries and Regional Development (DPIRD)	Transport for NSW (TfNSW)
Recreational improvements	Planning, assessment and implementation of waterway access and pedestrian walkway improvements	$1,290,000 + CVC staff time	-	-	To be funded from TfNSW operating budget subject to Maritime's assessed infrastructure and dredging priorities across NSW
Water quality and ecosystem health	Monitoring, education and signage relating to recreational water quality and ecosystem health	$696,000 + CVC staff time	-	DPIRD staff time	-
Riverbank management	Bank erosion assessment and implementation of improvement measures	$300,000 + CVC staff time	-	Implementation cost included within DPIRD operating budget	-
Strategic planning	Planning and development controls, CMP review, policy development and review, asset management, funding strategy, liaison with approval agencies	$507,000 + CVC staff time	-	-	-
Total		**$18,773,000 + CVC staff time**	**$5,057,000 + NPWS staff time**	**Implementation cost included within DPIRD operating budget**	**To be funded from TfNSW operating budget subject to Maritime's assessed infrastructure and dredging priorities across NSW**

Note: all expenditure is subject to availability of internal funding and external grants. Where actions require CVC or agency staff resources, actual costs have only been applied where it is expected that implementation will exceed current resourcing levels and additional funding is required. Cost estimates cover the preliminary investigations, environmental assessment, approvals and implementation. Cost estimates are preliminary only and are based on the best available information. Where a study/ review is required to determine the appropriate level of expenditure, the implementation costs will be confirmed through the study/ review.

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1. INTRODUCTION

Clarence Valley Council (CVC) has prepared this Coastal Management Program (CMP) to set the long-term strategy for the coordinated management of the Clarence Valley Open Coast with a focus on achieving the relevant objectives for each coastal management area in accordance with the *Coastal Management Act 2016* (CM Act). This CMP incorporates management actions and strategies to address key threats and support a diversity of natural values and human uses for a range of timeframes (immediate, 20 years, 50 years and 100 years). Management actions have been developed for the next ten years to balance and manage uses so that they are compatible with the environmental, social and economic values of the Clarence Valley coastal zone. Long-term pressures such as climate change, sea level rise and population growth have been considered in the formulation of management actions to ensure resilience against future threats and the conservation of these values for future generations. The CMP also includes management strategies to support the required strategic planning for managing longer-term threats and risks to the coastal zone.

This CMP has been developed in accordance with Stages 1 to 4 of the five-stage process for developing and implementing a CMP, as detailed in the *Coastal Management Manual* (OEH, 2018, Figure 1).

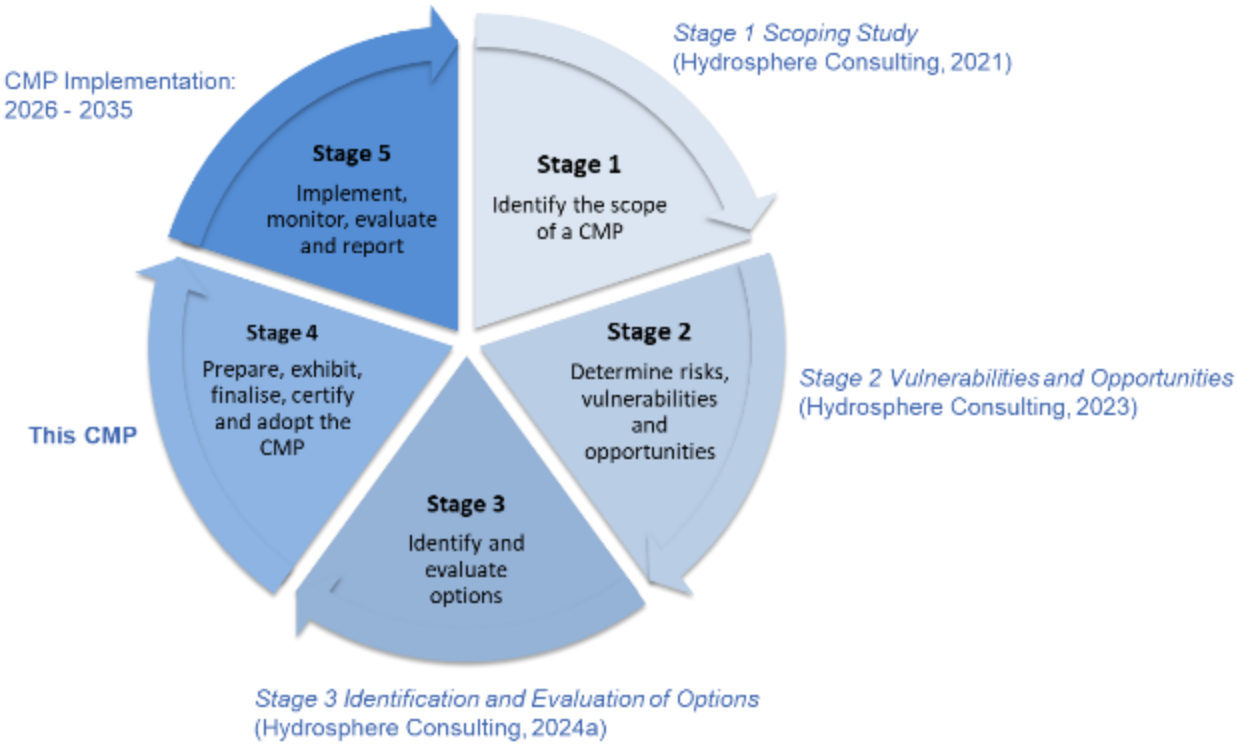

Figure 1: The five-stage process for developing a coastal management program

Source: Adapted from OEH (2018a)

2. BACKGROUND

2.1 The Coastal Management Framework in NSW

The CM Act establishes the framework and overarching objects for coastal management in NSW and supports the aims of the *Marine Estate Management Act 2014* (MEM Act) to provide for strategic and integrated management of the whole marine estate (marine waters, coasts and estuaries). The CM Act communicates the NSW Government's vision for coastal management and reflects the natural, social, cultural and economic values of our coastal areas and promotes the principles of ecologically sustainable development in managing these values. The CM Act establishes the statutory requirements for the preparation and certification of CMPs.

The *State Environmental Planning Policy (Resilience and Hazards) 2021* (the Resilience and Hazards SEPP) forms part of the broader land use planning framework in NSW. This is now the key environmental planning instrument for land use planning in the coastal zone and delivers the statutory management objectives for each of the four coastal management areas that make up the coastal zone (and which are set out in the CM Act). Mapping of these areas within the CMP study area is presented in Figure 4 (Section 24: Maps).

The Coastal Management Manual establishes the mandatory requirements for developing a CMP (Part A) as well as specific guidance for each stage of the CMP development and implementation (Part B, Stages 1 to 5) as follows:

- *NSW Coastal Management Manual Part A: Introduction and mandatory requirements for a coastal management program* (OEH, 2018a).
- *NSW Coastal Management Manual Part B: Stage 2 – Determine risks, vulnerabilities and opportunities* (OEH, 2019a).
- *NSW Coastal Management Manual Part B: Stage 3 – Identify and evaluate options* (OEH, 2019b).
- *NSW Coastal Management Manual Part B: Stage 4 – Prepare, exhibit, finalise, certify and adopt a coastal management program* (OEH, 2018b).
- *NSW Coastal Management Manual Part B: Stage 5 – Implement, monitor, evaluate and report* (OEH, 2018c).

In order to secure certification by the Minister, the CMP must meet the mandatory requirements detailed in the Coastal Management Manual Part A. This CMP has been prepared in accordance with the Coastal Management Manual Part A and utilising the guidance from the Coastal Management Manual Part B Stages 2 – 4.

The coastal management legislative and policy framework recognises natural coastal processes and the local and regional dynamic character of the coast while promoting land use planning decisions that accommodate them. The framework supports coordinated planning and management of the coast and public participation in these activities (Figure 1).

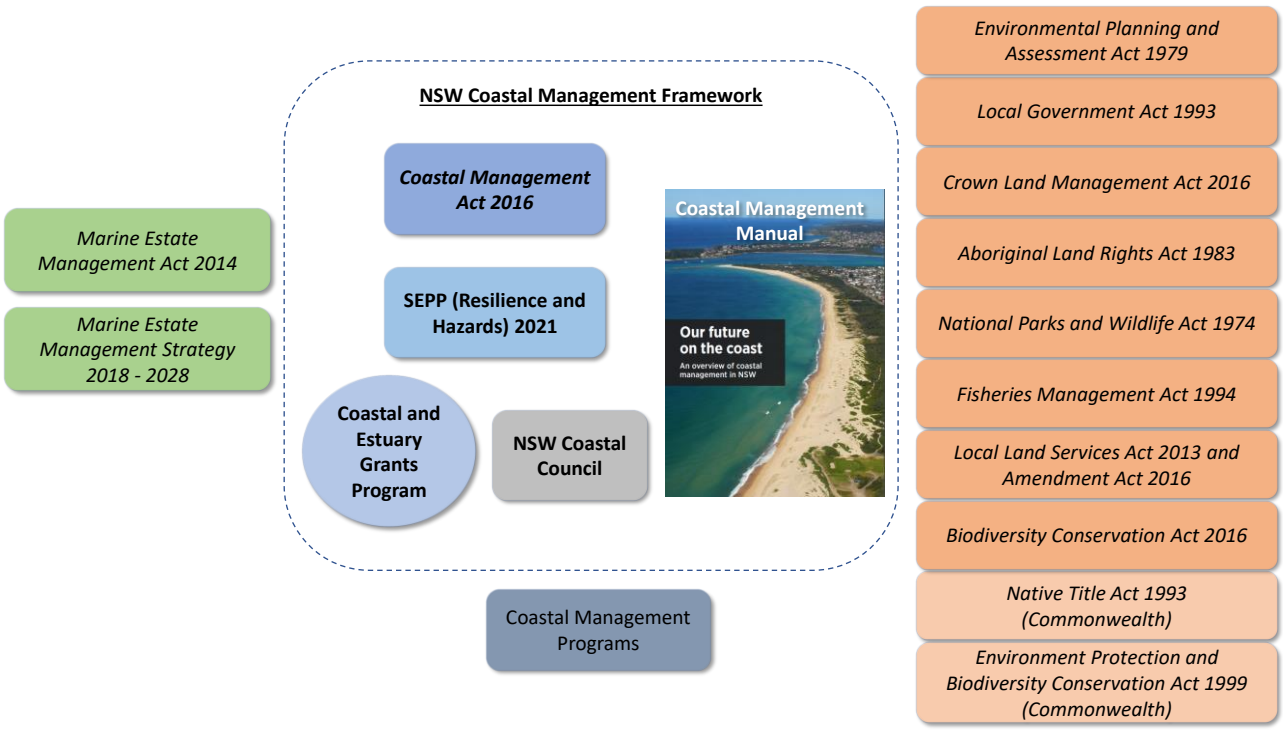

Figure 2: Coastal management framework

2.2 Areas Covered by this CMP

The Clarence Valley Local Government Area (LGA) is located on the north coast of NSW. This CMP is made in relation to the coastal zone shown in Figure 3, comprising the open coast, tidal waterways, foreshores and adjacent lands within the Clarence Valley LGA. The area covered by the Open Coast CMP is entirely within the Clarence Valley LGA. The CMP study area (the coastal zone within this CMP) includes the open beaches, foreshores and coastal waters of the Clarence Valley including the townships of Woody Head, Iluka, Yamba, Angourie, Brooms Head, Sandon, Minnie Water, Diggers Camp and Wooli. The study area also includes the estuaries and lagoons of Lake Cakora, Lake Arragan, Sandon River and Wooli Wooli River. The CMP covers the whole coastal zone within the Clarence Valley LGA apart from the Clarence River estuary. Council has chosen to develop a CMP that covers the whole coastal zone within the Clarence Valley LGA apart from the Clarence River estuary in order to maximise opportunities for the strategic and coordinated management approach for the open coast and the smaller estuaries and intermittently closed and open lakes and lagoons (ICOLLs). Due to its significant size and diverse management challenges, Council will prepare a separate CMP for the Clarence River estuary, which will provide the long-term coordinated strategy for managing the remainder of the coastal zone within the LGA.

The three coastal management areas defined in the CM Act and mapped in the Resilience and Hazards SEPP (Coastal Use Area - CUA, Coastal Environment Area - CEA and Coastal Wetlands and Littoral Rainforest Area - CWLRA) within the study area are shown in Figure 4. Although the Coastal Vulnerability Area is not mapped in the SEPP, the open coast is subject to coastal hazards, and these have also been addressed in this CMP.

The Clarence Valley coastline spans over two primary coastal sediment compartments, Clarence River to Point Danger (Tweed Heads) and Yamba Heads to Bare Bluff (Sapphire Beach). The secondary sediment compartments within the study area are Bundjalung (shared with Richmond Valley Council), Yuraygir and Woolgoolga (shared with City of Coffs Harbour) illustrated in Figure 5.

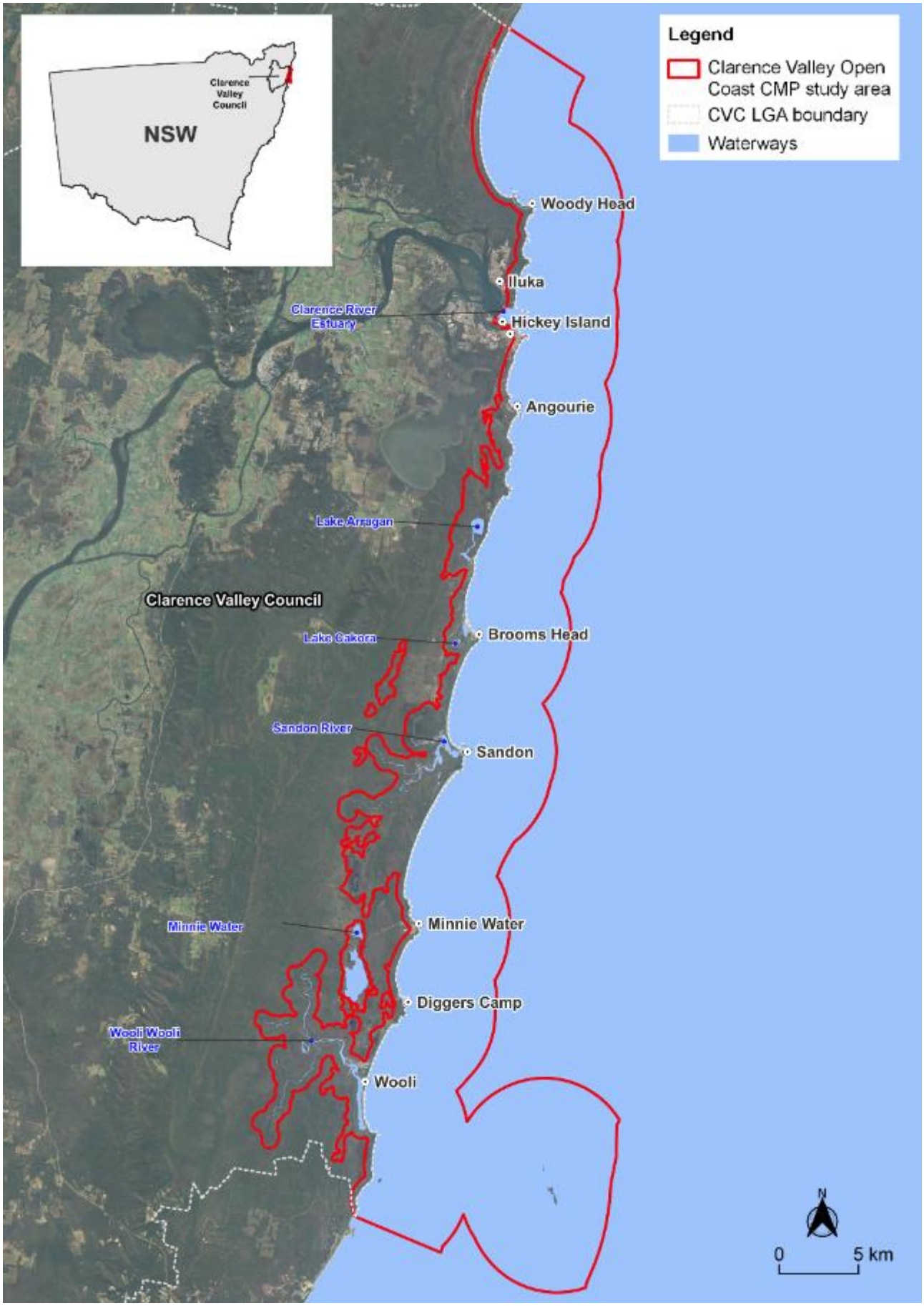

Figure 3: The Clarence Valley Open Coast CMP study area

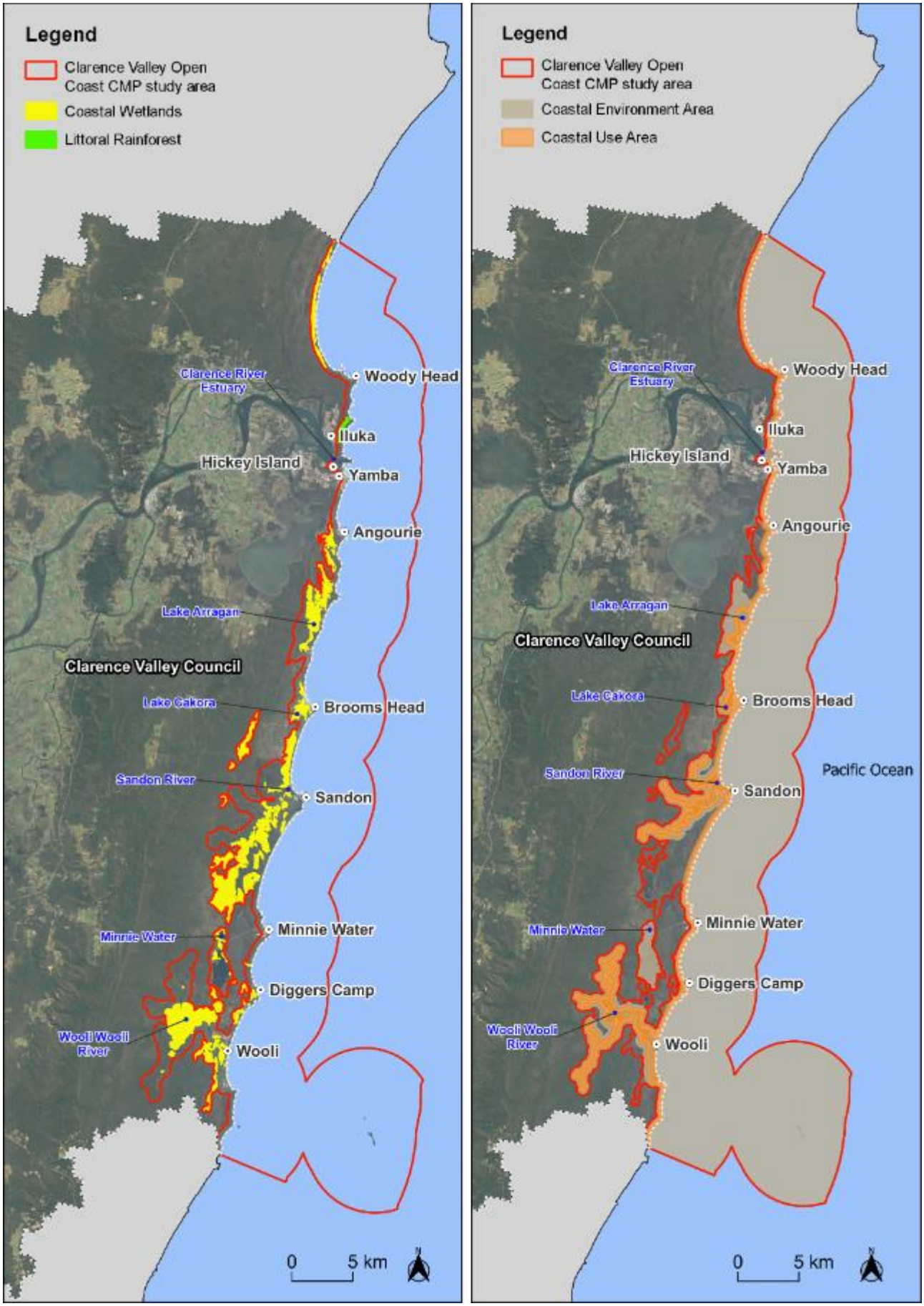

Figure 4: Coastal management areas for the Clarence Valley open coast

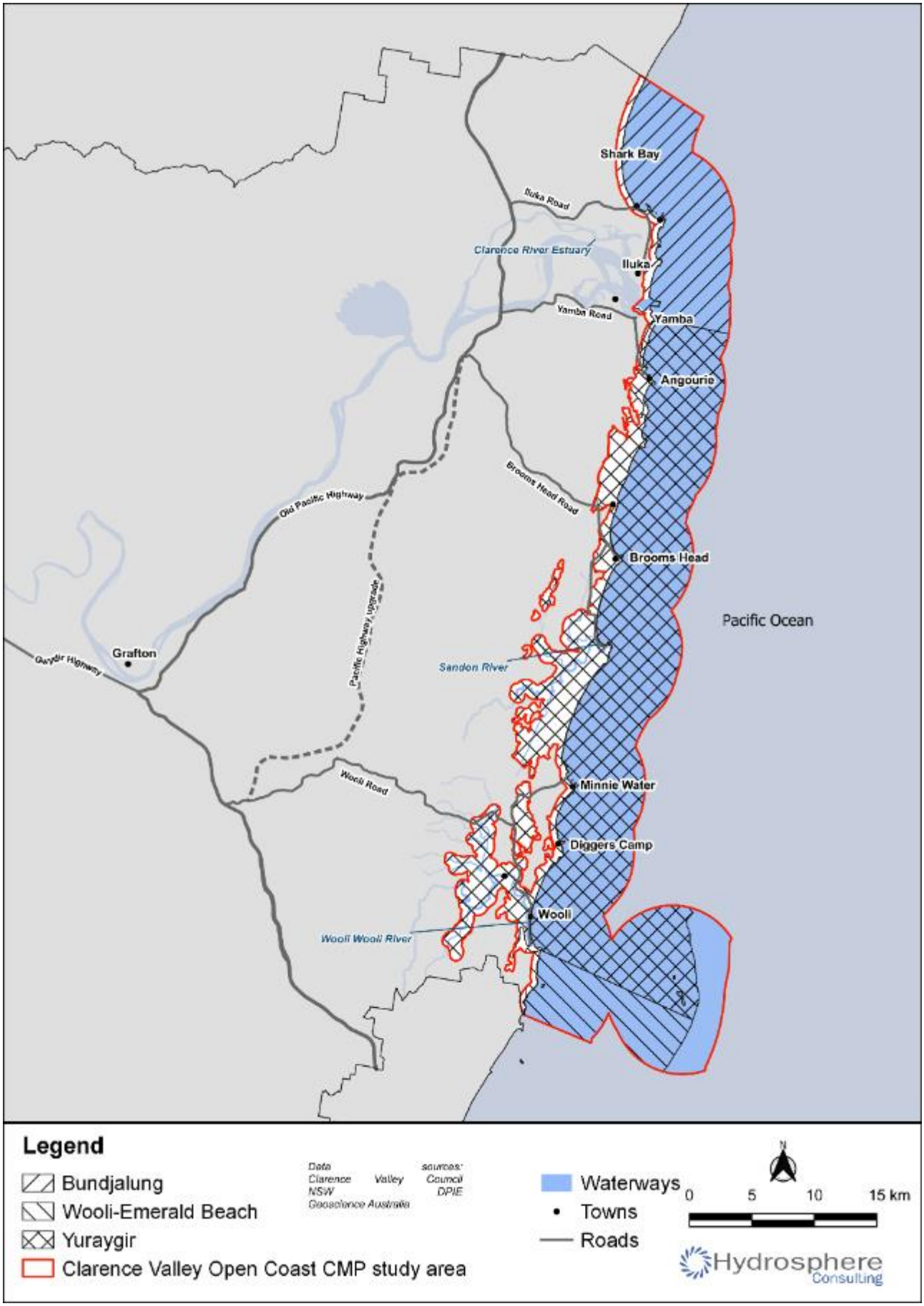

Figure 5: Secondary coastal sediment compartments within the CMP study area

2.3 Vision, Objectives and Strategic Direction

The vision statement for the Clarence Valley coastal zone was developed in Stage 1 from community feedback, the objects of the CM Act, the management objectives for the coastal management areas and CVC's vision and objectives as identified in its Community Strategic Plan (Figure 6).

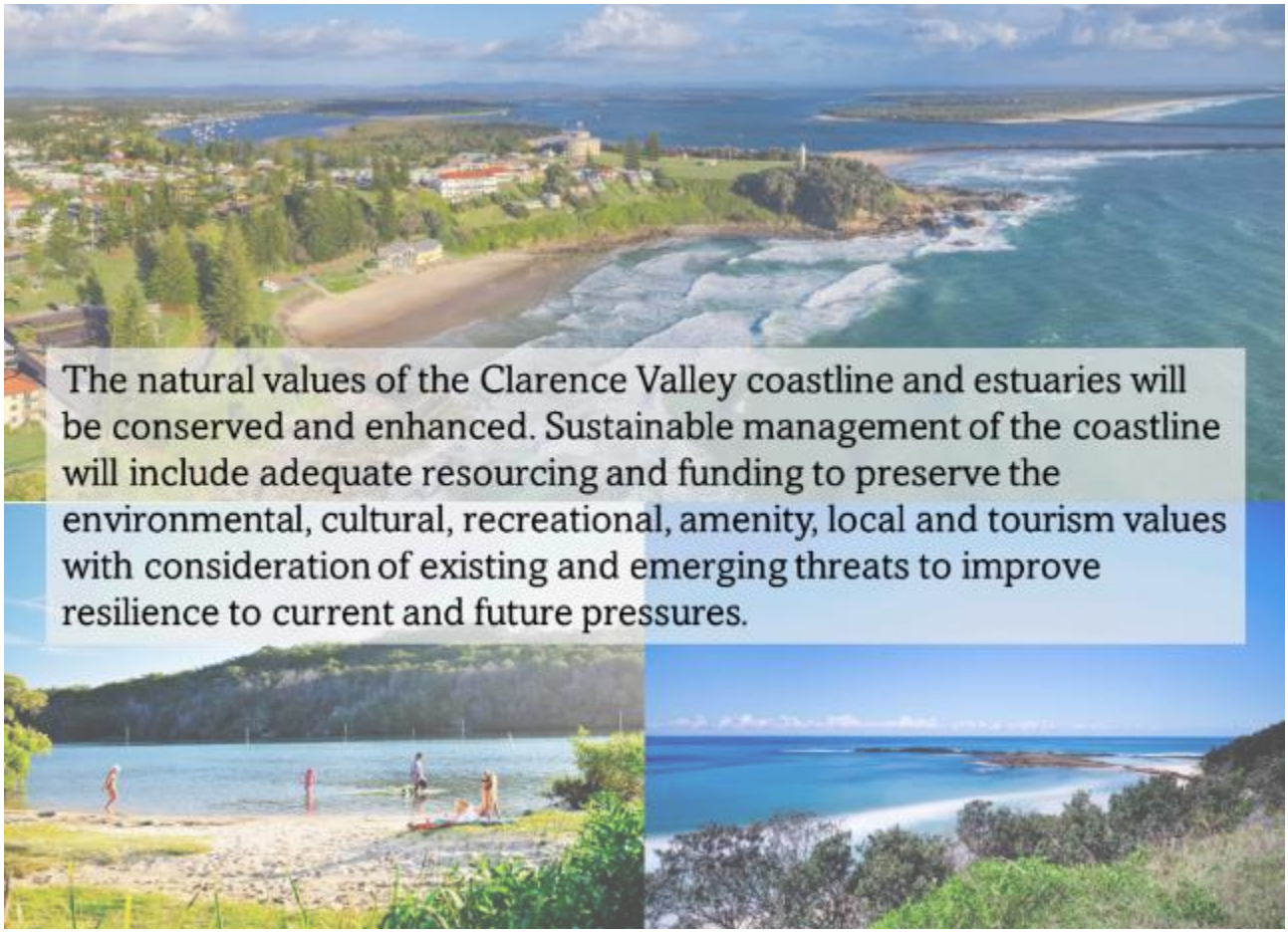

Figure 6: Vision for the Clarence Valley coastal zone

Part 1, Section 3 of the CM Act states: "*the objects of this Act are to manage the coastal environment of New South Wales in a manner consistent with the principles of ecologically sustainable development for the social, cultural and economic well-being of the people of the State*". It also sets out 13 objects of the CM Act that must be considered and promoted when preparing a CMP. The 13 objects of the CM Act and the objectives of the four coastal management areas have guided the development of this CMP (refer Appendix 1 for details).

Stakeholder and the community values were identified through consultation undertaken as part of this CMP (refer Sections 3 and 4). Local objectives developed for this CMP, consistent with the CM Act objectives, are:

1. Protect, restore and enhance natural habitats and their connectivity including littoral rainforests, coastal wetlands, riverbanks, riparian vegetation and fish habitat.
2. Improve the capacity of the coastal zone to withstand and recover from intense weather events and adapt to future increases in coastal hazards.
3. Increase the resilience of the open coast and estuaries through rehabilitation and compatible use of the foreshore and waterways.

4. Improve water quality by reducing the inflow of nutrients, sediments and faecal contamination to ensure that waterways are clean and safe and can support abundant native aquatic life and safe recreational uses.
5. Protect cultural sites and promote Aboriginal cultural values of the coastal zone through education and sustainable use of the coastal zone.
6. Improve public access to the river and foreshore for both land and water-based activities.
7. Provide and maintain a diverse range of user appropriate, well connected and easily accessed open space and facilities.
8. Reduce user conflicts.
9. Identify coastal hazard risks and develop actions that increase the adaptive capacity of CVC, the community and natural systems to the predicted impacts of climate change, including increased storm intensity and sea level rise.
10. Protect and enhance the quality of views to and from waterways and foreshores through appropriate designs and measures to mitigate visual impacts of development and other uses:
11. Increase engagement with the community and other stakeholders to improve understanding of the coastal zones, its condition and key threats and benefits associated with appropriate use of the waterways.
12. Protect and increase the economic prosperity and sustainability of commercial activities including oyster aquaculture and tourism.

The CMP will provide the long-term coordinated strategy for managing the Clarence Valley open coast and estuaries within the study area. An integrated whole-of-government and community approach is required to implement the strategy, with stakeholders working together to achieve the CMP objectives.

2.4 Existing Management Arrangements

Existing land tenure and management arrangements within the study area are shown on Figure 7 to Figure 9. Most of the Clarence coastline and land adjoining the estuaries and immediately landward of the hind dune is in public ownership as national park, Crown reserve or Council-managed Crown land (community land). The Yaegl people are the traditional owners and custodians of Yaegl Country and the Yaegl people's ongoing use and relationship to country is recognised with the successful native title determinations over lands and coastal waters along the coastline.

Approximately 80% of land in the study area (12,486 ha out of 15,460 ha) is managed as national park/ reserve within Yuraygir National Park, Bundjalung National Park and Iluka Nature Reserve. Virtually the entire Lake Arragan, Lake Cakora, Sandon River and Wooli Wooli River catchments are national park/ reserve. Along the coastline, 96% of the coastline north of the Clarence River estuary, 94% of the Yamba-Sandon coastline and 84% of the Sandon-Wooli coastline areas are managed as national park/ Reserve. The Solitary Islands Marine Park (SIMP) in conjunction with the adjacent Yuraygir National Park, is one of the few areas in Australia, where a full combination of estuaries, beaches, headlands, islands and offshore waters as well as a significant proportion of the catchments of those estuaries are protected. Only 1.7% (262 ha) of the CMP study area is urban or rural residential. Grazing is undertaken in 2.4% of the study area.

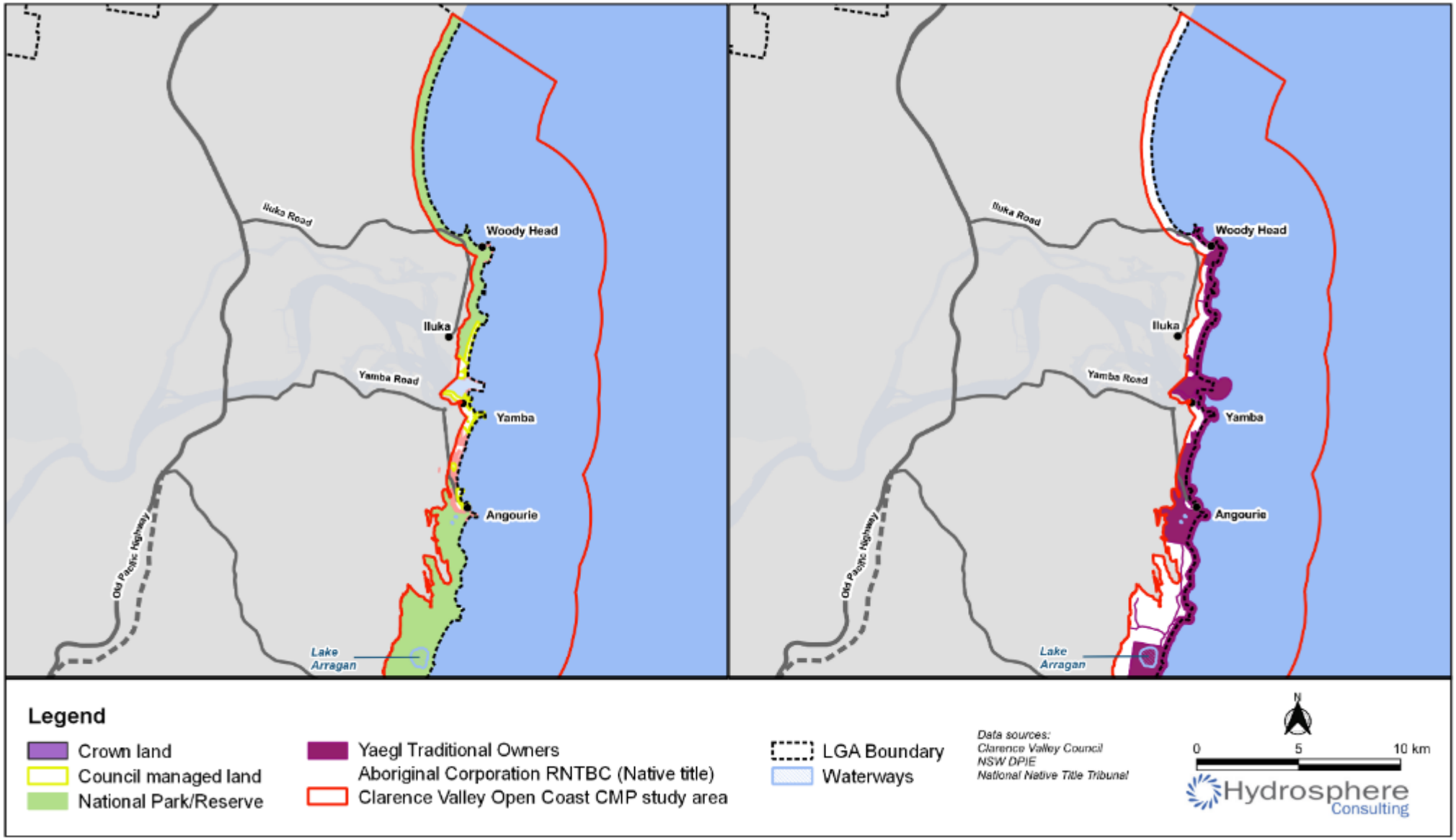

Figure 7: Land tenure and native title within the CMP area – Shark Bay to Lake Arragan

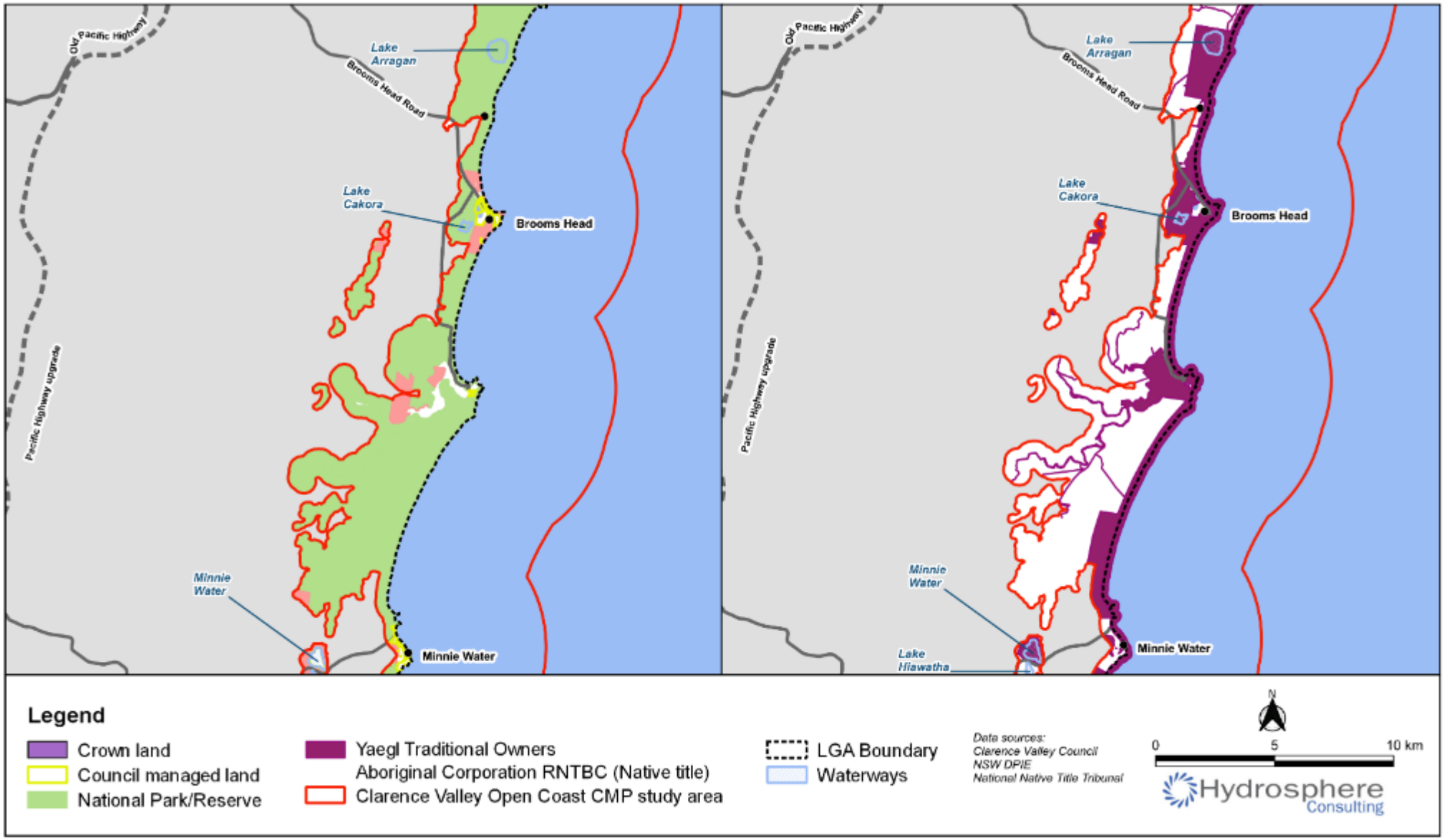

Figure 8: Land tenure and native title within the CMP area – Brooms Head to Minnie

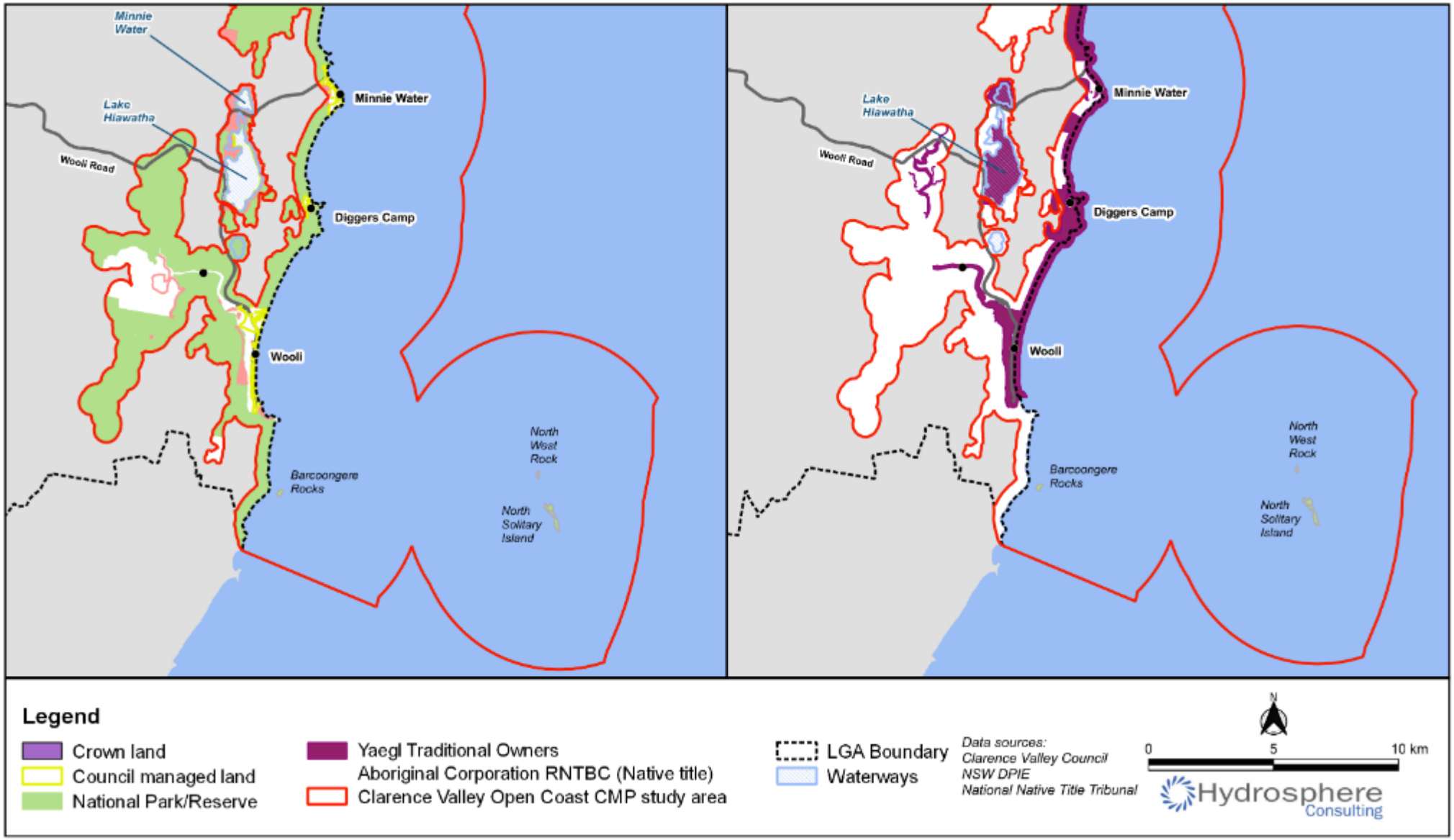

Figure 9: Land tenure and native title within the CMP area – Minnie Water to Wooli

North of the Clarence River, Iluka Road and associated assets and services are managed by CVC within the surrounding Bundjalung National Park. CVC manages land adjoining Iluka Main Beach including the northern carpark and hind dune area. The Clarence River entrance breakwaters and adjacent areas are managed by Transport for NSW – Maritime (TfNSW-Maritime). South of the Clarence River, the coastline around Yamba including Whiting Beach is managed by CVC. Green Point, Spooky Beach and the Blue and Green Pools area are also managed by CVC. The area surrounding Angourie Point is national park however parking and access to the point from Angourie is through Council and Crown managed reserves. South of Angourie, the majority of the coastline is managed by NPWS except for relatively small areas within each of the villages (Brooms Head, Sandon village, Minnie Water, Diggers Camp and Wooli) which are managed by CVC and the Crown Land division of the Department of Planning, Housing and Infrastructure (DPHI-Crown Lands). The Wooli Wooli River entrance breakwaters are also managed by TfNSW-Maritime.

The following organisations, community groups and government agencies have a role in the management of the CMP study area.

- Local government - CVC has a central role in managing the open coast, CVC assets and infrastructure and land dedicated as Crown reserves under its jurisdiction. CVC also manages a range of issues including cultural heritage, community events, recreational use of the foreshore, floodplain management and flora and fauna protection and conservation in areas under its jurisdiction. CVC is also responsible for development planning and controls across the LGA.
- Aboriginal community - Yaegl Traditional Owners Aboriginal Corporation (Yaegl TOAC) is the registered native title body corporate for the Yaegl native title determination areas within the CMP study area (Figure 7 to Figure 9). The Birrigan Gargle Local Aboriginal Land Council (LALC) region extends along the Clarence Valley coastline.
- NSW Government agencies:
    - The Biodiversity, Conservation and Science Group of the NSW Department of Climate Change, Energy, the Environment and Water (BCS - DCCEEW) works closely with local councils and communities to reduce threats from flood risk and coastal storms. BCS-DCCEEW ensures that people in NSW are well informed about these risks and better equipped to adapt to climate change. BCS - DCCEEW also works with local councils and communities to maintain or improve the health of estuaries/ lakes and enhance the recreational experience.
    - DPHI-Crown Lands is directly responsible for management of all submerged land (the beds of rivers, lakes and lagoons) and Crown reserves within the study area. DPHI-Crown Lands appoints Crown land managers and ensures that Crown land is administered and managed in accordance with the *Crown Land Management Act 2016*. Any actions in the CMP that are located on or affect Crown land that is administered by DPHI-Crown Lands, will require authorisation under the *Crown Land Management Act 2016* (e.g. leases and licences).
    - National Parks and Wildlife Service (NPWS) is directly responsible for management of the national parks estate under the *National Parks and Wildlife Act 1974*.
    - The NSW Department of Primary Industries and Regional Development – Fisheries (DPIRD Fisheries) administers the *Fisheries Management Act 1994* (FM Act) and the *Marine Estate Management Act 2014* (MEM Act). Under the FM Act, DPIRD Fisheries is responsible for ensuring that fish stocks are conserved and that there is “no net loss” of key fish habitats upon which they depend. Under the MEM Act, DPIRD Fisheries is responsible for ensuring strategic and integrated management of the whole marine estate – marine waters, coasts and estuaries.

  - The Marine Estate Management Authority (MEMA) advises the NSW Government on the management of the NSW marine estate under the *Marine Estate Management Act 2014*. The Authority brings together the heads of the NSW Government agencies with key marine estate responsibilities (DPIRD, BCS – DCCEEW, DPHI - Planning and TfNSW). MEMA ensures policies and programs address priority issues, are well coordinated, efficient, evidence based and result in positive outcomes. MEMA undertakes threat and risk assessments, develops management strategies, promotes collaboration between public authorities and fosters consultation with the community.
  - DPIRD-Marine Parks manages the SIMP.
  - The NSW Department of Planning, Housing and Infrastructure – Planning (DPHI-Planning) makes and implements decisions about land and how it is used including prioritisation of infrastructure.
  - Heritage NSW is responsible for the management and protection of Aboriginal cultural heritage and European heritage in NSW.
  - TfNSW-Maritime is the key agency with statutory and policy responsibilities related to the safety and accessibility of NSW waterways for recreational and commercial vessels. TfNSW-Maritime has a significant role in informing, supporting, and promoting safe, responsible and sustainable use on NSW waterways. The Maritime Infrastructure Delivery Office (MIDO) is a branch of TfNSW – Maritime responsible for the development and delivery of maritime infrastructure across NSW that supports recreational boating, fishing, tourism, and a range of other recreational and commercial activities.
  - North Coast Local Land Services (NCLLS) plays a key role in the management of catchment activities and natural resources relevant to estuary catchments and through the facilitation of relationships between landholders and key environmental organisations.
  - The NSW Environmental Protection Authority (EPA) is the primary environmental regulator for NSW.

- Community groups - Landcare/ Dunecare groups are non-profit community organisations which encourage and support sustainable natural resource management within the Clarence Valley LGA. The organisations undertake a range of projects with landholders, volunteer groups, and government agencies including river restoration, farm planning and bush regeneration.
- The Clarence Coastline and Estuary Management Committee (CEMC) is represented by key local stakeholder groups including government organisations, CVC councillors and interest groups. The committee ensures that the interests and views of these groups are understood and provides advice to CVC on coastal and estuary management.
- The State Emergency Service (SES) has responsibility for provision of emergency and rescue services during times of natural hazard emergencies and disasters, including flooding, storms (including storm tide and severe erosion events) and tsunami events.
- The NSW Police Force provides emergency response in a coastal emergency.
- The Rural Fire Service volunteer members attend incidents including bush and grass fires, house and structure fires, storm damage, search and rescue and motor vehicle accidents.

2.5 Regional and Local Strategies

The study area is currently managed in accordance with various regional and local level planning instruments, strategies and management plans implemented by CVC and other stakeholders. The key regional plans and local plans relevant to coastal management are shown on Figure 10. Other relevant management plans include Crown reserve plans of management and floodplain risk management plans. Previous coastal management plans were certified under the *Coastal Protection Act 1979* (now replaced by the CM Act):

- Wooli Beach Coastal Zone Management Plan (Royal HaskoningDHV, 2018).
- Brooms Head Beach and Lake Cakora Coastal Zone Management Plan (CVC, 2017).

There also are numerous other management programs being implemented by CVC, government agencies, statutory bodies and community groups addressing components of estuary and coastal zone management in parallel with primary management plans and programs. This CMP has been developed through consideration of the existing management arrangements. This CMP updates these management strategies with current knowledge and understanding of issues.

A summary of all coast and estuary management plans (both certified and uncertified), NPWS plans of management and Crown Reserve plans of management is provided in the Stage 1 Scoping Study (Hydrosphere Consulting, 2021). The key regional and local plans which guide this CMP are discussed in the following sections.

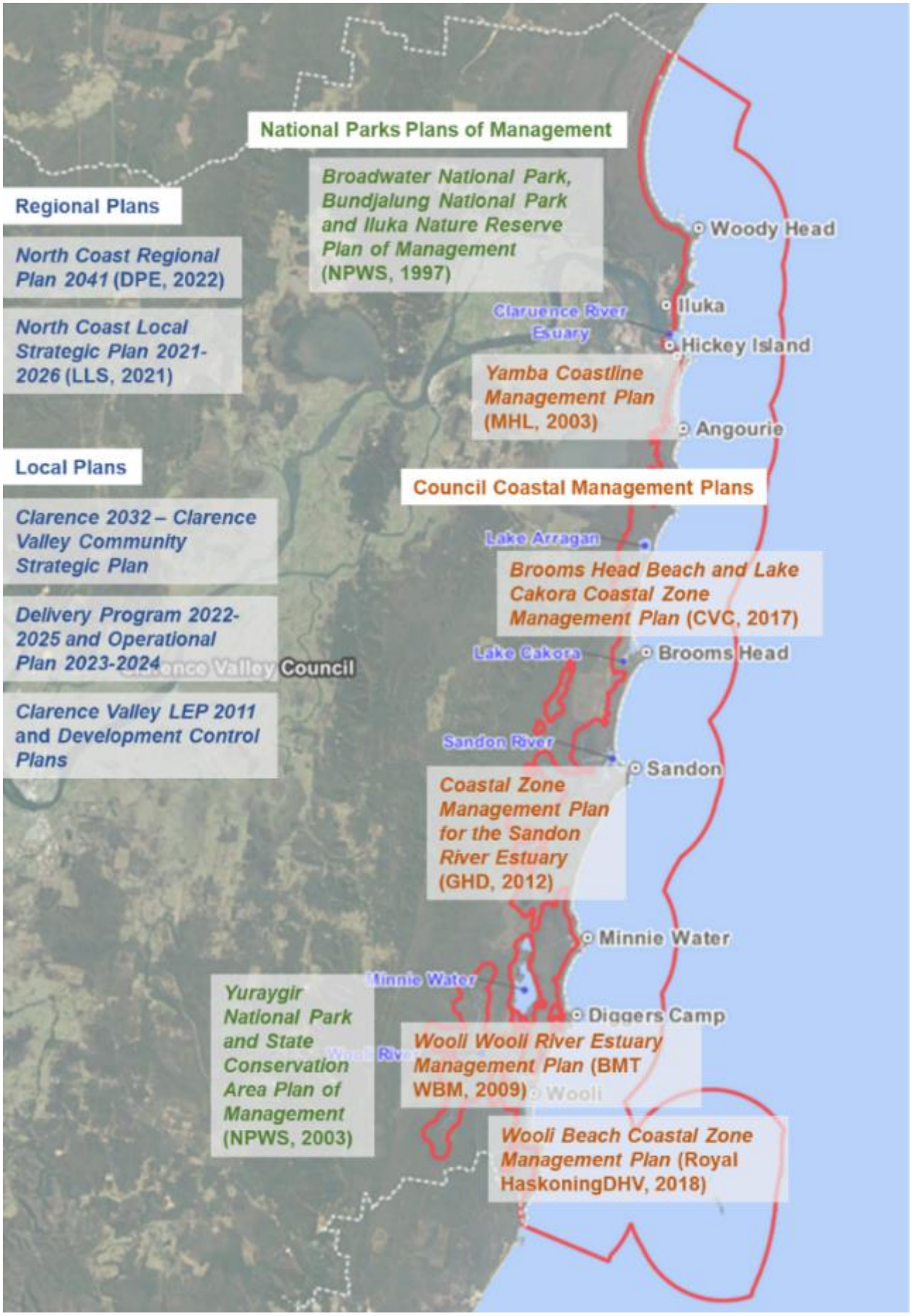

Figure 10: Regional and local strategies and management plans for the Clarence Valley open coast

2.5.1 North Coast Regional Plan 2041

The *North Coast Regional Plan 2041* (DPE, 2022) sets a 20-year strategic land use planning framework for the region, aiming to protect and enhance the region's assets and plan for a sustainable future. The plan provides an overarching strategy for the next two decades that reflects community and stakeholder aspirations and opportunities for the North Coast region. Several components of the Clarence Valley Open Coast CMP are relevant to the goals of the regional plan including:

- Goal 1 – Liveable, sustainable and resilient:
    - The Clarence Valley Open coast and estuaries include outstanding biodiversity assets that provide an environment and lifestyle that continues to attract visitors and residents. Rivers, estuaries, foreshores and beaches of the region are of immense environmental importance and are highly valued by the community. They provide habitat for a great diversity of marine, aquatic and terrestrial plants and animals including migratory shorebirds. Sustainable and balanced land use that protects the North Coast's biodiversity and environmental values is essential moving forward. Directing growth away from hazards and to locations that avoid and minimise impacts on the natural environment and protecting areas of high environmental value will also ensure the region grows sustainably and in line with community aspirations. In developing this CMP, CVC has considered climate change knowledge and adaptation actions in managing High Environmental Value assets.
    - The North Coast region is rich in Aboriginal heritage and includes places and objects that are of significance to Aboriginal people because of their traditions, observances, lore, customs, beliefs and history. This includes pre-contact, habitation and usage sites, burial sites and camping, hunting or fishing sites. CVC and NPWS will partner with the Yaegl community to ensure Country is cared for appropriately and sensitive sites are protected with Aboriginal people having access to Country to continue cultural practices. Consultation on future land use planning will acknowledge, respect, and reflect Aboriginal interests and cultural responsibilities.
    - The CMP provides adaptation and mitigation strategies in response to natural hazards, including climate change and supports environmentally sustainable development that is responsive to natural hazards. The impacts of rising sea levels and climate change will be critical to managing the coastal and floodplain risks. Coastal hazard studies that informed this CMP will inform new land use strategies to balance environmental protection with the need to protect development from hazards and to ensure infrastructure is adequate to evacuate people in extreme events.
- Goal 2 – Productive and connected:
    - The Clarence Valley LGA has a strong and vibrant visitor economy ranging from the traditional family holiday, lifestyle retreats and those seeking adventure on the many beaches and world class surf breaks.
    - The rich heritage of the Yaegl people will be celebrated and recognised through opportunities designed with local Aboriginal people which could provide opportunities to economically empower local Aboriginal communities.
    - Development of the CMP has considered opportunities to enhance the amenity, vibrancy and safety of centres and township precincts.
    - The CMP will assist in building the capacity for shared knowledge about Aboriginal land to create more effective relationships between LALCs, native title holders, state agencies and CVC. CVC will meaningfully engage with traditional owners to ensure aspirations are

reflected in plans, build capacity for Aboriginal communities to utilise the planning system and incorporate Aboriginal knowledge of the region into planning considerations and decisions. This CMP involves First Nations People in decision making and caring for Country.

- Goal 3 – Growth change and opportunity:
    - Land use planning strategies in the CMP will play a key role to help coordinate and facilitate development and investment and generate high quality and sustainable land use planning outcomes.

Although Yamba, Iluka and Angourie are identified as Urban Growth areas in the *North Coast Regional Plan 2041* (DPE, 2022), no major transport, industrial, employment, agriculture or housing development is proposed within the CMP area (Figure 11) and the unique character of the towns and villages is expected to be preserved. However, surrounding developments will attract residents and tourists to the coastal zone due to its attractiveness for recreational and holiday activities.

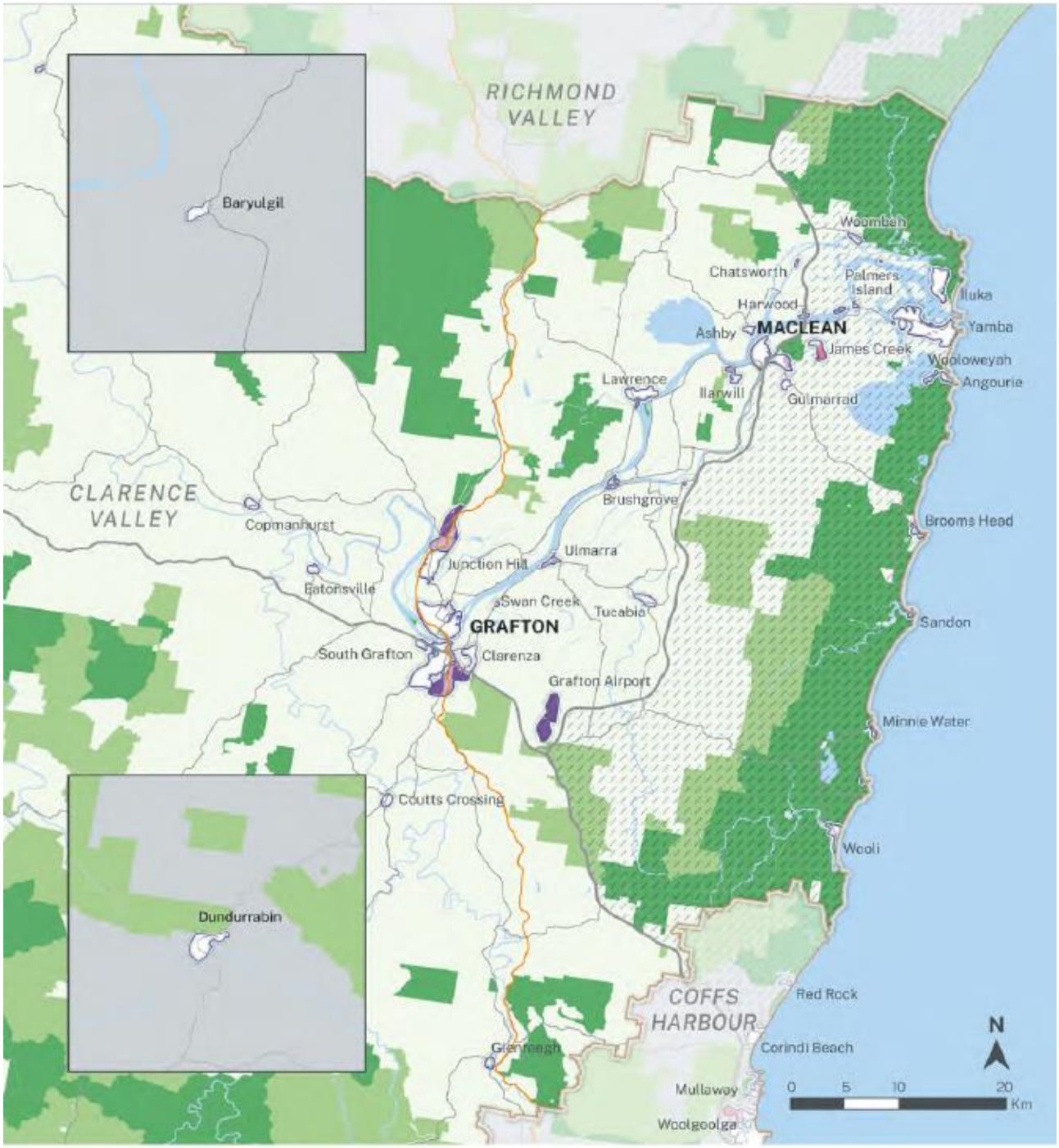

Figure 15: Urban growth area map for Clarence Valley LGA

- LGA boundary
- Road
- Highway
- Railway
- National parks and nature reserves
- State forest
- Water body
- Urban growth area
- Investigation area – urban land
- Investigation area – employment land
- Existing employment land
- Coastal strip

Growth areas show the boundaries of urban areas and as such, identify both existing and proposed urban lands. Not all land identified within the growth area can be developed for urban uses. All sites will be subject to more detailed investigations to determined capacity and future yield. Land that is subject to significant natural hazards, environmental constraints and or servicing constraints will be excluded from development.

Figure 11: Urban growth area map for Clarence Valley LGA

Source: DPE (2022)

2.5.2 Marine Estate Management Strategy

The *Marine Estate Management Strategy 2018-2028* (MEMS) provides an overarching strategic approach to the coordinated management of the NSW marine estate (i.e. the coastal waters, estuaries, lakes, lagoons and coastal wetlands). The Strategy considers the ten MEMS management principles as well as priority threats for the marine estate as identified in the NSW marine estate threat and risk assessment (TARA, BMT WBM, 2017). This CMP considers the key state-wide threats as well as priority threats to environmental assets and to social, cultural and economic benefits for the North Region as identified in the TARA.

The Strategy sets out nine initiatives and a set of associated objectives and key actions to address these priority threats and seeks to balance economic growth, use and conservation of the marine estate. In developing strategies and actions for the CMP, the principles and management initiatives of the MEMS were considered. The MEMS initiatives comprise:

1. Improving water quality and reducing litter.
2. Delivering healthy coastal habitats with sustainable use and development.
3. Planning for climate change.
4. Protecting the Aboriginal cultural values of the marine estate.
5. Reducing impacts on threated and protected species.
6. Ensuring sustainable fishing and aquaculture.
7. Enabling safe and sustainable boating.
8. Enhancing social, cultural and economic benefits.
9. Delivery effective governance.

Linkages between the CMP and the MEMS are provided in Appendix 2.

2.5.3 Integrated Planning and Reporting

The Integrated Planning and Reporting (IP&R) framework is established under Chapter 13 of the *Local Government Act 1993* and is the main mechanism by which councils comprehensively plan for and report on their asset management and service delivery responsibilities.

The CM Act requires that CMPs are given effect through the IP&R framework. This will include performance auditing powers to ensure that programs are appropriately implemented. This means that CMPs and identified coastal management activities are aligned with broader community strategic plans, reflect community priorities and are feasible, financially viable and able to be resourced.

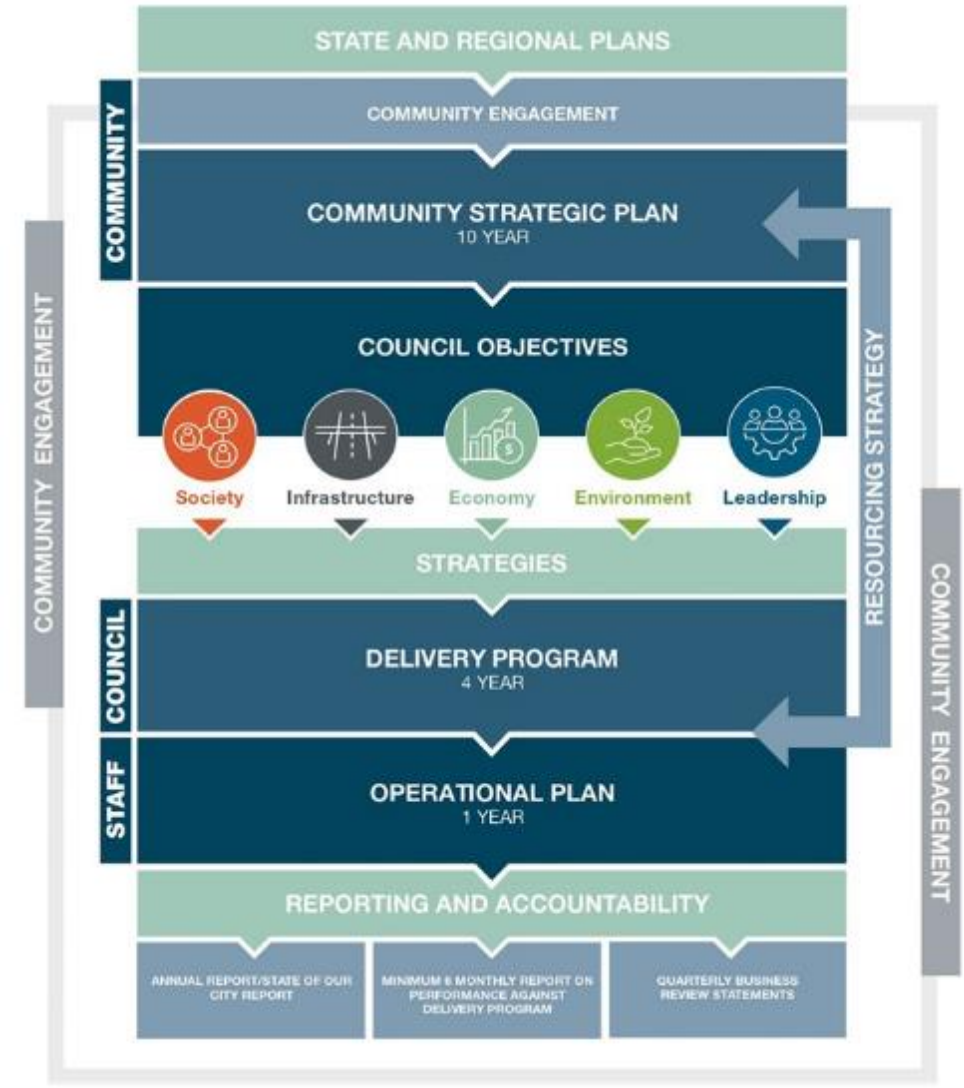

Figure 12: Integrated Planning and Reporting framework

The *Clarence 2032 – Clarence Valley Community Strategic Plan* (CSP) sits above all other CVC plans and policies in the planning hierarchy. The CSP identifies long-term priorities, outcomes and aspirations for the future of the community and the LGA. CVC uses this document to guide and inform its decision making and planning for at least the next ten years. The CVC *Local Strategic Planning Statement* (LSPS) (CVC, 2020) provides a vision for the Clarence Valley, details the special characteristics which contribute to local identity and shared community values and provides a summary of actions to manage growth and change into the future. The Delivery Program and Operational Plan identify all key activities to be undertaken by CVC during its elected term, and which year the activities are to be undertaken. The CSP has assisted in guiding the development of this CMP through its strong aspiration to care for the natural environment. The CMP actions have been organised and scheduled with consideration of CVC's IP&R framework, Delivery Program and Operational Plan and associated reporting requirements.

This CMP refers to maintenance, improvement and provision of CVC assets or infrastructure. While this CMP makes many recommendations with respect to assets, it is not the intention of this program to replace or duplicate any CVC asset management plan, strategy, register or database. CVC's IP&R framework provides for asset management planning for which the risks and actions identified in this plan will be a consideration in CVC's asset management strategy.

3. CONSULTATION

Consultation and engagement throughout all stages of the development of the Open Coast CMP has been guided by CVC's Community Engagement Strategy, in line with the IAP2 Public Participation Spectrum and the NSW Government's Social Justice Principles. CVC has collaborated with land managers, state government agencies, traditional owners and community representatives to provide effective and integrated coastal management outcomes. Consultation with the community, public authorities and CVC has been undertaken in accordance with a communication and engagement strategy prepared for this CMP during Stage 1 (Hydrosphere Consulting, 2021). The engagement strategy was prepared in accordance with:

- The *Coastal Management Act 2016* and related guidelines for community and stakeholder engagement in preparing and implementing a CMP (NSW Government, 2018).
- CVC's *Community Engagement Policy* (2018).

Updates have been presented to the CEMC, the community and Clarence Valley Council on a regular basis. The actions and strategies in this CMP have been developed to target the issues and threats identified during consultation activities and to preserve the community values of the Clarence Valley open coast.

The Clarence Conversations website includes project information, useful links, downloads, a discussion forum and questions page. The webpage has been available and updated through all stages of the CMP development including links to background information and project documents and invitation to engage through the Questions Page or Discussion Forum. Project updates were also provided on the Clarence Valley Noticeboard and social media.

3.1 Stage 1

The primary purposes of the Stage 1 (scoping study) are to review progress made in managing issues in coastal areas, develop a shared understanding of the current situation and identify the focus of the new CMP.

Development of the Stage 1 Scoping Study included stakeholder engagement activities designed to inform and involve stakeholders by bringing all interested parties on board early to share information and ideas, identify stakeholders and prepare a stakeholder profile. Feedback from the community and other stakeholders was used to identify values and coastal management issues. A community survey was conducted during Stage 1 to engage the community in the project, identify community issues and concerns and facilitate ideas. Submissions were also received from stakeholders and community members either via mail, email or via the web contact form from the dedicated project webpage. Outcomes of the Stage 1 consultation activities are discussed in detail in the Scoping Study (Hydrosphere Consulting, 2021) which was made publicly available on CVC's website.

3.2 Stage 2

Studies prepared in Stage 2 provide information to support decision-making in later stages of the planning process. The additional information assists communities to better understand coastal management issues and to analyse and evaluate coastal risks and opportunities.

Representatives from CVC, NPWS and the project team held several discussions with Yaegl TOAC members and NTSCorp representatives throughout 2021 - 2024 including presentations introducing and explaining the CMP activities and inviting Yaegl involvement.

Updates have been presented to the CEMC on a regular basis between September 2021 and November 2023. In addition to the CEMC meetings, engagement with NSW Government agencies has included ongoing liaison regarding technical aspects of the project including review of methodology, progress and reports. CVC worked closely with the NPWS and DCCEEW to deliver the coastal hazard assessments for the CMP. DCCEEW also conducted an external peer review of the coastal erosion/ recession assessment methodology (JBP, 2023) to contribute to the development of a state-wide approach and ensure a consistent, robust and legally defensible coastal hazard modelling and assessment approach is undertaken by all NSW councils. The project team worked with DCCEEW to confirm the approach to be undertaken to finalise this component of the CMP development.

Outcomes of the Stage 2 consultation activities are discussed in the *Stage 2 Vulnerabilities and Opportunities* (Hydrosphere Consulting, 2023a) which was made publicly available on CVC's website.

3.3 Stage 3

Stage 3 of the coastal management program (CMP) process involved identifying coastal management issues affecting the CMP study area and identifying coastal management actions required to address those coastal management issues in an integrated and strategic manner.

Stakeholder engagement activities during Stage 3 included:

- The Stage 3 recommendations were discussed and agreed with CVC staff with relevant responsibilities.
- The project team met with agency representatives from DPHI-Crown Lands, DPIRD-Fisheries, DPIRD-Marine Parks, NPWS and TfNSW–Maritime to discuss the Stage 3 recommendations and obtain feedback. Preliminary draft actions were provided to relevant agencies for review and comment.
- The project team met with Yaegl representatives to discuss the Stage 3 recommendations and obtain feedback. Preliminary draft actions were provided to Yaegl TOAC for review and comment.
- The Stage 3 report was presented to the CEMC in March 2024.
- The Stage 3 report was presented to Clarence Valley Council in March 2024.
- Public exhibition of the Stage 3 report (*Clarence Valley Coastline and Estuaries Coastal Management Program, Stage 3: Identification and Evaluation of Options,* Hydrosphere Consulting, 2024a) was undertaken during April 2024. Information sessions were held at Yamba, Brooms Head and Wooli. Stage 3 documents were also available for viewing at CVC libraries in Maclean, Yamba, Iluka and Grafton and the Wooli Post Office. Common themes raised during the community consultation period were:
    - Impacts of 4WDs on beaches, particularly Brooms Head and Wooli.
    - Riverbank erosion (Wooli Wooli River) and the need for formalised waterway access.
    - Sedimentation in Wooli Wooli River, navigation safety and the need for dredging.
    - Lack of policing of vehicles and dogs on beaches, particularly Brooms Head and Wooli.

- Lack of adequate education and signage regarding vehicles and dogs on beaches, and pedestrian access to dunes, particularly Brooms Head and Wooli.
- Erosion of northern section of Wooli Beach near One Tree.
- A need for designated beach access ways to prevent damage to dune vegetation.
- A need for accessible beach access.
- A need for more dune rehabilitation to restore areas damaged by erosion and/or human activity.
- Poor water quality in Lake Cakora, perceived to be a result of flooding of on-site sewerage management (OSSM) systems during high lake levels and the need for water quality monitoring.
- Coastal erosion at Brooms Head and condition of the northern foreshore.
- Maintenance required for the Brooms Head reserve foreshore revetment.
- Inundation of South Terrace, Wooli during floods/ high tides and difficulty accessing the village.
- Social impacts of foreshore access on private property e.g. vandalism, noise.
- Concerns about funding of coastal protection works by private landholders.

Many respondents raised issues regarding lack of maintenance of stormwater drains, particularly in Wooli and Brooms Head. The maintenance of stormwater drainage systems is managed under CVC's stormwater system maintenance policy although water quality issues are addressed in the CMP.

The use of Brooms Head Reserve for the Brooms Head Holiday Park was also a key theme raised by the community including concerns about public access to the foreshore and amenities during holiday periods and effluent and grey water management from the holiday park. These issues are being addressed in the development of a Plan of Management for Brooms Head Reserve.

Feral pigs at Brooms Head were an issue raised by a few community members. The management of pest animals is coordinated by North Coast Local Land Services in accordance with strategic pest animal management plans, rather than the CMP.

Outcomes of the Stage 3 consultation activities were made publicly available on CVC's website.

3.4 Stage 4

Stage 4 involved the preparation, exhibition and submission of the draft CMP to the Minister for certification. Exhibition of the draft CMP is undertaken to confirm the outcomes of collaboration with the community and stakeholders about the coastal management issues being addressed, actions proposed and the rationale for selecting those options and provides a further opportunity for community involvement.

During Stage 4, the project team continued the discussions with agency representatives from Yaegl TOAC, DPHI-Crown Lands, DPHI-Planning, DPIRD-Fisheries, DPIRD-Marine Parks, NPWS and TfNSW–Maritime to obtain concurrence with proposed CMP actions.

The draft CMP and associated documents were publicly exhibited between 28 June 2024 and 29 July 2024 in accordance with the CMP Act statutory requirements. During this time the draft CMP was forwarded to relevant government agencies for comment and consideration. The agencies that are responsible for actions

or have actions in this CMP that affect land or assets managed by them have provided formal agreement to those actions.

4. THE CLARENCE VALLEY OPEN COAST

This section provides a summary of the character, processes and values of the Clarence Valley open coast which are detailed in the supporting information for this CMP - Stage 1, Hydrosphere Consulting (2021), Stage 2 (Hydrosphere Consulting, 2023a) and Stage 3, Hydrosphere Consulting (2024a).

4.1 Physical Character

The CMP study area and the broader catchments of the coastal waterways lie within the southern area of the Clarence Basin. The coastal zone throughout the study area is dominated by quaternary sand beach barrier systems and coastal plains which overlay the Clarence Basin material. Bedrock outcrops (typically sandstone and siltstone) occur as headlands punctuating the beach system. The Clarence Valley coastline is comprised predominantly of sandy beaches and associated dune systems with rocky headlands and intertidal rock platforms (Plate 1).

1 - Yamba

2 – Brooms Head Back Beach

3 – Iluka Beach

4 – Sandon Beach

Plate 1: Beaches along the Clarence Valley coast

North of the Clarence River, the region is part of the Clarence-Moreton Basin, where softer sedimentary rocks have been eroded to form broader valleys, typically with longer beaches and fewer headlands than experienced along the south of the Clarence LGA. The southern section of the study area is part of the New England Fold Belt whose resilient sedimentary and metasedimentary rocks dominate the rocky sections of

coast between Yamba to South West Rocks. This coastline is characterised by its moderately long sandy beaches, separated by rocky outcrops and headlands, most notably at Yamba, and Minnie Water. Throughout the coastline, the presence of exposed Pleistocene dunes suggests a slowly receding coast.

The coastal geomorphology of the region is influenced by the following processes (CoastAdapt, 2017a; 2017b; 2017c):

- The humid warm to cool temperate climate.
- Micro-tides.
- South-easterly Tasman Sea swells.
- Easterly seas.
- Dominant quartz (terrigenous) sediments with northerly longshore transport in the northern part.
- The El Niño Southern Oscillation (driving beach erosion/ accretion cycles and cyclone frequency).

The Clarence Valley coastline is a wave dominated coastline and the estuary geomorphology types are influenced by this setting. The estuaries within the study area are either wave-dominated barrier estuaries or coastal lagoons (Table 1 and Plate 2). The hydrology and catchments of the estuaries are largely unmodified. Hickey Island, within the entrance of the Clarence River, formed in the early 1900s as a result of changes in hydrodynamics and sediment transport in the lower estuary, in particular due to the construction of Middle Wall (Royal HaskoningDHV, 2014).

Table 2: Estuary types within the study area

Estuary	Type	Entrance
Clarence River	Wave dominated barrier estuary	Open trained
Mara Creek	Coastal lagoon	Intermittently open, untrained
Lake Arragan	Coastal lagoon	Intermittently open, untrained
Lake Cakora	Coastal lagoon	Intermittently open, untrained
Sandon River	Wave dominated barrier estuary	Open, natural control point to the south with a bedrock headland and the Plover Island tombolo on the northern side
Wooli Wooli River	Wave dominated barrier estuary	Open trained

Source: EES (2018a; 2018b; 2018c), Roy *et al*. (2001)

1 – Clarence River entrance breakwaters

2 – Lake Cakora entrance

3 – Sandon River

4 – Wooli Wooli River entrance

Plate 2: Study area estuaries

4.2 Coastal Processes

The ocean conditions and wave climate along the Clarence Valley coastline are influenced by short-term weather and long-term climatic conditions. Coastal processes and influences on coastal processes occurring along the Clarence Valley coastline are discussed in Hydrosphere Consulting (2021), JBP (2022) and JBP (2023) and can be summarised as:

- Wave direction - the dominant swell direction along the Clarence Valley coastline is from the east to south-east. There is a seasonal trend in wave direction with swells predominantly east-south-east during summer, shifting further south in autumn with dominant south-east to south-south-east during winter. The spectrum expands in spring with some winds coming from the north-east sector but is still predominately south-east. During summer, east to south-east swells are dominant. Typically, the largest swells come from the south-south-east with a small portion of larger swells from the north-east east during summer.
- Wave height - wave heights peak between March and April. Periodic weather events can result in large wave conditions that impact on shorelines.

- Wind - morning winds are typically light and from the west with stronger winds from the south occasionally. Afternoon winds are typified by stronger north-east and south-east winds. Winds influence aeolian transport of sand and local wave conditions.
- Sediment movement - the Clarence Valley coastline is a longshore drift coastline. Overall sediment movement (in a northerly direction) is influenced by the predominant swell direction (south-easterly). Longshore drift occurs within and between sediment compartments. There are other localised sediment movement, including on and offshore movements under different conditions and other localised anomalies. The coastal sediment budget south of the Clarence River is illustrated in Figure 13.
- Weather patterns - the El Niño Southern Oscillation (ENSO) is responsible for influencing weather patterns on the east coast and subsequently is a major driver of wave climate and associated coastal processes and conditions. The ENSO drives the El Niño/ La Niña weather cycles. Typically, El Niño events are associated with reduced storminess, weaker easterly trade winds and a generally more southerly wave climate. La Niña events are typified by the reverse characteristics, increased storminess, stronger trade winds and a more easterly wave climate.

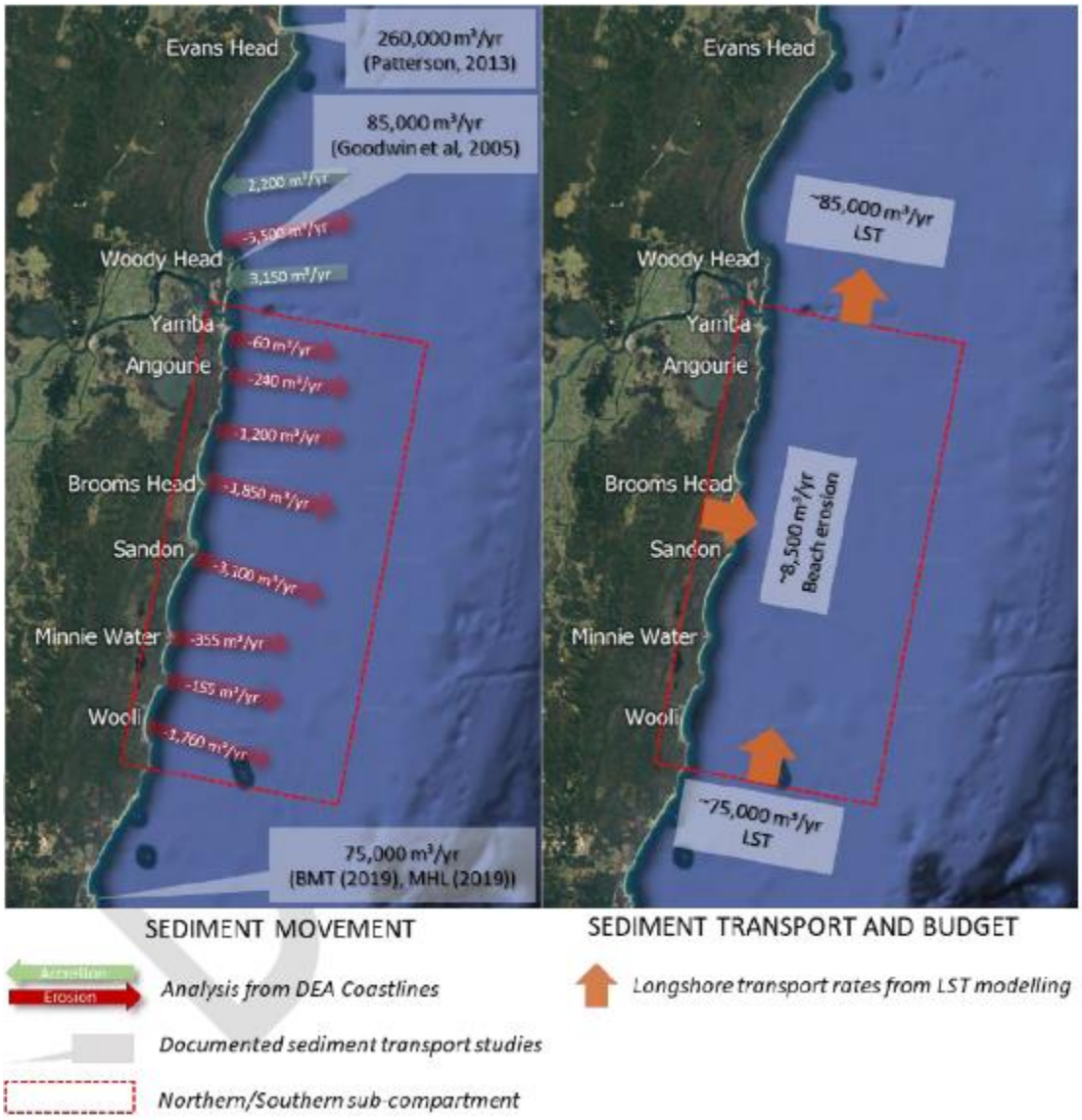

Figure 13: Beach recession or accretion rates (left) and overall sediment budget south of the Clarence River (right)

Source: JBP (2023). DEA Coastlines (https://maps.dea.ga.gov.au/)

The Clarence Valley coastline has a moderate tidal influence and a moderate to high wave energy climate which has formed multiple crenulate shaped embayments such as at Woody Head and Sandon (Plate 3). Sand is supplied to the beaches by longshore drift from the south, with sand pulses around headlands a key mechanism for the longshore transport, generating large migratory updrift rips that erode the beach and transport sand to the north through sand waves (Plate 3).

Plate 3: Example coastal processes: Left: crenulate shaped beach at Sandon, right: erosion at Wooli

4.3 Culture and Heritage

The Clarence Valley coastline is the traditional land of the Yaegl People. Yaegl Country centres around the lower Clarence River extending south along the coastline to Red Rock and north to Black Rocks (Jerusalem Creek). Yaegl Country is bordered by Gumbaynggirr Country to the south and south-west and Bundjalung country to the north and north-west (Figure 14).

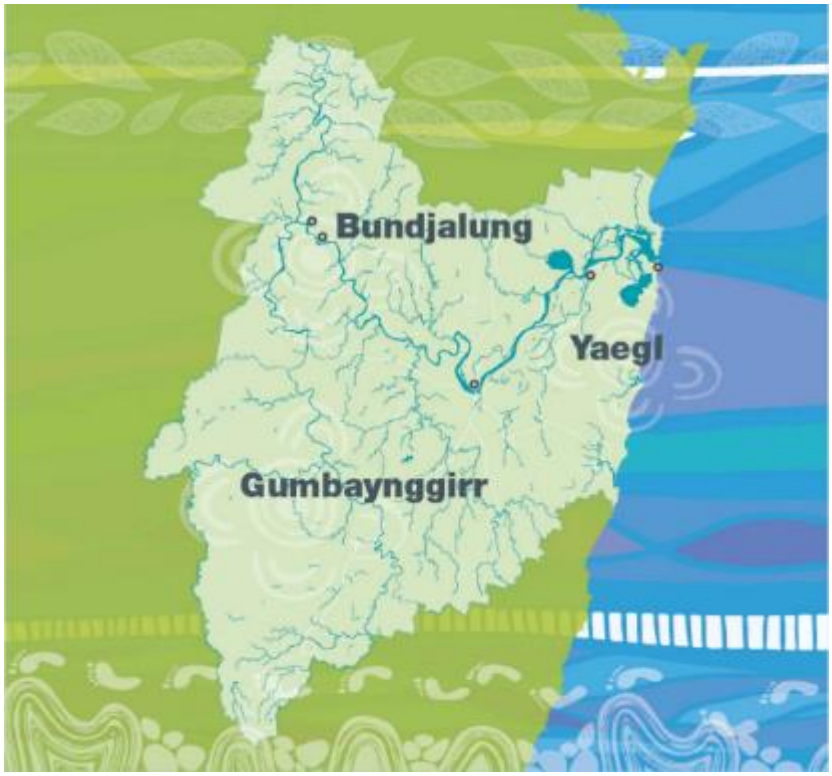

Figure 14: Traditional custodians of the Clarence Valley area - the Bundjalung, Gumbaynggirr and Yaegl nations

Source: https://www.clarence.nsw.gov.au/First-Nations

Prior to European arrival, the Yaegl people occupied and skilfully managed the coastline and surrounding areas for thousands of years. The coastal areas continue to play a significant role in the daily lives of the Yaegl people, providing an abundance of natural resources for sustenance, ceremonial rituals and a deep social, cultural and spiritual connection. Numerous significant sites, areas and landscapes are located along the coastline. In Kijas (2009) Ken 'Fox' Laurie notes the ongoing attachment of the Yaegl People to the Clarence Valley coastline:

"*The Yaegl people are the traditional custodians of the Clarence Coast. Its outcrops, estuaries and beaches hold places where people have camped for thousands of years and used abundant resources provided by nature in this favourable location… The coastline is a network of pathways between places of spiritual importance. Its landmarks are associated with stories and important figures. A local dreamtime story relates to Durrangan and the creation story of the stone canoe… A strong attachment between the Goorie people and their local landscape indicates the presence of long-standing knowledge about animals, plants and the environment: a complex web of places associated with fishing, hunting and collecting where people continued to return to meet, to fish, to collect bush foods and to trade.*"

The estuaries and their forested catchments include ceremonial sites (carved trees, stone arrangements, natural mythological ceremonial sites, initiation grounds and waterholes), extractive sites (stone and ochre quarries, axe grinding grooves and scarred trees), open campsites, middens, fish traps, contact sites, rock shelters and art sites (Kijas, 2009).

Europeans began to colonise the Clarence Valley coastline in the mid-1800s, particularly cedar getters and pastoralists. Most coastal villages were established in the early 20th century. Commercial fishing (trawling, netting, trapping and line fishing at beaches, rivers, creeks, estuaries and inshore waters) was undertaken from the early 20th century in addition to oyster growing. Extensive sandmining occurred along the coast predominantly in the 1960s and 1970s. Recreational fishing, camping and hunting dates from the early 20th century. Increased tourism from the late 1960s includes surfers, recreational fishers, bushwalkers and naturists among the visitors. These European activities changed the natural coastal landscape, and as such, sites, artefacts and values relating to these activities have also become part of the contemporary coastal landscape (Tuck, 2007; Tuck, 2018).

4.4 Environmental Values

The core environmental values of the study area are associated with its landscape amenity (i.e. geographical features, scenic amenity and views), healthy and diverse natural environments and biodiversity values. The natural beauty of the Clarence Valley coastline is highlighted in the large areas of national parks and nature reserves. The national parks protect and conserve habitat for a large range of endangered ecological communities and threatened flora and fauna species. The study area also includes a large component of the SIMP and the Solitary Islands. The northern estuaries within the marine park are some of the state's most pristine, largely because the majority of adjacent land remains in a near natural state and is conserved as part of Yuraygir National Park. The local Aboriginal communities within the Yaegl Nation have strong cultural links with the northern part of the marine park and are actively involved in conservation planning.

The coastline within the study area north of the Clarence River estuary is primarily located within Bundjalung National Park and Iluka Nature Reserve. Vegetation of Bundjalung National Park within the coastal zone is predominantly coastal heathland communities consisting of both wet and dry heath. This vegetation occurs on the sand ridges and plains backing the beach and are interspersed with swamps (particularly behind

Shark Bay/ Ten Mile Beach north of Iluka Road). A large area of remnant subtropical littoral rainforest occurs within the Iluka Nature Reserve (part of the Gondwana Rainforests of Australia World Heritage Area), the largest remaining stand in NSW. The vegetation within this area supports a diverse range of fauna species with over 280 species of reptiles, birds and mammals, including threatened species known to occur within Bundjalung National Park (NPWS, 1997).

South of Yamba the land adjacent to the coastline is primarily located within Yuraygir National Park (apart from the villages). The eastern portion of the northern and central sections of the reserve are dominated by heathlands, consisting of dry, wet and graminoid clay heath of various associations, with minor occurrences of sedgeland, melaleuca woodlands and eucalypt forest. The southern section of the park is dominated by wet heathland and sedgeland communities, melaleuca woodlands and eucalypt forest. The diversity of vegetation features within Yuraygir National Park provides a broad range of habitats supporting an extensive variety of fauna species including numerous threatened bird and mammal species and significant amphibian and reptile species (NPWS, 2003).

Waters along the coast from the Sandon River estuary south (including Sandon River and Wooli Wooli River estuaries) are within the SIMP. The SIMP encompasses a diverse range of habitats including estuaries, sandy beaches, intertidal rocky shores, sub-tidal reefs, open oceans and rocky offshore islands. These habitats support numerous reef fish, hard coral, mollusc species, crustaceans, echinoderms, marine worms, 35 shark and ray species, 30 marine mammal species, marine reptiles and over 120 coastal and marine bird species (NPWS, 2003).

The Clarence Valley beaches provide potential nesting habitat for two threatened marine turtle species, Green Turtle (*Chelonia mydas*) and Loggerhead Turtle (*Caretta caretta*). Numerous migratory shorebird species utilise a range of habitats across the study area including ocean beaches, rocky headlands/ platforms, sand and mudflats within the estuaries and lagoons and adjacent mangroves and saltmarsh. Habitats used vary between species and intent (roosting or foraging) however the majority of these coastal habitats are used at some stage by migratory shorebirds. A number of resident shorebird species utilise habitat along the coastline and within estuaries including threatened species which forage, roost, nest and breed within the study area. Specific nesting areas of the species within the study area include lower Clarence River estuary (including Hickey Island), Angourie, Brooms Head to Sandon, Minnie Water, Diggers Camp, Wilsons Headland and Wooli.

4.5 Community Uses and Values

The open coast and estuaries are dynamic and diverse encompassing a broad range of natural features including sandy beaches, coastal dunes, rocky headlands, marine areas, lakes, estuary entrances, littoral rainforest, wetlands/ heathlands and estuarine environments. For many community members, interaction with the coast and estuaries is a highly valued part of life. The beaches and waterways provide a place for social interaction, recreation, relaxation, nature appreciation, connection, exercise and commercial activities. Water quality is one of the prime estuarine 'health' indicators and clean waterways are highly valued by the community. Many of the key economic industries in the local area rely on good water quality including tourism, aquaculture (oyster production) and commercial fishing.

Public land is valued for its important role in the social, intellectual, spiritual and physical enrichment and health benefits of residents, workers, and visitors. The CMP study area comprises significant and valuable parks and reserves that are easily accessible to the local community and visitors attracted to the

opportunities the area provides, such as beaches, coastal lakes and significant open space areas for multiple recreational, social and cultural purposes. The intrinsic value of public land is also recognised, as is the important role it plays in biodiversity conservation and ecosystem function. The local communities place a high value on coastal dune vegetation. Council-managed public land also protects remnant vegetation patches and contributes to wildlife corridors allowing animals to move between small and large bushland areas. This network of open spaces also contributes significantly to the landscape quality of the Clarence Valley. The parks and reserves within the study area represent a significant recreation and conservation resource to residents, visitors and CVC generally. The community places a high priority on effective park and reserve management. Population increases dramatically during peak holiday periods placing pressure on CVC to provide and maintain public land and infrastructure (CVC, 2023a).

Commercial fishing activities occur in Sandon River and Wooli Wooli River estuaries and along the length of the Clarence Valley coastline with the exception of Woody Bay, Turners Beach to Pippi Beach and Angourie Point south to Lake Arragan entrance. Priority Oyster Aquaculture Areas (POAA) are located in Sandon River (4.5 ha) and Wooli Wooli River (18.3 ha) estuaries (Hydrosphere Consulting, 2021). A regional seaport at Yamba is situated at the mouth of the Clarence River which is one of five internationally recognised ports in NSW. The loading wharf of the Port of Yamba is located on Goodwood Island (outside the study area) however the jurisdictional extent of the Port extends throughout the lower Clarence River estuary including the river entrance and channels in the lower estuary.

The Clarence Valley coastline is a popular tourist destination for activities such as fishing, water sports, whale watching, coastal walks, wildlife appreciation with many camping and accommodation options (Plate 3). Accommodation for visitors includes motels, holiday cottages and caravan parks in the adjoining coastal villages. Within the NPWS estate, Woody Head camping area (Bundjalung National Park) and various small camping areas cater for low-key, short-term camping (Sandon River, Illaroo, Boorkoom, Red Cliff and Lake Arragan camping areas in Yuraygir National Park). A range of national park picnic areas and day walks are also provided in these coastal parks. Beaches are also very popular for walking, particularly those close to and easily accessible from towns and villages. Other tourist accommodation within the CMP study area includes holiday parks at Brooms Head and Wooli and numerous private tourist facilities. Other camping areas and tourist facilities also service the study area including Black Rocks camping area in Bundjalung National Park and Station Creek in Yuraygir National Parks as well as holiday parks at Iluka, Yamba and Minnie Water.

Surfing is also very popular along the Clarence Valley coastline. Surfing is typically concentrated around the population centres, particular Yamba and Angourie. Angourie Point in particular is a national class surf break and considered to be ‘sacred’ break amongst the local and national surfing community. The importance of Angourie Point to the surfing community is highlighted in the designation of Angourie Point as a National Surfing Reserve (the second of its kind in Australia).

Bushwalking tracks, both formal and informal, exist along the coastline, mostly within national parks. The two most notable bushwalks are the Iluka Nature Reserve track and the Yuraygir Coastal Walk within Yuraygir National Park extending 65 km from Mara Creek in the north to Red Rock in the south. The track can be accessed at various locations along the route.

1 – water-based activities at Sandon River

2 – Iluka rainforest walking track

3 – camping at Woody Head

4 – Whiting Beach

Plate 4: Community uses and values

The Clarence Valley has several favourable characteristics related to economic opportunities in the coastal zone including coastal, riverine and hinterland amenity, arable soils, favourable climate and access to Sydney and Brisbane via the Pacific Highway. The coastal community of Yamba fulfils the local service needs of residents on the coast and visitors. Future economic growth areas include tourism, aquaculture and marine manufacturing.

No major housing development has been identified in the CMP study area. Some residential growth is expected to occur in the existing urban growth centres (focused on existing major towns). The existing uses of the coastal zone and the projected regional population growth has been considered in the selection of management actions including coastal habitat restoration, foreshore management and waterway access enhancement.

5. A SNAPSHOT OF ISSUES

The key threats and management issues relating to coastal hazards are discussed in detail in the Stage 1 Scoping Study (Hydrosphere Consulting, 2021) and the Stage 2 report (Hydrosphere Consulting, 2023a) and summarised in the following sections.

5.1 Coastal Hazards

The coastal hazards defined in *Coastal Management Act 2016* and considered in this CMP are discussed in the following sections (OEH, 2019a).

5.1.1 Beach erosion

The sediment budget is maintained in a closed sediment compartment (Figure 15). Changes in the distribution of sediment between the nearshore, alongshore, beach face, foredune and estuaries are considered in the assessment of potential beach erosion. Short-term fluctuations of the shoreline are often quite dramatic and may mask long-term trends in accretion or recession.

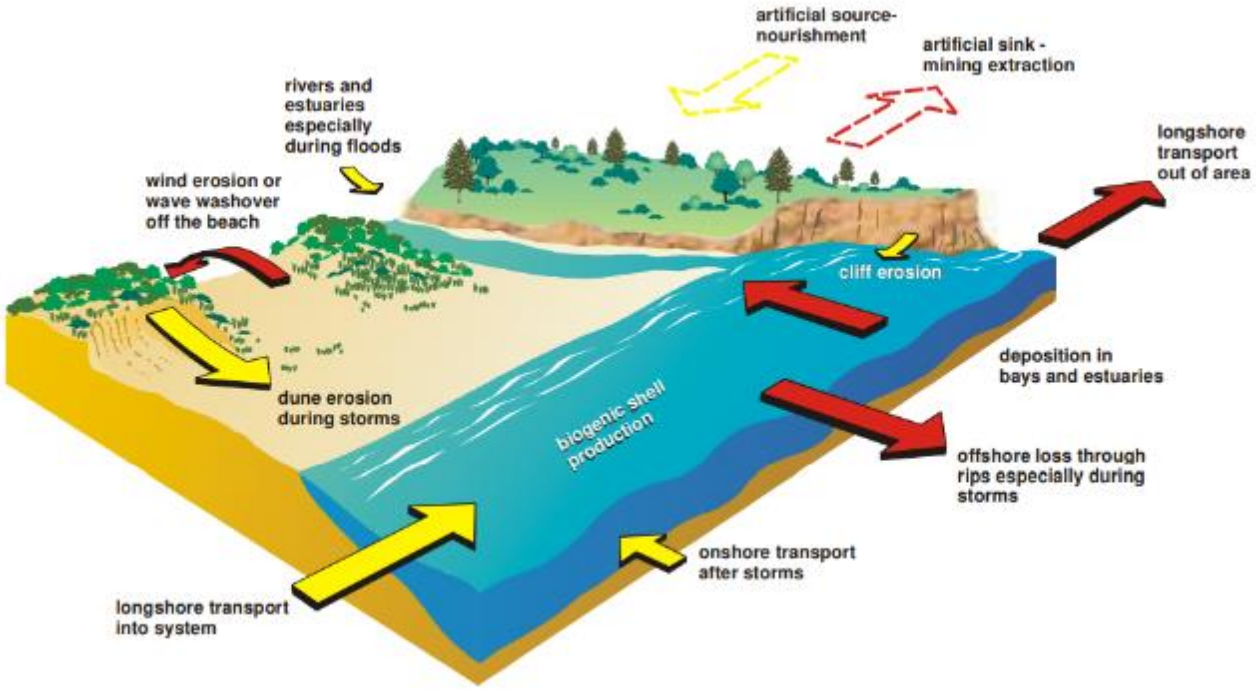

Figure 15: Components of the coastal sediment budget

Source: DLWC (2001)

Beach erosion refers to the removal of beach materials by wave action, tidal currents, littoral currents or wind. It is usually associated with storms or elevated water levels and can occur on the open coast and in estuaries. Beach erosion events are often interspersed with beach recovery phases when sediment moves back onshore to rebuild the beach and dunes (Figure 16).

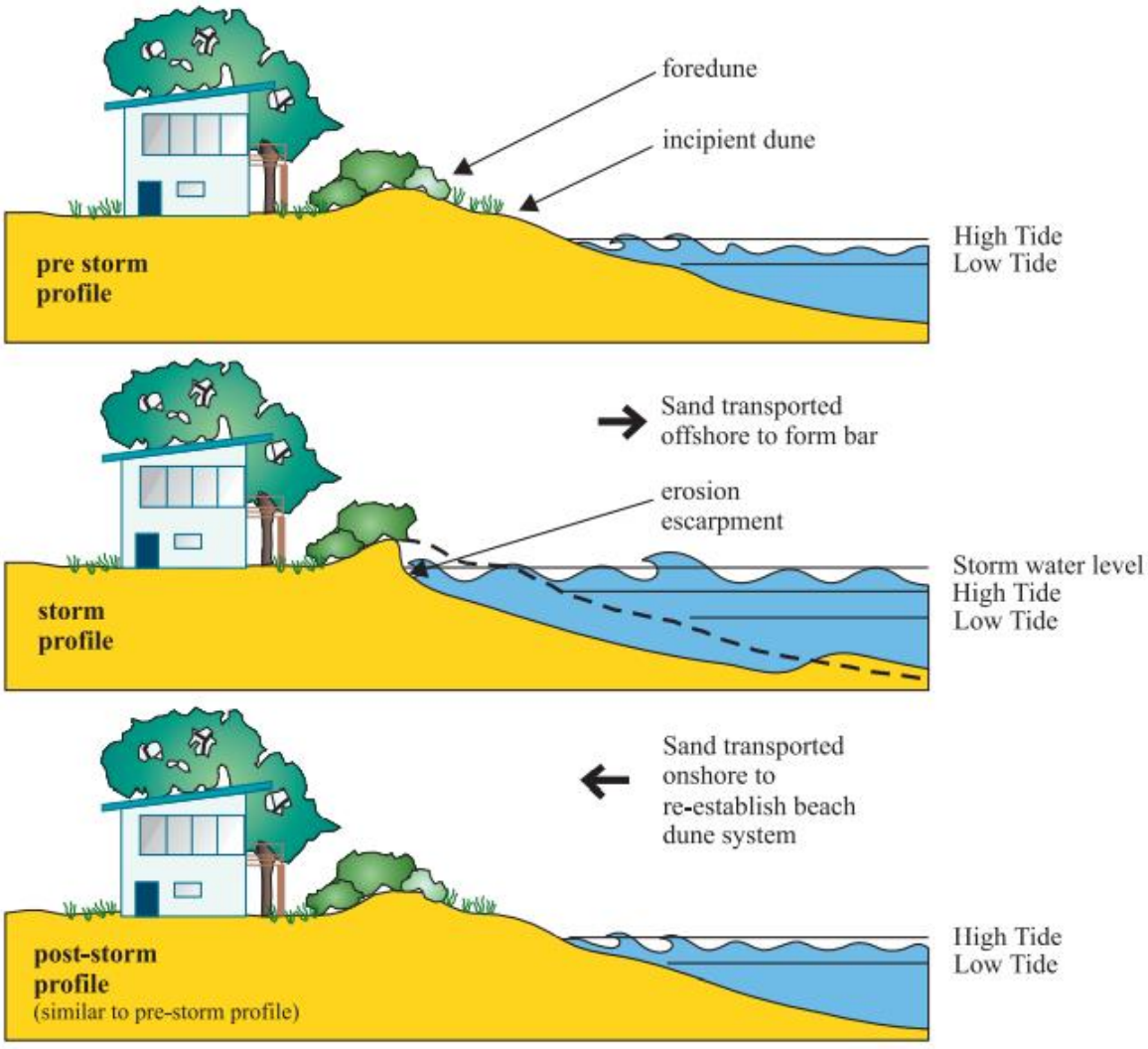

Figure 16: Beach erosion and recovery phases

5.1.2 Shoreline recession

Shoreline recession refers to continuing landward movement of the shoreline or a net landward movement of the shoreline over a specified time. As shoreline recession occurs, the beach fluctuation zone is translated landward (Figure 17). Whether long term recession occurs depends primarily on the state of the sediment budget for a particular part of the coast. Coastal sediment compartments can gain and/or lose sediment from several sources. If the losses persistently exceed the gains, then the shorelines within that compartment will recede. Sea level rise is a key driver of shoreline recession.

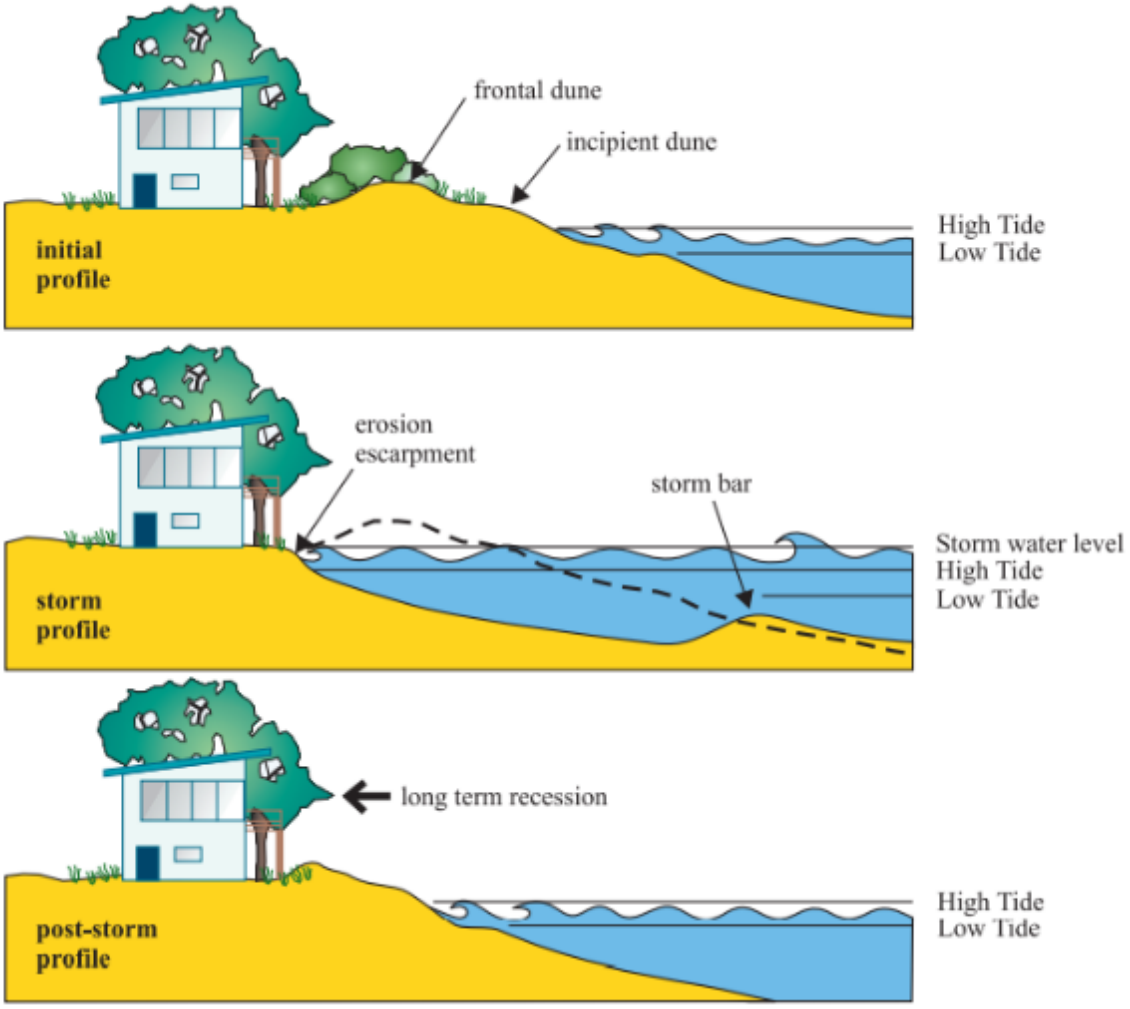

Figure 17: Long-term shoreline recession - landward displacement due to permanent sand loss

Source: DLWC (2001)

5.1.3 Coastal lake or watercourse entrance instability

Both natural and trained entrances of estuaries and coastal lakes present a variety of potential hazards and risks. The entrance dynamics and the condition of the entrance also affect flood hazards, water quality and ecological health in the estuary or coastal lake. Entrances are highly dynamic environments with their shape constantly changing in response to processes such as alongshore sediment transport, tidal flows, storms, and catchment flooding. In trained entrances (e.g. Clarence River and Wooli Wooli River), the sediment transport patterns are modified, with potential impacts on beach erosion, current velocity and channel stability. ICOLLs such as Lake Cakora and Lake Arragan are highly sensitive to catchment runoff and the frequency of entrance opening and closure.

5.1.4 Tidal inundation

Tidal inundation is generally related to elevated tidal water levels under average meteorological conditions. Tidal inundation may include shorter-term incursion of seawater into low-lying land during an elevated water level event such as a high tide or more permanent inundation due to land subsidence, changes in tidal range or sea level rise.

5.1.5 Coastal inundation

Coastal inundation is generally related to short-term storm events and occurs when a combination of marine and atmospheric processes raises ocean water levels above normal elevations and inundates low-lying areas or overtops dunes, structures and barriers (Figure 18). Wave overtopping and storm surge can also be associated with tsunami events. Any changes in mean sea level will directly affect the extent and severity of tidal/ coastal inundation hazards.

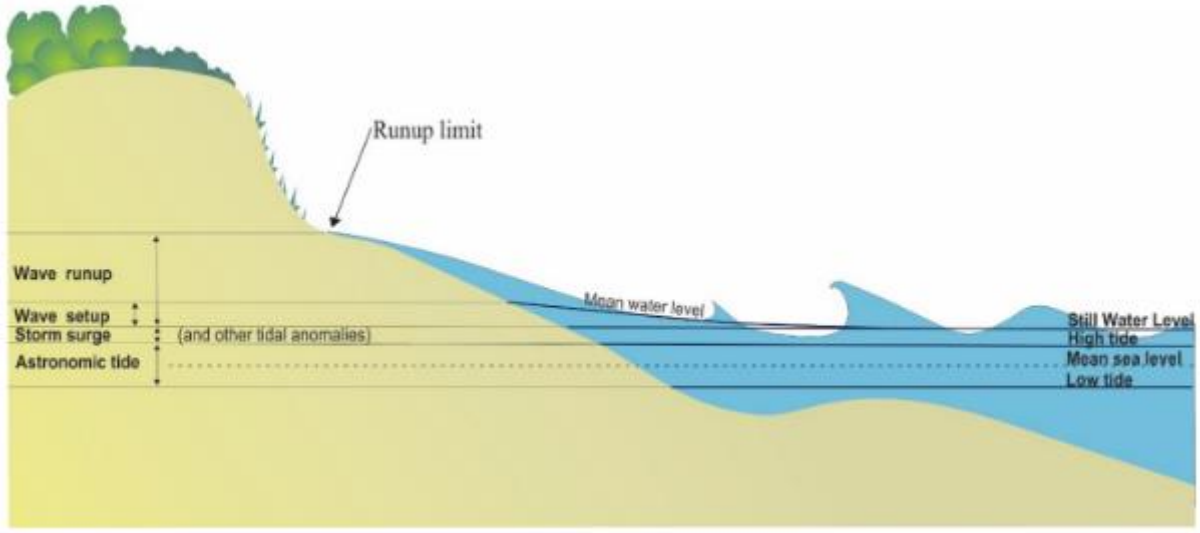

Figure 18: Elevated water levels on the open coast

Source: OEH (2019a)

5.1.6 Cliff/ slope instability

Geotechnical or slope instability hazard occurs on the headlands and bluffs along the coastline within and separating coastal sediment compartments (sections of the coastline with similar characteristics and processes which share a common sediment resource with clearly defined physical boundaries). The differing degree of instability often relates to the interaction of weathering and erosion processes on different geological formations and rock types along with changes to the types of vegetation on the slope. Geotechnical hazards present risks both to property and to life, such as rock falling from headlands and cliff faces, collapse of unconsolidated materials (such as high dune escarpments), reduced foundation capacity and the collapse of cliffs under houses and development.

5.1.7 Erosion and inundation of foreshores

Erosion and inundation of foreshores caused by tidal waters and the action of waves, including the interaction of those waters with catchment floodwaters has been considered as two separate issues for the CMP development:

1. Erosion of foreshores - foreshores and floodplains are comprised of unconsolidated material that was deposited during the evolution of the estuary. The estuary foreshores may not recover from erosion events and ongoing recession or bank erosion may occur. The erosion of estuary foreshores may also be associated with the long-term evolution of the estuary due to geomorphic processes. The majority of the banks within the lower Clarence River estuary are protected with rock revetment/ training walls. Bank erosion in Sandon River is considered to be natural and due to the ongoing lateral adjustment of the waterway. Some erosion sites have been identified in Wooli Wooli River

and were attributed to a variety of causes but mostly related to removal of riparian vegetation combined with tidal and flood flows or boat wake and wind waves (Hydrosphere Consulting, 2021). Bank erosion in Wooli Wooli River continues to be a concern to the local community. Bank erosion in Wooli Wooli River estuary is addressed in this CMP.

2. Inundation of foreshores under tides, waves, and catchment flood waters which is not considered in this CMP. CVC prepared a flood study for Wooli Wooli River which included assessment of tidal (sunny day) inundation. Outputs included updated flood mapping to support land use planning. There are no flood studies undertaken for Sandon River or Lake Cakora.

5.1.8 Stage 2 coastal hazard assessments

During Stage 2 of the CMP development, coastal hazard assessments were undertaken for the hazards of coastal erosion, recession, tidal inundation and coastal inundation for a range of planning periods (present day, 2043, 2073 and 2123). The coastal hazard assessment and associated maps (JBP, 2022; JBP, 2023) were prepared to support the development of the CMP as part of Stage 2. The maps were used in the detailed risk assessment (Section 5.5), to support the understanding of coastal hazard risks and the prioritisation of management actions.

Coastal hazards were defined in terms of an event frequency based on terminology used in flood management planning, specifically the terminology used in *Australian Rainfall and Runoff* (Geoscience Australia, 2019) in order to apply consistent natural hazard risk assessment nomenclature. For tidal and coastal inundation, the event frequency is described using an annual exceedance probability (AEP, the probability that a particular inundation event will be exceeded in a given year). Future erosion and recession hazard projections are a combination of short-term and long-term probabilistic components. Therefore erosion and recession scenarios are described in terms of likely exceedance probability (EP). For a given planning timeframe, erosion/ recession maps indicate the probability (e.g. 1%) that the hazard extent will be exceeded (example shown in Figure 19). The event likelihood or frequency (Table 3) has been presented as a qualitative description, useful to aid community and stakeholder understanding of risk.

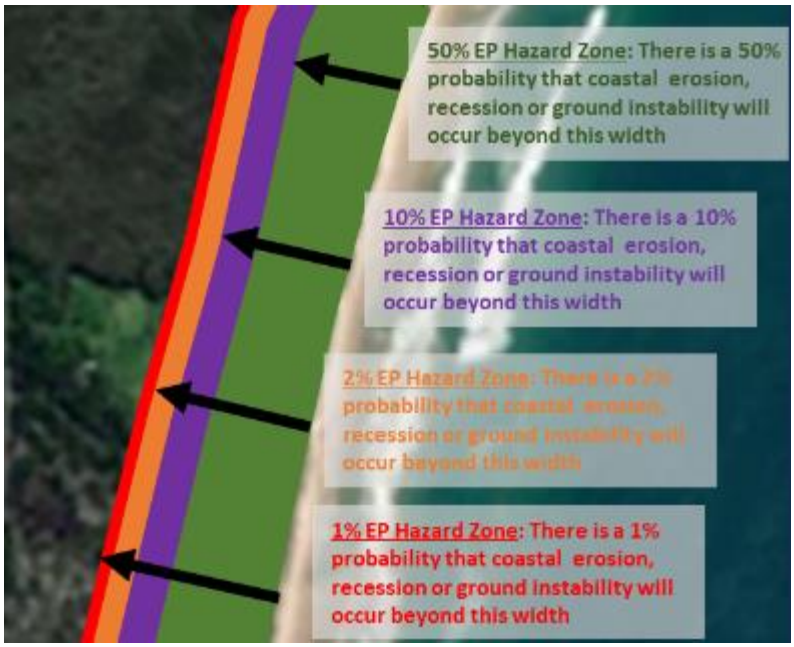

Figure 19: Width of hazard zone (coastal erosion, recession or ground instability) for each event frequency

Future planning periods include allowances for sea level rise based on the projections in the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (IPCC, 2023). These were presented as two scenarios based on Shared Socio-economic Pathways (SSPs). Two sea level rise scenarios were selected based on the Shared Socio-economic Pathways (SSPs) utilised in CVC's flood risk planning approach (SSP2 and SSP5). These SSPs consider how socio-economic factors may change over the next century including potential changes to population, economic growth, education, urbanisation and the rate of technological development. SSP2 represents a pathway where the world follows a path in which social, economic and technological trends do not shift markedly from historical patterns. It considers intermediate greenhouse gas emissions, with carbon dioxide (CO_2) emissions maintaining current levels until 2050, then falling, but not reaching net zero by 2100. SSP2 broadly reflects the Representative Concentration Pathway (RCP) 4.5 outlined in the previous IPCC Fifth Assessment Report. SSP5 represents a pathway of the highest level of fossil fuel use, food demand, energy use and greenhouse gas emissions. It includes very high greenhouse gas emissions, where CO_2 emissions triple by 2075. However, it also includes a socio-economic pathway where competitive markets, innovation and participatory societies are able to produce rapid technological progress to achieve sustainable development over the long-term. SSP5 broadly reflects RCP 8.5 outlined in the previous IPCC Fifth Assessment Report. Further information is available in the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (IPCC, 2023). The coastal hazard scenarios considered in the Stage 2 assessment are shown in Table 3.

Table 3: Coastal hazard assessment scenarios

Hazard	Planning timeframes	Tidal and coastal inundation event frequency (AEP)[1]	Erosion and recession exceedance probability (EP)[2]	Frequency descriptor	Future climate[3]
Tidal inundation (High High Water Solstice Spring, HHWSS)	Present day (2023) +20 years (2043) +50 years (2073) +100 years (2123)	> 1 per year	-	Very Frequent	SSP2 and SSP5
Coastal inundation (extreme sea level)	Present day (2023) +20 years (2043) +50 years (2073) +100 years (2123)	10% AEP	-	Frequent to Rare	SSP2 and SSP5
		2% AEP		Rare	
		1% AEP		Rare to Very Rare	
Beach erosion and shoreline recession	Present day (2023) +20 years (2043) +50 years (2073) +100 years (2123)	-	50% EP	Frequent	SSP2 and SSP5
			10% EP	Frequent to Rare	
			2% EP	Rare	
			1% EP	Rare to Very Rare	

1. For tidal and coastal inundation, the event frequency is described using an annual exceedance probability (AEP, the probability that a particular inundation event will be exceeded in a given year).
2. Future erosion and recession hazard projections are a combination of short-term and long-term probabilistic components. Therefore erosion and recession scenarios are described in terms of exceedance probability (EP)
3. SSP - Shared Socio-economic Pathways consider how socio-economic factors may change over the next century including potential changes to population, economic growth, education, urbanisation and the rate of technological development. SSP2 represents a pathway where the world follows a path in which social, economic and technological trends do not shift markedly from historical patterns. SSP5 represents the highest level of fossil fuel use, food demand, energy use and greenhouse gas emissions.

Along the Clarence coastline many beaches are vulnerable to coastal erosion/ recession. Low-lying areas within the lower catchments of the estuaries and ICOLLs are most vulnerable to tidal/ coastal inundation with inundation of lesser concern along the beaches. Areas vulnerable to tidal or coastal inundation and erosion/ recession are discussed for each management zone in Sections 8 to 21. While the hazard mapping shows a threat of erosion along the majority of the coastline, the presence of coastal protection works, underlying or exposed bedrock is expected to mitigate some of the risk. However, there is limited information on the condition and suitability of the coastal protection works and the presence and condition of the coastal protection works cannot be guaranteed across all planning periods without appropriate engineering assessments. While fit-for-purpose structures may reduce the erosion/ recession hazard, they may not limit the risk for rare or very rare events as they would be expected to fail depending on their design, or over the long-term, where structures are not maintained or upgraded. Ongoing assessment of these structures, upgrade and adaptation to sea level rise will be required to provide long-term protection. Similarly, the exact nature of the bedrock requires detailed geotechnical investigation in areas relying on the bedrock to reduce the erosion risk.

The impacts and threats of tidal/ coastal inundation and erosion/ recession individually are exacerbated if combined. This could occur if severe erosion and inundation occurred simultaneously or incrementally over time as recession progresses and inundation depths and frequency increases or if erosion/ recession results in the lowering of dune barriers, increasing the risk of coastal inundation (wave overtopping). The Sandon and Wooli ‘peninsulas’ are threatened by coastal erosion/ recession from the east and from the west by tidal/ coastal inundation from the estuary. Similarly, Hickey Island is threatened by erosion/recession from the north and tidal/ coastal inundation from the estuary to the south. Mapping (JBP, 2022; JBP, 2023) indicates that there are locations where erosion risk and inundation risk overlap, where there is a further risk of potentially broader scale, more permanent implications, if the two hazards occur simultaneously. This could result in a ‘break through’ where long-term or permanent estuary-ocean exchange would occur leading to the complete loss of land and assets within the area. A less drastic outcome is an area or zone of increased intermittent tidal inundation or wave overtopping during coastal storm events. Example coastal hazard mapping for 2043 is provided for these areas in the following figures.

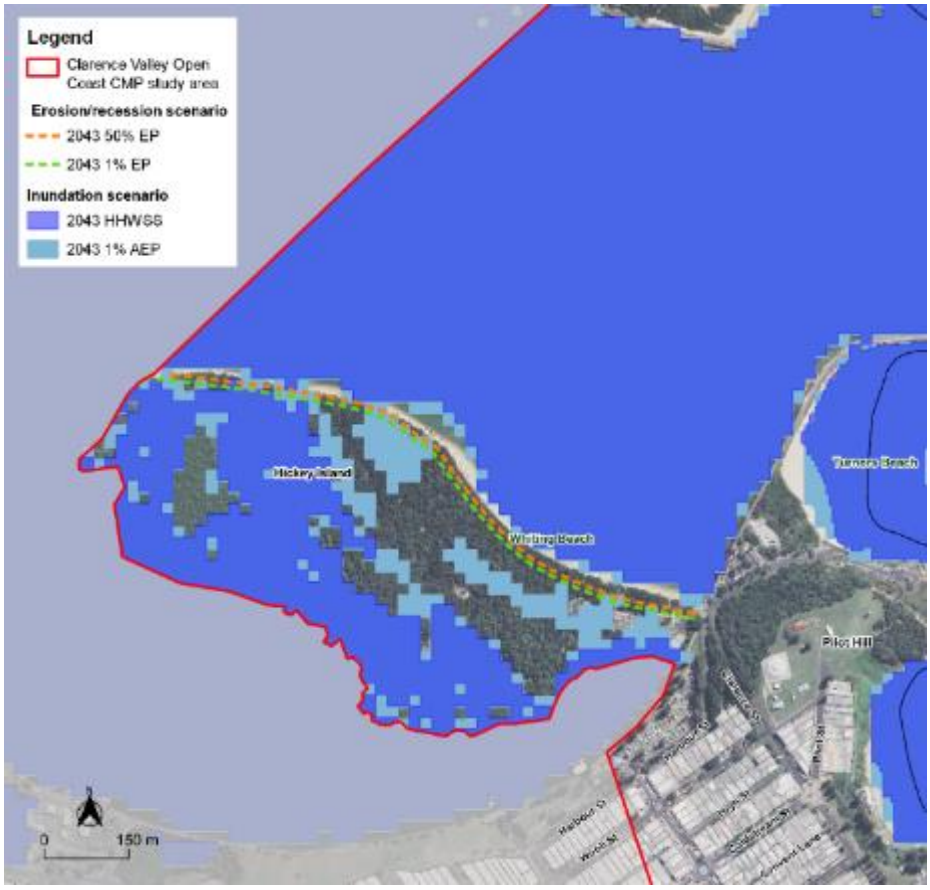

Figure 20: Coastal hazard threats at Hickey Island – 2043 SSP2

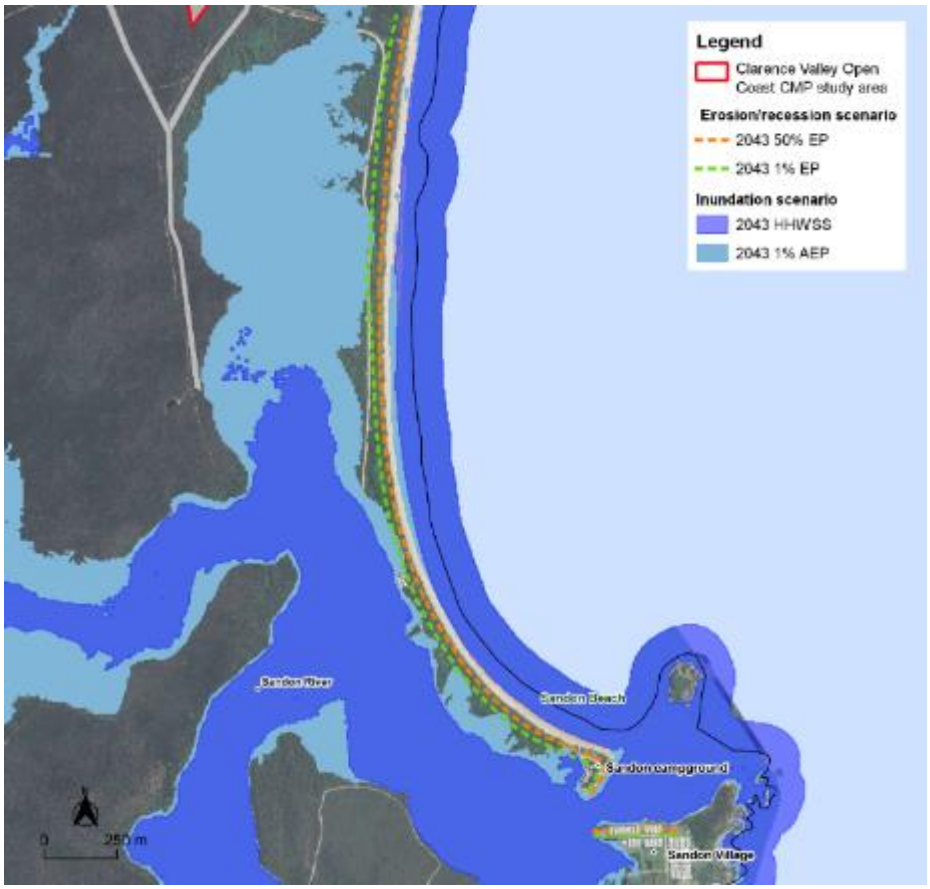

Figure 21: Coastal hazard threats at Sandon peninsula – 2043 SSP2

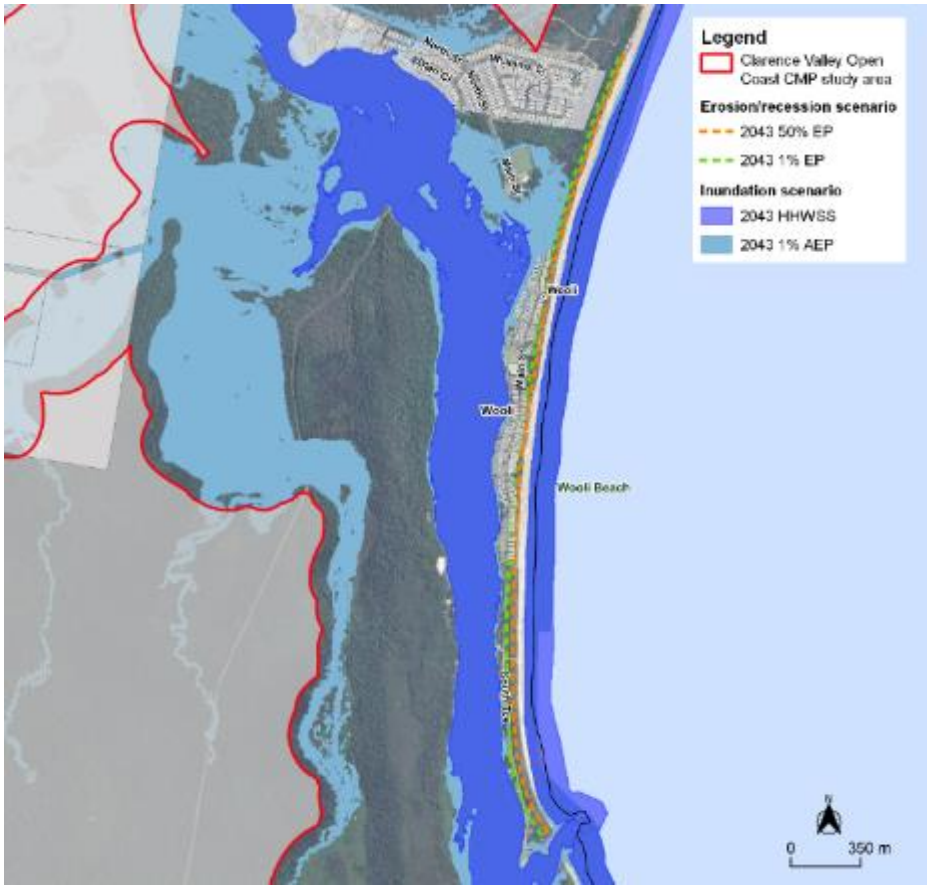

Figure 22: Coastal hazard threats at Wooli peninsula – 2043 SSP2

Slope instability is the critical issue for the Yamba coastline particularly the areas backing Main Beach and Convent Beach. The majority of the geotechnical landslide hazards in this area result from the effects of coastal actions on the beach and dunes. The exception is the risk associated with instability of the moderately steep headland slope at Pilot Hill. Slope instability and associated risks to CVC infrastructure and individuals at Cakora Point (Brooms Head) have been identified including rock falls and tumbling from jointed greywacke, crest fretting causing receding crests and rock falls from overhangs.

5.2 Coastal Uses and Access

Conflicts between coastal uses and values can impact the amenity of the area and these conflicts are exacerbated by coastal hazards and the popularity of the area. Use and access issues within the CMP area include:

- Coastal development - existing development along the foreshore is vulnerable to coastal hazards at present with risks increasing over time. The majority of future urban development within the Clarence Valley LGA will occur outside of the CMP study area in the existing major towns in the shire and existing rural areas of the shire. However, future development and tourism/ visitors to the coastal zone due to its attractiveness for recreational and holiday activities will place increasing pressure on the coastal zone including water quality and biodiversity.
- Litter - litter and marine debris were a common concern raised by respondents to the Stage 1 community survey although there is limited data on the scale and extent of litter within the study area.
- Vehicles on beaches - four-wheel driving is a popular activity on the Woody Head/Iluka, Sandon, Brooms Head, Minnie Water and Wooli coasts. Vehicles are permitted on some beaches and some

conditions apply. Concerns raised by the community include damage to the incipient dune and coastal habitats from the vehicles and public safety risks.

- Dogs on beaches - uncontrolled dogs on beaches and their impacts on other beach users and native fauna was a key concern raised by the community.
- Damage to beach access points - damage to beach access points due to coastal hazards or stormwater runoff was a key threat identified at many beaches along the coastline. Issues include the safety and maintenance of formal beach access points following erosion events.

5.3 Ecological Condition

The CMP Scoping Study (Hydrosphere Consulting, 2021) and Stage 2 report (Hydrosphere Consulting, 2023a) present the information on water quality and ecological condition for each waterway. Although poor water quality was not raised as a significant issue by the public, good water quality was raised as the most important attribute of the study area. The collection of ecosystem health data in the CMP area has been sporadic, site/ project specific and there has been little or no integration between sampling efforts, or of data storage and analysis.

The following causes of poor water quality have been identified within the study area.

- Urban wastewater management - functionality of on-site wastewater management systems has been identified as an issue within the Wooli Wooli River, Sandon River and Lake Cakora catchments (Hydrosphere Consulting, 2021) and risks are likely to increase into the future due to climate change (increased inundation due to sea level rise), further degraded systems and more intensive use.
- Diffuse pollution - stormwater discharges from all urban areas within the study area include Yamba, Angourie, Brooms Head, Minnie Water and Wooli. The entrance condition of estuaries and ICOLLs, in particular, can contribute to reduced flushing times and eutrophication. The condition of the Lake Cakora entrance influences water quality in the estuary.

The key threats to ecological values include:

- Seagrass decline (Sandon River and Wooli Wooli River).
- Threats to marine turtles nesting on beaches within the study area include vehicles on beaches, predation of nests and hatchlings by feral animals, human interference, increased temperatures, sea level and extreme weather events from climate change, artificial light impacting hatchling behaviour, survival and natural predation, and weather events.
- The nesting habits of shorebirds make them particularly susceptible to human induced impacts including impacts from human disturbance particularly in high visitation areas, dogs, feral animals such as foxes, recreational and commercial fishing and boat users and vehicles on beaches.
- Invasive weeds - a range of introduced pest plants occur within the CMP area. The most widespread species of weed are lantana (*Lantana camara*) and bitou bush (*Chrysanthemoides monilifera rotundata*) which was previously used for dune stabilisation.
- Threats to coastal habitats (e.g. dunes, littoral rainforest and headlands) due to human disturbance particularly in high visitation areas, coastal hazards (erosion, recession and tidal inundation), weeds and feral animals.

5.4 Climate Change Impacts

The Clarence Valley coastline will experience broadscale climate change impacts as well as interrelated localised impacts into the future due to sea level rise, an increase in extreme rainfall events and storms, increase in estuary water temperature and acidity, increase in fire weather and associated impacts on biodiversity and other values of the open coast and estuaries. Detailed information is provided in the Scoping Study (Hydrosphere Consulting, 2021). The impacts of climate change have been considered in the coastal hazard assessments and risk assessments as well as in the development of management strategies to address risks to the coastal zone.

5.5 Risk Assessment

The stakeholder consultation and subsequent risk assessment undertaken during initial stages of the CMP development identified and prioritised the threats to be addressed by this CMP. The risk assessment outcomes and key threats are summarised in the following sections and detailed in the supporting information for this CMP - Stage 1, Hydrosphere Consulting (2021) and Stage 2 (Hydrosphere Consulting, 2023a).

A preliminary risk assessment and gap analysis was completed as part of the *Stage 1 Scoping Study* (Hydrosphere Consulting, 2021). This assessment prioritised risks and identified those that needed to be further investigated in subsequent stages of the CMP. Following detailed assessments completed as part of Stage 2, the risk assessment was refined and updated with new information and included in the *Stage 2 Vulnerabilities and Opportunities* report (Hydrosphere Consulting, 2023a). Minor changes to risk rankings were made during Stage 3 based on new information available and community feedback.

The methodology uses the risk consequence and likelihood criteria (derived from event frequencies in Table 3) outlined in Table 4 to Table 6 with qualitative scales to assess the risk of identified issues impacting the values and assets of the study area under current management practices.

Table 4: Qualitative measures of consequence or impact

Consequence	Description
Catastrophic	Significant on-going and/or permanent negative impacts on the environmental, social or economic values, and where these values are endangered either permanently or irreversibly.
Major	Substantial measurable and/or ongoing negative impacts on the environmental, social or economic values.
Moderate	Measurable and/or on-going negative impacts on the environmental, social or economic values.
Minor	Discernible and/or temporary negative impacts on the environmental, social or economic values.
Insignificant	No or barely discernible negative impacts on the environmental, social or economic values.

Table 5: Qualitative measures of likelihood under current management practices

Likelihood	Description
Almost certain	A very large certainty that this will occur in this situation within the timeframe.
Likely	Expected to occur in this situation within the timeframe.
Possible	Some clear evidence exists to suggest this is possible in this situation within the timeframe.
Unlikely	Uncommon, but has been known to occur elsewhere. Expected to occur here only in specific circumstances within the timeframe.
Rare	Never reported for this situation, but still plausible within the timeframe.

Table 6: Qualitative risk estimation

Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	Minimal	Low	Moderate	High	High
Likely	Minimal	Low	Moderate	High	High
Possible	Minimal	Minimal	Low	Moderate	High
Unlikely	Minimal	Minimal	Minimal	Low	Moderate
Rare	Minimal	Minimal	Minimal	Low	Moderate

Threats to the CMP study area and corresponding risk levels identified by the risk assessment are summarised in Table 7 as current and future risk (20-year, 50-year and 100-year). Even though some risks may not be apparent at present, risks that require updates to planning controls or strategies to address complex and/or large-scale risks that require long-term planning are also considered in the CMP. General, shire-wide management actions are also likely to address other lower priority threats and the threats that are expected to emerge over time.

Table 7: Risk assessment results for Clarence Valley open coast

Threats and location	Current risk	20-year risk	50-year risk	100-year risk
T1 - Beach erosion				
Ten Mile Beach	Low	Moderate	High	High
Iluka Road (Shark Bay)	High	High	High	High
Woody Bay	High	High	High	High
Woody Head campground	High	High	High	High
Iluka area	Minimal	Minimal	Low	Low
Iluka Beach	Minimal	Minimal	Low	Low
Andersons Beach	Minimal	Minimal	Low	Low
Whiting Beach	Moderate	Moderate	High	High
Turners Beach	Minimal	Minimal	Low	Low
Yamba Main Beach	Moderate	Moderate	Moderate	Moderate
Convent Beach	Moderate	Moderate	Moderate	Moderate
Pippi Beach	Low	Low	Moderate	Moderate
Barri Beach	Low	Low	Low	Low
Spooky Beach	Low	Low	Low	Low
Angourie area	Low	Low	Low	Low
Brooms Head (Main Beach)	Low	Low	Low	Low
Lake Cakora (Ocean Road properties)	High	High	High	High
Lake Cakora entrance	High	High	High	High
Brooms Head reserve	High	High	High	High
The Sandon	Low	Low	Moderate	Moderate
Sandon campground	High	High	High	High
Sandon village	Moderate	Moderate	High	High
Sandon Beach	Minimal	Low	Low	Low
Illaroo campground	Low	Moderate	High	High
Minnie Water Beach	Moderate	Moderate	Moderate	Moderate
Minnie Water Back Beach	Low	Low	Low	Low
Diggers Camp	Moderate	Moderate	High	High
Wooli Beach (north)	Minimal	Low	Moderate	Moderate
Wooli village (north)	Minimal	Low	Moderate	Moderate
Wooli village (south)	High	High	High	High
Wooli Beach (south)	Moderate	High	High	High
Jones Beach	Low	Low	Low	Low

Threats and location	Current risk	20-year risk	50-year risk	100-year risk
T2 - Shoreline recession				
Ten Mile Beach	Low	Low	Low	Low
Iluka Road (Shark Bay)	High	High	High	High
Woody Bay	High	High	High	High
Iluka area	Minimal	Minimal	Low	Low
Iluka Beach	Minimal	Minimal	Low	Low
Andersons Beach	Low	Low	Low	Low
Whiting Beach	Moderate	Moderate	High	High
Turners Beach	Minimal	Low	Low	Moderate
Yamba Main Beach	Low	Moderate	High	High
Convent Beach	Minimal	Low	Moderate	Moderate
Pippi Beach	Minimal	Minimal	Moderate	Moderate
Barri Beach	Minimal	Minimal	Low	Low
Spooky Beach	Low	Low	Low	Low
Angourie area	Low	Low	Low	Low
Brooms Head (Main Beach)	Low	Moderate	High	High
Lake Cakora (Ocean Road properties)	High	High	High	High
Lake Cakora entrance	Moderate	High	High	High
Brooms Head reserve	Moderate	Moderate	High	High
The Sandon	Low	Low	Moderate	High
Sandon River campground	Moderate	Moderate	High	High
Sandon village	Moderate	Moderate	Moderate	Moderate
Sandon Beach	Minimal	Low	Low	Low
Illaroo campground	Low	Moderate	High	High
Minnie Water Beach	Low	Low	Moderate	High
Minnie Water Back Beach	Minimal	Low	Low	Low
Diggers Camp	Low	Low	Low	Low
Wooli Beach (north)	Minimal	Moderate	High	High
Wooli village	High	High	High	High
Wooli Beach (south)	Moderate	High	High	High
Jones Beach	Low	Low	Low	Low

Threats and location	Current risk	20-year risk	50-year risk	100-year risk
T3 - Tidal/ coastal inundation[1]				
Ten Mile Beach	Minimal	Minimal	Minimal	Minimal
Shark Bay	Minimal	Low	Low	Moderate
Woody Bay/ Woody Head	Minimal	Minimal	Low	Low
Iluka Back Beach	Minimal	Minimal	Low	Low
Iluka Beach	Minimal	Minimal	Low	Low
Andersons Beach	Minimal	Minimal	Low	Low
Iluka	Low	Low	Moderate	Moderate
Whiting Beach	Moderate	High	High	High
Turners Beach	Minimal	Low	Low	Low
Yamba Main Beach	Low	Low	Moderate	Moderate
Convent Beach	Minimal	Minimal	Minimal	Low
Pippi Beach	Minimal	Low	Low	Low
Barri Beach	Minimal	Low	Low	Low
Spooky Beach	Minimal	Minimal	Minimal	Low
Angourie area	Minimal	Minimal	Minimal	Minimal
Brooms Head (Main Beach)	Minimal	Minimal	Minimal	Minimal
Lake Cakora (Ocean Road properties)	High	High	High	High
Brooms Head reserve	Low	Low	Low	Moderate
Brooms Head (village)	High	High	High	High
The Sandon	Minimal	Minimal	Minimal	Minimal
Sandon campground and access road	High	High	High	High
Sandon village	Moderate	Moderate	High	High
Sandon Beach	Minimal	Minimal	Minimal	Minimal
Illaroo campground	Low	Moderate	Moderate	Moderate
Minnie Water Beach	Minimal	Low	Low	Low
Minnie Water Back Beach	Minimal	Minimal	Minimal	Minimal
Diggers Camp	Minimal	Low	Moderate	Moderate
Wooli Beach (north)	Minimal	Minimal	Low	Low
Wooli village (north)	Moderate	High	High	High
Wooli village (south)	High	High	High	High
Jones Beach	Minimal	Minimal	Minimal	Minimal

Threats and location	Current risk	20-year risk	50-year risk	100-year risk
T4 - Entrance instability				
Clarence River	Low	Low	Low	Low
Lake Cakora	Moderate	Moderate	Moderate	Moderate
Lake Arragan/ Mara Creek	Minimal	Minimal	Minimal	Minimal
Sandon River	Minimal	Minimal	Minimal	Minimal
Wooli Wooli River entrance	Low	Low	Low	Low
T5 - Slope instability/ landslip				
Headlands within Bundjalung National Park)	Minimal	Minimal	Minimal	Minimal
Red Cliff area (Little Shelley Beach, Shelley Beach, Plumbago Beach, Red Cliff)[2]	High	High	High	High
Other headlands within Yuraygir National Park)	Minimal	Minimal	Minimal	Minimal
Pilot Hill	High	High	High	High
Convent Beach	Moderate	Moderate	Moderate	Moderate
Yamba Point	Low	Low	Low	Low
Pippi Beach	Low	Low	Low	Low
Cakora Point	Low	Low	Low	Low
T6 - Erosion of foreshores (MEMS TARA priority threat)				
Lake Cakora	Moderate	Moderate	High	High
Sandon River	Minimal	Low	Moderate	Moderate
Wooli Wooli River	Moderate	Moderate	High	High
T7 - Historic clearing of riparian vegetation and adjacent habitat (MEMS TARA priority threat)				
Wooli Wooli River	Moderate	Moderate	Moderate	Moderate
Sandon River	Minimal	Minimal	Minimal	Minimal
T8 - Foreshore development (MEMS TARA priority threat)				
Yamba-Angourie coast	Moderate	Moderate	Moderate	Moderate
Sandon village	Low	Low	Low	Low
Smaller villages (Brooms Head, Sandon, Wooli)	Low	Low	Low	Low

Threats and location	Current risk	20-year risk	50-year risk	100-year risk
T9 - Invasive weeds (e.g. Bitou bush, Lantana)				
Coastline north of Clarence River estuary	Moderate	Moderate	Moderate	Moderate
Yamba-Angourie coast	Moderate	Moderate	Moderate	Moderate
Brooms Head (Northern Beach)	Moderate	Moderate	Moderate	Moderate
Yuraygir National Park	Moderate	Moderate	Moderate	Moderate
Sandon River	Minimal	Minimal	Minimal	Minimal
Wooli Beach	Moderate	Moderate	Moderate	Moderate
Wooli Wooli River	Moderate	Moderate	Moderate	Moderate
T10 - Uncontrolled stock access to and grazing within the riparian zone				
Wooli Wooli River	Low	Low	Low	Low
T11 - Seagrass decline				
Sandon River	Moderate	Moderate	Moderate	Moderate
Wooli Wooli River	Moderate	Moderate	Moderate	Moderate
T12 – Coastal vegetation damage[3]				
Bundjalung National Park	Minimal	Minimal	Minimal	Minimal
Iluka	Moderate	High	High	High
Hickey Island	Moderate	High	High	High
Yamba beaches	Moderate	High	High	High
Angourie	Moderate	High	High	High
Brooms Head	Moderate	High	High	High
Sandon	Minimal	Minimal	Minimal	Minimal
Sandon River (estuarine vegetation - (mangrove, saltmarsh, seagrass)	Minimal	Minimal	Minimal	Minimal
Minnie Water	Moderate	Moderate	Moderate	Moderate
Diggers Camp	Moderate	Moderate	Moderate	Moderate
Wooli	Moderate	High	High	High
Wooli Wooli River (estuarine vegetation - (mangrove, saltmarsh, seagrass)	Minimal	Minimal	Minimal	Minimal
Yuraygir National Park	Minimal	Minimal	Minimal	Minimal
T13 - Unauthorised clearing of reserves for views				
Brooms Head	Minimal	Minimal	Minimal	Minimal
Wooli Beach	Minimal	Minimal	Minimal	Minimal
Yamba	Minimal	Minimal	Minimal	Minimal
T14 - Overfishing, non-compliance with fishery regulations				
All areas	Low	Low	Low	Low

Threats and location	Current risk	20-year risk	50-year risk	100-year risk
T15 - Anthropogenic barriers (i.e. physical barriers, land use and planning constraints) to migration of vegetation communities with sea level rise				
Lake Cakora	Minimal	Low	Moderate	Moderate
Sandon River	Minimal	Low	Moderate	Moderate
Wooli Wooli River	Minimal	Low	Moderate	Moderate
T16 - Uncontrolled dog access				
Brooms Head	Moderate	Moderate	Moderate	Moderate
National parks (e.g. Shark Bay)	Low	Low	Low	Low
T17 - 4WD/ motorbikes on beaches				
Shark Bay	Moderate	Moderate	Moderate	Moderate
Pippi Beach	Moderate	Moderate	Moderate	Moderate
Brooms Head	Moderate	Moderate	Moderate	Moderate
Sandon Beach	Moderate	Moderate	Moderate	Moderate
Wooli Beach	Moderate	Moderate	Moderate	Moderate
T18 - Predation and invasion by introduced animals (e.g. pigs, cane toads, foxes, rabbits)				
Bundjalung National Park	Moderate	Moderate	Moderate	Moderate
Angourie	Moderate	Moderate	Moderate	Moderate
Brooms Head	Low	Low	Low	Low
Yuraygir National Park	Moderate	Moderate	Moderate	Moderate
Sandon River	Low	Low	Low	Low
Wooli Wooli River	Low	Low	Low	Low
T19 - Insufficient protection for marine animals				
All areas	Minimal	Minimal	Minimal	Minimal
T20 - Illegal (freedom) camping				
All areas	Low	Low	Low	Low
T21 - Spear fishing				
All areas	Minimal	Minimal	Minimal	Minimal
T22 – Modification of coastal wetland habitat due to coastal hazards				
Bundjalung National Park	Moderate	Moderate	High	High
Hickey Island	Moderate	Moderate	High	High
Brooms Head north	Moderate	Moderate	High	High
Lake Cakora	Moderate	Moderate	High	High
Yuraygir National Park and surrounds	Moderate	Moderate	High	High
Minnie Water Beach	Moderate	Moderate	High	High
Wooli Wooli River	Moderate	Moderate	High	High

Threats and location	Current risk	20-year risk	50-year risk	100-year risk
T23 - Urban stormwater pollution (MEMS TARA priority threat)				
Lake Cakora	Low	Low	Low	Low
Sandon River	Minimal	Minimal	Minimal	Minimal
Wooli Wooli River	Low	Low	Low	Low
T24 - Pollution from on-site wastewater systems				
Brooms Head/ Lake Cakora (caravan park)	Low	Low	Low	Low
Lake Cakora (residential properties)	Moderate	Moderate	Moderate	Moderate
Wooli village	Moderate	Moderate	Moderate	Moderate
Sandon village	Moderate	Moderate	Moderate	Moderate
Sandon campground	Low	Low	Low	Low
T25 - Poor flushing of ICOLLs				
Lake Cakora	Moderate	Moderate	Moderate	Moderate
Lake Arragan	Low	Low	Low	Low
T26 - Sea level rise increasing salinity within the estuary				
Lake Cakora	Minimal	Low	Moderate	Moderate
Sandon River	Minimal	Low	Moderate	Moderate
Wooli Wooli River	Minimal	Low	Moderate	Moderate
T27 - Climate warming and extreme temperatures				
Study area	Minimal	Low	Moderate	Moderate
T28 - Increased storminess and changed rainfall patterns				
Study area	Minimal	Low	Moderate	Moderate
T29 - Land/ waterway contamination				
Estuaries (e.g. chemical/fuel spills)	Minimal	Minimal	Minimal	Minimal
Sandon (tarring oyster sticks)	Low	Low	Low	Low
Angourie Blue and Green Pools	Low	Low	Low	Low
T30 - Forestry activities				
Sandon River and Wooli Wooli River catchments	Low	Low	Low	Low
T31 - Shoaling and sediment movement within estuaries				
Clarence River entrance	High	High	High	High
Sandon River	Low	Low	Low	Low
Wooli Wooli River	Moderate	Moderate	Moderate	Moderate
T32 - Erosion and sedimentation affecting navigation				
Clarence River entrance	High	High	High	High

Threats and location	Current risk	20-year risk	50-year risk	100-year risk
Wooli Wooli River	Moderate	Moderate	Moderate	Moderate
T33 - Estuary entrance modifications (MEMS TARA priority threat)				
Clarence River entrance	Low	Low	Low	Low
Wooli Wooli River	Low	Low	Low	Low
T34 - Limited pedestrian access				
Brooms Head (north)	Low	Low	Low	Low
Wooli Beach	Low	Low	Low	Low
All areas	Low	Low	Low	Low
T35 - Informal pedestrian access				
Wooli Beach	Low	Low	Low	Low
All areas	Low	Low	Low	Low
T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users[4]				
Woody Head campground	Low	Low	Low	Low
Angourie	Moderate	Moderate	Moderate	Moderate
Brooms Head	Moderate	Moderate	Moderate	Moderate
Sandon campground	Low	Low	Low	Low
T37 - Bushfire damage to access				
Yuraygir National Park	Low	Low	Low	Low
T38 - Limited boating access				
Wooli Wooli River (upper estuary)	Low	Low	Low	Low
T39 - Poor condition of public facilities (boat ramps etc.)				
Wooli Wooli River	Low	Low	Low	Low
All areas	Low	Low	Low	Low
T40 - Unauthorised access points				
Wooli Wooli River	Low	Low	Low	Low
T41 - Competing uses of the estuary/ coastal zone				
Sandon River	Low	Low	Low	Low
T42 - Unstable/unsafe bar crossing				
Wooli Wooli River	Low	Low	Low	Low
Sandon River	Low	Low	Low	Low
T43 - Damage to beach access points				
Shark Bay	Moderate	High	High	High
Yuraygir National Park beach areas (e.g. Diggers Camp)	Moderate	High	High	High

Threats and location	Current risk	20-year risk	50-year risk	100-year risk
Other beach areas - e.g. Iluka, Yamba, Angourie (Spooky Beach), Minnie Water, Brooms Head, Wooli	Moderate	High	High	High
T44 - Stormwater erosion at beaches/ estuaries				
Minnie Water	Low	Low	Low	Low
T45 - Insufficient access for commercial fishers				
Red Cliff/ Lake Arragan	Low	Low	Low	Low
T46 - Inadequate boat launch facilities				
Brooms Head	Low	Low	Low	Low
T47 - Reduced accessible beach at high tide due to coastal protection works				
Woody Bay	Moderate	Moderate	Moderate	Moderate
Brooms Head	Moderate	Moderate	Moderate	Moderate
T48 - Insufficient emergency services access				
All areas	Low	Low	Low	Low
T49 - Inadequate parking (boat trailers)				
Brooms Head	Low	Low	Low	Low
T50 - Multiple land managers				
Sandon River	Low	Low	Low	Low
T51 - Inadequate action on coastal protection (due to difficulties gaining community consensus, high cost of implementation and stringent approval requirements)				
All areas (not specified)	Low	Low	Low	Low
Woody Bay	Low	Low	Low	Low
Yuraygir National Park	Low	Low	Low	Low
T52 - Inaccurate or incomplete mapping of coastal management areas				
CWLRA	Moderate	High	High	High
CVA	Moderate	High	High	High
CUA and CEA	Minimal	Minimal	Minimal	Moderate
T53 - Inadequate land use planning and development controls				
All areas	Moderate	Moderate	Moderate	Moderate
T54 - Lack of protection/ management of former oyster leases				
Sandon River (Toumbaal Creek)	Low	Low	Low	Low
T55 - Inadequate consultation with Aboriginal land managers				
Study area	Low	Low	Low	Low
T56 - Damage to cultural heritage items/ sites				
Study area	Moderate	Moderate	Moderate	Moderate

Threats and location	Current risk	20-year risk	50-year risk	100-year risk
T57 - Fish cleaning waste				
Minnie Water	Low	Low	Low	Low
T58 - Beached or deceased whales on/ near beaches				
Marine areas	Low	Low	Low	Low
T59 - Shark activity				
All beaches	Low	Low	Low	Low
T60 - Fallen/ dangerous trees on eroded beaches				
Woody Bay	Moderate	Moderate	Moderate	Moderate
T61 - Marine debris and kelp following storm event				
Brooms Head foreshore	Low	Low	Low	Low
T62 – Litter				
All areas (terrestrial)	Moderate	Moderate	Moderate	Moderate
All areas (marine)	Moderate	Moderate	Moderate	Moderate
T63 – Limited accessible access to beaches				
All beaches	Moderate	Moderate	Moderate	Moderate

1. T3 covers the separate coastal hazards of tidal inundation and coastal inundation.
2. Risks at Red Cliff and Lake Arragan were identified by NPWS after the completion of the CMP risk assessment.
3. T12 was modified to include damage to coastal vegetation and habitats based on community feedback.
4. T36 was amended following community feedback.
5. T63 was included at Stage 4.

Threats were prioritised to assist in determining the importance of management action as part of subsequent stages of the CMP. High priority threats are those presenting a moderate or high present-day risk to values and uses of the Clarence Valley open coast. The high priority threats relevant to each coastal management area are listed in Table 8 and discussed further in the following sections for each management zone.

Table 8: Location of high priority threats identified by the risk assessment (CWLRA – Coastal Wetlands Littoral Rainforest Area, CUA – Coastal Use Area and CEA – Coastal Environment Area)

High priority threats	Locations	CWLRA	CUA	CEA
North of Clarence River				
T1 - Beach erosion	Shark Bay, Iluka Road, Woody Head campground, Woody Bay		✓	✓
T2 – Shoreline recession	Shark Bay, Iluka Road, Woody Bay		✓	✓
T9 - Invasive weeds	Bundjalung National Park	✓	✓	✓
T12 – Coastal vegetation damage	Iluka	✓	✓	✓
T17 - 4WD/ motorbikes on beaches	Shark Bay (Bundjalung National Park)		✓	✓
T18 - Predation and invasion by introduced animals	Bundjalung National Park	✓	✓	✓
T22 - Modification of coastal wetland habitat due to coastal hazards	Bundjalung National Park	✓	✓	✓

High priority threats	Locations	CWLRA	CUA	CEA
T43 - Damage to beach access points	Shark Bay, Iluka		✓	✓
T47 - Reduced accessible beach at high tide due to coastal protection works	Woody Head		✓	✓
T60 - Fallen/ dangerous trees on eroded beaches	Woody Bay		✓	✓
Clarence River entrance				
T1 - Beach erosion	Whiting Beach		✓	✓
T2 – Shoreline recession	Whiting Beach		✓	✓
T3 - Tidal/ coastal inundation	Whiting Beach		✓	✓
T22 - Modification of coastal wetland habitat due to coastal hazards	Hickey Island	✓	✓	✓
T31 - Shoaling and sediment movement within estuaries	Clarence River entrance			✓
T32 - Erosion and sedimentation affecting navigation	Clarence River entrance			✓
Yamba/ Angourie				
T1 - Beach erosion	Yamba Main Beach, Convent Beach		✓	✓
T5 - Slope instability/ landslip	Pilot Hill, Convent Beach		✓	✓
T8 - Foreshore development	Yamba - Angourie		✓	✓
T9 - Invasive weeds	Yamba - Angourie	✓	✓	✓
T12 – Coastal vegetation damage	Yamba - Angourie	✓	✓	✓
T17 - 4WD/ motorbikes on beaches	Barri Point		✓	✓
T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users	Angourie		✓	✓
T43 - Damage to beach access points	Yamba, Spooky Beach		✓	✓
Red Cliff				
T5 - Slope instability/ landslip[1]	Lake Arragan, Red Clif		✓	✓

High priority threats	Locations	CWLRA	CUA	CEA
Brooms Head/ Lake Cakora				
T1 - Beach erosion	Lake Cakora (Ocean Road properties), Lake Cakora entrance, Brooms Head reserve	✓	✓	✓
T2 – Shoreline recession	Lake Cakora entrance, Ocean Road properties, Brooms Head reserve	✓	✓	✓
T3 - Tidal/ coastal inundation	Lake Cakora (Ocean Road properties), Brooms Head (village)	✓	✓	✓
T4 - Entrance instability	Lake Cakora		✓	✓
T6 - Erosion of foreshores	Lake Cakora	✓	✓	✓
T9 - Invasive weeds	Brooms Head beach, Yuraygir National Park	✓	✓	✓
T12 – Coastal vegetation damage	Brooms Head	✓	✓	✓
T16 - Uncontrolled dog access	Brooms Head beach		✓	✓
T17 - 4WD/ motorbikes on beaches	Brooms Head beach		✓	✓
T22 - Modification of coastal wetland habitat due to coastal hazards	Brooms Head north, Lake Cakora	✓	✓	✓
T25 - Poor flushing of ICOLLs	Lake Cakora	✓		✓
T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users	Brooms Head		✓	✓
T43 - Damage to beach access points	Brooms Head		✓	✓
T47 - Reduced accessible beach at high tide due to coastal protection works	Brooms Head		✓	✓

High priority threats	Locations	CWLRA	CUA	CEA
Sandon area				
T1 - Beach erosion	Sandon campground, Sandon village		✓	✓
T2 – Shoreline recession	Sandon campground, Sandon village		✓	✓
T3 - Tidal/ coastal inundation	Sandon campground and access road, Sandon village	✓	✓	✓
T9 - Invasive weeds	Yuraygir National Park	✓	✓	✓
T11 - Seagrass decline	Sandon River (particularly Toumbaal Creek)	✓		✓
T17 - 4WD/ motorbikes on beaches	Sandon Beach (Yuraygir National Park)		✓	✓
T18 - Predation and invasion by introduced animals	Yuraygir National Park	✓	✓	✓
T22 - Modification of coastal wetland habitat due to coastal hazards	Yuraygir National Park and surrounds	✓	✓	✓
Wooli/ Diggers Camp/ Minnie Water				
T1 - Beach erosion	Diggers Camp, Wooli village (south)		✓	✓
T2 – Shoreline recession	Wooli village		✓	✓
T3 - Tidal/ coastal inundation	Wooli village (north), Wooli village (south)	✓	✓	✓
T6 - Erosion of foreshores	Wooli Wooli River	✓	✓	✓
T7 - Historic clearing of riparian vegetation and adjacent habitat	Wooli Wooli River	✓	✓	✓
T9 - Invasive weeds	Wooli Wooli River, Wooli Beach, Yuraygir National Park	✓	✓	✓
T11 - Seagrass decline	Wooli Wooli River	✓		✓
T12 – Coastal vegetation damage	Diggers Camp, Wooli	✓	✓	✓
T17 - 4WD/ motorbikes on beaches	Wooli Beach		✓	✓
T18 - Predation and invasion by introduced animals	Yuraygir National Park	✓	✓	✓
T22 - Modification of coastal wetland habitat due to coastal hazards	Minnie Water Beach, Wooli Wooli River, Yuraygir National Park	✓	✓	✓
T31 - Shoaling and sediment movement within estuaries	Wooli Wooli River			✓
T32 - Erosion and sedimentation affecting navigation	Wooli Wooli River			✓
T43 - Damage to beach access points	Wooli, Diggers Camp, Minnie Water		✓	✓

High priority threats	Locations	CWLRA	CUA	CEA
All areas				
T52 - Inaccurate or incomplete mapping of coastal management areas	CVA, CWLRA	✓		
T53 - Inadequate land use planning and development controls	All areas	✓	✓	✓
T54 - Damage to cultural heritage items/ sites	All areas	✓	✓	✓
T62 - Litter	All areas	✓	✓	✓

1. Risks at Red Cliff and Lake Arragan were identified by NPWS after the completion of the CMP risk assessment.

6. COASTAL MANAGEMENT ACTIONS

6.1 Development of Coastal Management Strategies and Actions

Stage 3 of the CMP process involved identifying coastal management options required to address the coastal management issues, reduce exposure to coastal hazards, and to take advantage of opportunities in an integrated and strategic manner.

Stage 3 of the CMP involved the following tasks:

1. Review of potential strategic approaches.
2. Identification of potential management options that support the CMP objectives across the study area.
3. Identification of potential management options for each management zone (local options).
4. Multi-criteria assessment to identify recommended options. The assessment of options for each management zone considered the local coastal processes and hazards, values of each area and the extent of public and private development. The multi-criteria assessment considered a range of cost and non-cost criteria to determine if an option is acceptable, likely to be acceptable (but further assessment is required), or not acceptable. Options that are not acceptable were not considered further.
5. Identification of priorities for CMP implementation based on the threat and risk assessment undertaken in Stage 2, CVC priorities and potential funding opportunities.

The broad strategic approaches for managing risk in coastal vulnerability areas shown on Figure 23 provide a range of appropriate approaches to address the key threats in the study area. The applicability of each approach differs for the parts of the study area that are already developed and the long stretches of coast that are reserved as national park. The appropriate responses also depend on the threats and risks identified for each area. For example, responses to beach erosion include restoration of the beach following an erosion event such as dune rehabilitation and dune rebuilding to maintain natural defences and facilitate natural recovery. Erosion responses may also include coastal protection works. Recession responses address the slower long-term sediment deficit and may also include beach nourishment and structural coastal protection works. Management of tidal inundation involves adaptation to sea level rise while coastal inundation (temporary storm surge) requires the management of localised flooding, storm surge and wave overtopping, potentially through protection works or emergency response measures. Land use planning and development controls can be used to increase the effectiveness of other approaches.

Figure 23: Strategic risk management approaches to address coastal hazards

Source: OEH (2019)

The options identification, assessment and prioritisation methodology is detailed in the Stage 3 report (Hydrosphere Consulting, 2024a) and summarised in Figure 24.

Following public exhibition of the Stage 3 report (Section 3.3), feedback from community, first nations and agency stakeholders was considered in the selection of management actions for inclusion in the CMP.

It is recognised that coastal processes will impact on the natural landscape over time and that intervention may not be able to stop 'nature taking its course'. However, there is uncertainty with the extent and timing of coastal hazards. This uncertainty and the need to be adaptive to changing circumstances was acknowledged in the selection of management actions. In some areas, where the present risk does not warrant a particular approach, or there is not enough certainty to adopt a particular approach, approaches can be combined, or the emphasis may change from one to another over time as circumstances change. The environmental and social context and accepted best practice may also change over time. To achieve the best outcomes for the study area, a combination of approaches will be implemented over time as circumstances change and thresholds are reached. Triggers (incidents or occurrences that initiates other events) and thresholds (a point when irreversible change is likely to occur, risks become unacceptable, or the current management response is no longer effective) will be developed to allow appropriate adaptation pathways. These may be linked to a specific magnitude or frequency of hazards and damages, the condition of environmental or built assets or the effectiveness of other mitigation or emergency response measures.

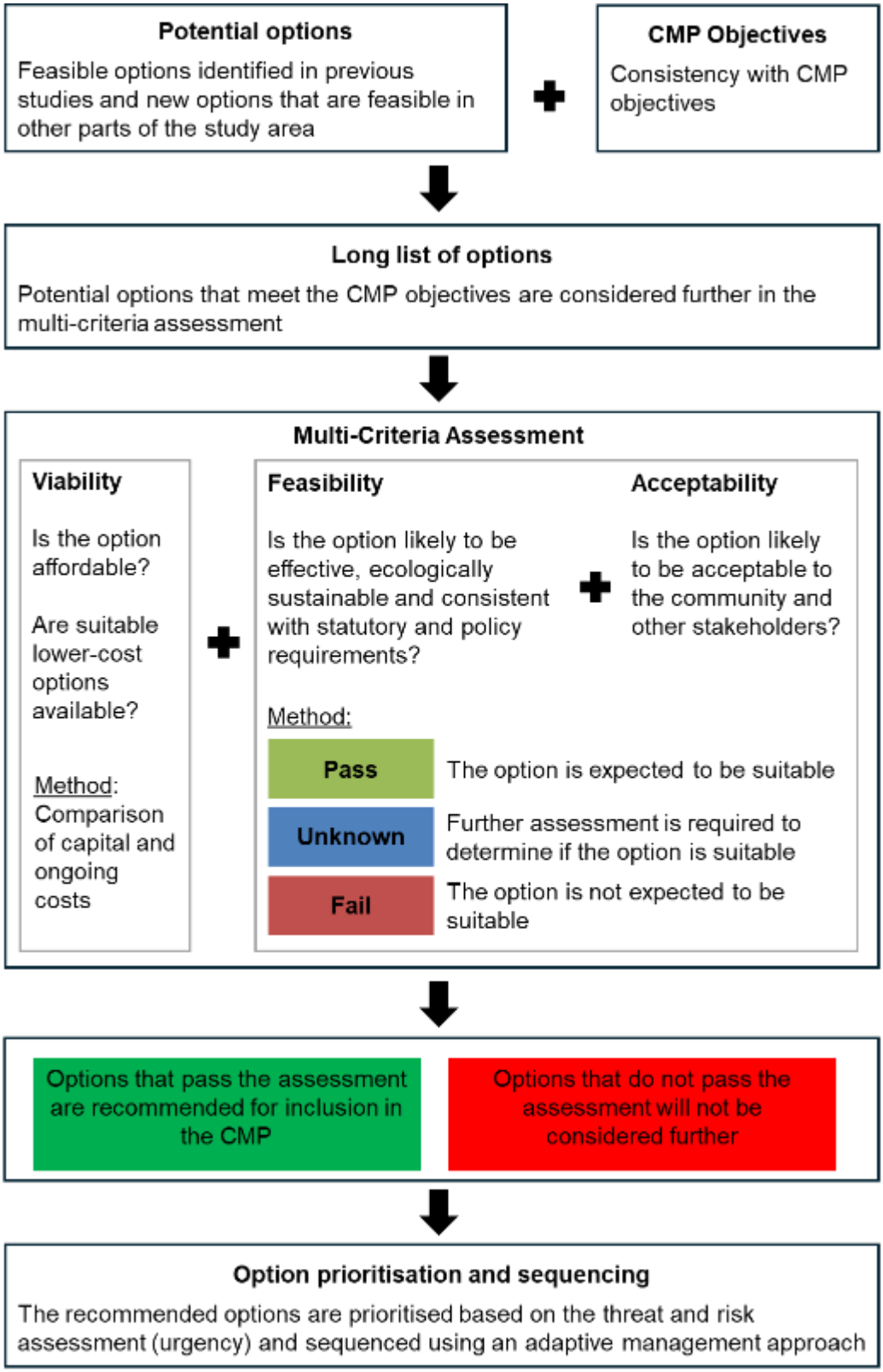

Figure 24: Stage 3 options assessment methodology

6.2 CMP Actions

Based on the Stage 3 recommendations and stakeholder feedback, management strategies and CMP actions have been developed for a ten-year period as required by the NSW coastal management framework. The CMP has also considered risks to the 100-year planning period and therefore strategies have been developed to address longer term threats and facilitate longer term strategic planning.

The management strategy and CMP actions for each management zone consist of a combination of studies, investigations and on-ground works. Some actions require additional investigation prior to implementation of on-ground works. This is to ensure the appropriate effort, funding and geographical focus of on-ground works is undertaken. An adaptive management approach has been developed for each management zone including identification of potential triggers and thresholds.

The CMP actions have been described in terms of:

- Action identifier and name.
- Priority – initial prioritisation of actions has considered the threat and risk assessment undertaken in Stage 2. Some actions that are required across multiple areas (e.g. coastal hazard monitoring and coastal habitat restoration) have been further prioritised based on the risk and opportunities at each location. As the CMP actions address the threats with a moderate or high risk in the current timeframe, the CMP actions are either a high or medium priority.
- Timeframe (short-term: year 1 - 3, medium-term: year 4 – 7, long-term: year 8 – 10 or ongoing), according to the importance and urgency for implementation identified during Stage 3 and confirmed during stakeholder consultation as well as the logical sequence of related actions.
- Threats addressed (Section 5.5).
- Relevant coastal management areas (Coastal Use Area - CUA, Coastal Environment Area - CEA and Coastal Wetlands and Littoral Rainforest Area – CWLRA, Section 2.2).
- Distribution of costs and benefits (B/C distribution).
- Action description.
- Tasks to achieve the action including:
    - Lead agency responsible for delivery of the task.
    - Support agencies which may be required and/or requested to assist in implementation of the action, either through in-kind contributions or as a potential funding or information source.
    - Ten-year cost estimate ($2025). Where actions are being implemented through an ongoing concurrent program or would be resources through CVC's existing obligations, additional expenditure has not been included.
    - Potential funding sources:
        - CVC general income from ordinary rates and fees/ charges (CVC).
        - NSW Government's Coastal and Estuary Grants Program (CEGP) administered by DCCEEW.
        - The Disaster Ready Fund (DRF) administered by the Australian Government.
        - Community Building Partnership (CBP) program administered by the NSW Department of Communities and Justice.

  - Department of Regional NSW Riparian Stabilisation Package (including the NSW Estuarine Asset Protection Program – NEAPP) administered by DPIRD-Fisheries.
  - Crown Reserves Improvement Fund (CRIF) administered by DPHI-Crown Lands.
  - NSW Environment Trust (ET) grants.
  - Indigenous Advancement Strategy (IAS) administered by the National Indigenous Australians Agency.
  - Litter prevention grants (EPA).
  - Recreational Fishing Trust (RFT) administered by DPIRD-Fisheries.
  - Saving our Species (SOS) program administered by DCCEEW.
  - Landcare grants.
  - In-kind resources or partnerships with local community groups (e.g. Landcare/ Dunecare).
- Performance targets to be monitored as part of the Monitoring, Evaluation and Reporting Program (Section 18).

The CMP actions are detailed in the following sections.

ACTIONS TO BE IMPLEMENTED BY CLARENCE VALLEY COUNCIL

7. SUPPORTING ACTIONS

Some actions are relevant to the whole study area, are fundamental to the successful implementation of a CMP, and support the management approach across the study area or are not specific to a particular location. Strategies that support the CMP implementation in the local management zones are listed in Table 9, discussed in the following sections and included on the figures showing the CMP actions for relevant management zones.

Table 9: CMP supporting actions

Strategies/ actions	Tasks	Threats addressed	CMP section
Strategy CH1 – Cultural Heritage Management			
Action CH1-1: Protection of cultural heritage	CH1-1a: Establish a working group with traditional owners CH1-1b: Assess impacts of coastal hazards on cultural heritage values CH1-1c: Develop opportunities to enhance cultural heritage values CH1-1d: Support the development of opportunities for education, employment, and training for Yaegl people CH1-1e: Review and update controls to protect cultural heritage	T56 – Damage to cultural heritage items/ sites	7.1
Strategy PD1 - Planning and Development Controls			
Action PD1-1: Review and implement planning controls to address coastal hazards	PD1-1a: Review and evaluate potential approaches to address coastal hazard risks in planning and development controls PD1-1b: Implement preferred approach to planning controls PD1-1c: Educational materials	All	7.2

Strategies/ actions	Tasks	Threats addressed	CMP section
Strategy FM1 - Foreshore Management			
Action FM1-1: Kelp management	FM1-1a: Develop a policy and procedure for management of kelp on beaches	T61 - Marine debris and kelp following storm event	7.3
Action FM1-2: Manage vehicular beach access	FM1-2a: Review vehicular beach access policy	T17 – 4WD/ motorbikes on beaches	
Action FM1-3: Dog management	FM1-3a: Incorporate management of dogs into Animal Management Strategy	T16 - Uncontrolled dog access	
Action FM1-4: Reduce litter and marine debris	FM1-4a: Promote/ implement initiatives to reduce illegal dumping and littering	T61 - Marine debris and kelp following storm event, T62 - Litter	
Action FM1-5: Accessible beach access	FM1-5a: Implement outcomes of accessible beach audit	T63 – Limited accessible access to beaches	
Strategy AM1 - Asset Management			
Action AM1-1: Incorporate coastal hazard risks in CVC asset management planning	AM1-1a: Incorporate coastal hazard risks into CVC asset management strategies and plans	T1 – Beach erosion, T2 – Shoreline recession, T3 - Tidal/ coastal Inundation, T5 - Slope instability/ landslip, T6 - Erosion of foreshores	7.4
Action AM1-2: Provide coastal hazard information to non-Council asset managers	AM1-2a: Provide coastal hazard information to non-Council asset managers to enable them to incorporate coastal hazard risks in asset management strategies	T1 – Beach erosion, T2 – Shoreline recession, T3 - Tidal/ coastal Inundation, T5 - Slope instability/ landslip, T6 - Erosion of foreshores	

Strategies/ actions	Tasks	Threats addressed	CMP section
Strategy LA1 - Licensing and Approvals			
Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions	LA1-1a: Review reserve boundaries for Council-managed Crown reserve areas that are affected by coastal hazards LA1-1b: Consult Yaegl TOAC on actions in the CMP that affect land where Native Title rights and interests have been recognised by the Federal Court LA1-1c: Develop mechanisms to facilitate landowner approvals for CMP actions	All	7.5
Strategy FS1 – Funding			
Action FS1-1: Develop a CMP funding strategy	FS1-1a: Develop strategy to ensure funding sources FS1-1b: Implement CMP funding strategy	All	7.6
Strategy EM1 - Emergency Management			
Action EM1-1: Implement emergency response procedures	EM1-1a: Implement CZEAS EM1-1b: Reassess CZEAS	T1 - Beach erosion, T3 – Coastal inundation, T5 - Slope instability/ landslip	7.7

7.1 Strategy CH1 – Cultural Heritage Management

Involvement of traditional owners in coastal management facilitates the appropriate consideration of traditional knowledge. Consultation with Yaegl traditional owners during the development of the CMP has identified potential opportunities to be further investigated and developed.

Action CH1-1: Protection of cultural heritage

Priority	High	**Timeframe**	Short-medium term	**Stage 3 option**	SA15, SA16, SA24
Threats addressed	T56 – Damage to cultural heritage items/ sites				
Coastal mgt areas	CUA, CEA			**B/C distribution**	100% public

A key component of the CMP involves community education and building awareness about cultural significance and values of the study area, coastal processes, hazards and risks to public safety and the implications of threats and hazards for the amenity, wellbeing and prosperity derived from the coastal environment. Yaegl traditional owners will continue to be engaged in the governance and management of land and sea Country along the Clarence Valley coastline within Yaegl native title lands. Traditional owners will be included and involved in directing and prioritising implementation of CMP actions and working with CVC and other agencies to secure funding, as well as involvement in the implementation of on-ground works.

CVC will continue to collaborate with Yaegl people to gain an understanding of the cultural and heritage significance of the coastline, share cultural knowledge and identify culturally appropriate ways to acknowledge and protect the indigenous cultural heritage of the Clarence Valley coastline. This will build on the consultation undertaken during the CMP development and provide traditional owners a voice in CMP implementation. It will promote the cultural significance of the coastline and enable First Nations people to care for their land and sea Country. A key aim will be to facilitate education, employment, and training for Yaegl people as well as cultural heritage education and truth-telling.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
CH1-1a: Establish a working group with traditional owners	CVC	Yaegl TOAC	-	CVC
A working group (Yaegl TOAC, CVC's Senior Coast and Estuary Officer and other relevant CVC staff) will be established including development of principles for working together and a meeting schedule. The working group will provide input into *Task CH1-1b*, *Task CH1-1c, Task CH1-1d, Task CH1-1e, Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions* and on-ground CMP actions on Yaegl native title lands.				
Performance target	Working group established by December 2025 and active throughout CMP implementation.			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
CH1-1b: Assess impacts of coastal hazards on cultural heritage values	CVC	DCCEEW, Yaegl TOAC	$50,000	CEGP, IAS, ET, CVC
The impacts of coastal hazards on cultural heritage assets/ sites and values will be assessed in consultation with traditional owners. A suitable methodology will be developed through the Yaegl working group (*Task CH1-1a*) including on-country assessments, documentation of impacts of coastal hazards on identified values and identification of potential management measures. Yaegl knowledge holders and cultural heritage site officers will be engaged to assess sites affected by current hazards and potential future hazards and provide input into the assessment.				
Performance target	Assessment of impacts of coastal hazards on cultural heritage values completed by June 2027.			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
CH1-1c: Develop opportunities to enhance cultural heritage values	CVC	DCCEEW, NPWS, DPHI-Crown Lands, Yaegl TOAC	$150,000	CEGP, IAS, ET, CVC
On-ground actions that enhance cultural heritage values within the CMP study area will be developed in consultation with the Yaegl working group (*Task CH1-1a*). Potential actions include: • Management measures identified through the assessment of impacts of coastal hazards on cultural heritage values (*Task CH1-1b*). • Establishment of storage areas for cultural heritage artefacts. • Enhancement/ restoration of cultural sites such as fish traps at Woody Head (in consultation with NPWS) and Brooms Head (in consultation with DPHI-Crown Lands). • Revised/ additional signage to encourage wider community understanding of culture, native title and traditional lore. • Formalised access arrangements to minimise impacts on cultural sites. • Coastal habitat restoration. Priority actions will be identified and developed including approvals and funding opportunities. Priority actions will be implemented as funding permits.				
Performance target	High priority actions to enhance cultural heritage values are implemented by June 2029 as funding is obtained.			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
CH1-1d: Support the development of opportunities for education, employment, and training for Yaegl people	CVC	DCCEEW, NPWS, Yaegl TOAC	-	CEGP, IAS
CVC will support education, employment, and training opportunities to be developed by Yaegl traditional owners addressing native title rights and responsibilities within the CMP study area including: • Indigenous Ranger groups under the National Indigenous Australians Agency's National Indigenous Rangers Program or other programs. • Yaegl involvement in coastal management actions including assessments, monitoring, revegetation, and restoration activities as identified in *Task CH1-1b* and *Task CH1-1c*.				
Performance target	Positive feedback provided by traditional owners.			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
CH1-1e: Review and update controls to protect cultural heritage	CVC	DCCEEW, Yaegl TOAC	$30,000	CEGP, ET, CVC
CVC will develop mechanisms to enhance the protection of cultural heritage in land use planning and development assessment and controls and CVC works/ operations to prevent conflicts between cultural values and future activities and development. Appropriate provisions will be developed with reference to: • The Aboriginal Heritage Information Management System (AHIMS). • The NSW Government's Aboriginal sites decision support tool which extends the AHIMS by illustrating the potential distribution of site features recorded in AHIMS. • The Yaegl cultural mapping project developed by Yaegl TOAC and CVC. Local planning controls (CVC LEP and DCP) will be reviewed and updated to incorporate the agreed approach. Internal CVC mapping and procedures for identification and management of cultural heritage in strategic planning and infrastructure civil works projects will also be updated including identification of when and how the appropriate traditional owners would be consulted/ engaged. A training program for Yaegl site officers, CVC staff and other appropriate agencies will also be developed.				
Performance target	Revised controls to protect cultural heritage in place by June 2027.			

7.2 Strategy PD1 - Planning and Development Controls

There is a need for inclusion of current natural hazard information into CVC's planning framework through the appropriate, transparent processes offered through the NSW coastal management framework or local planning provisions to ensure the community is informed about natural hazards and risk to property, and to minimise CVC's risk of litigation from future planning, development decisions and coastal management actions. A coordinated and consistent approach to strategic planning and an appropriate level of protection of environmental, cultural, public and private residential and commercial assets in the coastal zone is required to ensure adequate planning for and protection from coastal hazards, future development pressures and emerging threats associated with a changing climate.

Action PD1-1: Review and implement planning controls to address coastal hazards

Priority	High	**Timeframe**	Short-term	**Stage 3 option**	SA21, SA22
Threats addressed	All				
Coastal mgt areas	CUA, CEA			**B/C distribution**	100% public
Specific development controls are required to address building, additions and alterations which may increase the value of assets at risk and extend the life of assets at risk in the coastal zone. CVC will review and update land use planning and development controls based on the coastal hazards identified through CMP development. This would be facilitated by changes which may cover inclusion of a coastal vulnerability area (CVA) in the Resilience and Hazards SEPP, modification of other SEPP mapping or LEP and DCP modifications. As part of the implementation of the preferred approach, information on the implications of coastal hazards on land use and future development will be provided to the community.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
PD1-1a: Review and evaluate potential approaches to address coastal hazard risks in planning and development controls	CVC	DPHI-Planning, DCCEEW	$50,000	CEGP, CVC, DRF

CVC will review and evaluate potential LGA-wide planning control approaches to address coastal hazard risks considering available local or state-based mechanisms, the coastal hazards to be included and integration with the Clarence River Estuary CMP. Potential considerations are:

- Suitable mapping exists to prepare a planning proposal addressing the coastal erosion and shoreline recession for the Open Coast CMP study area. This mapping represents the hazards assuming an undefended shoreline. Further consideration may be required to address areas which are protected to some degree by coastal protection works. This could be pursued as part of the Open Coast CMP or deferred until suitable mapping is available for other hazards.
- The hazard mapping for tidal and coastal inundation currently covers the Open Coast CMP area only but would extend into the Clarence River estuary. Planning controls for the lower Clarence River estuary will be deferred until the development of the Clarence River Estuary CMP.
- There is no existing mapping of erosion of foreshores (estuarine bank erosion) suitable for inclusion in planning controls. Planning controls would be considered as part of the Clarence River Estuary CMP but may incorporate the smaller estuaries of the Open Coast CMP study area if detailed information is available (e.g. as part of *Action F2-1: Wooli Wooli riverbank and riparian condition assessment*).
- There is no existing mapping of slope stability suitable for planning controls. Additional geotechnical assessments will be undertaken for Pilot Hill, Convent Beach and Cakora Point before the hazard extents can be developed as part of *Action Y2-2: Additional geotechnical investigations and review of slope stability at Pilot Hill, Action CB1-1: Additional geotechnical investigations and review of slope stability at Convent Beach* and *Action BH3-1: Additional geotechnical investigations and review of slope stability at Cakora Point*). Planning controls addressing slope stability may also be applicable in other areas of the LGA where similar risks exist but have not yet been investigated. Potential approaches are provided in FSG Geotechnics and Foundations (2022).
- Mapping to address the inundation of foreshores under tides, waves and catchment flood waters is undertaken through CVC's flood risk planning.

Evaluation of options will consider the cost and resources required to implement the planning controls, the effectiveness of the controls in mitigating coastal hazards, risks to CVC and any socio-economic implications. A preferred option will be identified for implementation.

Performance target	Preferred approach to address coastal hazard risks in planning and development controls identified by December 2025.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
PD1-1b: Implement preferred approach to planning controls	CVC	DPHI-Planning, DCCEEW	$50,000	CEGP, CVC, DRF
The preferred approach to planning controls will be implemented including documentation and consultation requirements.				
Performance target	Preferred approach to planning controls implemented by June 2027			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
PD1-1c: Coastal hazard webpage	CVC	DCCEEW, DPHI-Crown Lands	$5,000	CVC, CEGP
CVC will provide access to educational materials for private landholders, lessees of public land, land managers and developers regarding the implications of coastal hazards on land use and future development and appropriate emergency responses. A dedicated coastal hazard webpage will be set up including fact sheets, information updates, assistance with application of planning controls (based on the preferred approach identified in *Task PD1-1b*) as well as links to information from NSW Government agencies and outcomes of coastal hazard monitoring for each management zone and the Monitoring, Evaluation and Reporting Program.				
Performance target	Coastal hazard webpage published by June 2027 and regularly updated.			

7.3 Strategy FM1 - Foreshore Management

Interaction with the coast and estuaries is a highly valued part of life in the Clarence Valley LGA. The beaches and waterways within the study area provide a place for social interaction, recreation, relaxation, nature appreciation, connection, exercise and commercial activities as well as residential and tourist accommodation. However, conflicts between waterway uses and values can impact the amenity of the area, and these conflicts are exacerbated by coastal hazards and the popularity of the area.

Action FM1-1: Kelp management

Priority	Medium	**Timeframe**	Medium-term	**Stage 3 option**	SA9
Threats addressed	T61 - Marine debris and kelp following storm event				
Coastal mgt areas	CUA, CEA	**B/C distribution**	100% public		

Varying amounts of beach-cast kelp/ seaweed accumulate sporadically across various beaches along the Clarence Valley coastline. This is a natural process which plays an important role in a beach ecosystem. Beach-cast seaweed provides food and habitat for a wide range of fauna species and assists in the cycling of nutrients on beaches. The deposition of large amounts of seaweed can also play a role in stabilising beaches by promoting the accretion of sand. Kelp is expected to be removed through natural processes including decomposition, transport offshore by waves/ currents or covering in sand (without intervention). Where possible, CVC's preferred approach is to undertake no intervention in the natural process of seaweed accumulation on beaches. Seaweed will usually be retained within the coastal ecological system, however, the removal of marine and other vegetation washed onto popular beaches may be required to protect public health and safety.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
FM1-1a: Develop a policy and procedure for management of kelp on beaches	CVC	DPIRD-Fisheries, DPIRD-Marine Parks	-	CVC

CVC will develop a policy and procedure to provide a clear and consistent approach to the management of seaweed/ kelp on Council-managed coastal reserves. This will include:

- The identification of priority locations for intervention (e.g. Brooms Head, Yamba Main Beach).
- Social, environmental, economic and governance factors.
- The identification of potential triggers for intervention (e.g. based on expected tidal and wave action, public health and safety risks, volume of seaweed accumulated, impact on public amenity, impacts on commercial or tourism activities, season, expected visitation).
- Development of location-based risk assessment procedures, action plans, disposal locations and work methods.
- Identification of statutory requirements (under the *Marine Estate Management Act 2014*, *National Parks and Wildlife Act 1974* and the *Fisheries Management Act 1994* and associated regulations) and adopted Plans of Management.
- A procedure for consideration of commercial kelp collection applications.
- Identification of approval mechanisms.
- Consultation with agencies, traditional owners and the community.
- A communication strategy to ensure the community remains informed.

Performance target	Policy and procedure for management of kelp on beaches developed by June 2031

Action FM1-2: Manage vehicular beach access

Priority	Medium	**Timeframe**	Ongoing	**Stage 3 option**	SA10
Threats addressed	T17 – 4WD/ motorbikes on beaches				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	

Four-wheel driving is a popular activity on the Shark Bay/ Iluka, Brooms Head, Sandon, Minnie Water and Wooli coasts, however this creates user conflict and environmental impacts identified by community members. CVC regulates the use of vehicles on Council-managed reserves and a permit system applies. NPWS regulates the use of vehicles on national parks estate (refer *Action NP2-1: Incorporate coastal hazard risks into Reserve Plans of Management*). Vehicles are permitted on some beaches and some conditions apply. Ongoing policy review will be undertaken incorporating coastal hazards, impacts on habitat values and feedback from the community and beach users.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
FM1-2a: Review vehicular beach access policy	CVC	DCCEEW, NPWS, DPIRD-Fisheries, DPIRD-Marine Parks	$15,000	CVC

The CVC policy addressing the use of vehicles on beaches and reserves will be reviewed in consultation with the community and other relevant land managers including:

- The demand for vehicular access.
- The effectiveness of restrictions, enforcement and permit systems in regulating vehicular beach use.
- The effectiveness of signage and education tools.
- Impacts on coastal habitats.
- Public safety risks.
- Potential for increased 4WD beach access on Clarence Valley beaches due to 4WD beach access closures in other locations on the North Coast.
- Community and traditional owner feedback.

Based on the review, the policy will be updated and recommended modifications (e.g. signage) will be implemented.

Performance target	Review of CVC vehicular beach access policy every four years to ensure threats are being addressed

Action FM1-3: Dog management

Priority	Medium	**Timeframe**	Ongoing	**Stage 3 option**	SA11
Threats addressed	T16 - Uncontrolled dog access				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	

Uncontrolled dogs on beaches are a key concern raised by some community members. In most Clarence Valley parks and reserves, 'on leash' dog exercise is permitted. Dogs are not permitted to be walked 'off leash' unless they are within one of CVC's designated dog exercise areas. In some areas, CVC may prohibit all dogs. These are usually areas of significant fauna habitat (e.g. key management sites for threatened species such as shorebird nesting areas, koala and coastal emu habitat) or where a conflict exists between other recreational uses (e.g. beach use, surf lifesaving patrols or bird watching). Signs are installed at strategic locations describing the permitted usage of the area.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
FM1-3a: Incorporate management of dogs into Animal Management Strategy	CVC	DCCEEW	$15,000	CVC

CVC's Animal Management Strategy will incorporate the management of dogs on beaches and foreshore areas including on and off leash areas. The strategy will be developed in consultation with the community considering:

- The effectiveness of enforcement mechanisms in regulating dog access.
- The effectiveness of signage and education tools.
- Impacts on coastal habitats.
- Impacts on public amenity.
- Public safety risks.
- Community and traditional owner feedback.

Any recommended actions (e.g. signage) will be implemented.

Performance target	Review of CVC policy regarding dogs on beaches every four years to ensure threats are being addressed

Action FM1-4: Reduce litter and marine debris

Priority	Medium	**Timeframe**	Ongoing	**Stage 3 option**	SA8
Threats addressed	T61 - Marine debris and kelp following storm event, T62 - Litter				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	

Litter and marine debris were a common concern raised by respondents to the Stage 1 community survey although there is limited data on the scale and extent of litter within the study area. CVC will promote/ implement initiatives to reduce illegal dumping and littering.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
FM1-4a: Promote/ implement initiatives to reduce illegal dumping and littering	CVC	DCCEEW, EPA	$10,000	EPA, CVC
CVC will promote/ implement initiatives to reduce illegal dumping and littering (e.g. the "Don't be a Tosser!" campaign, Clean Up events, OzFish Fish For Life – Keep it Clean campaign, Tackle Loop and Tangle Bins) and assist community groups and other key stakeholders to deliver litter prevention projects and develop strategic plans to address litter through the NSW Government's Waste and Sustainable Materials Strategy 2041 (WASM) Litter Prevention Grants Program and the EPA Local Litter Check (https://www.epa.nsw.gov.au/your-environment/litter/resources/local-litter-check).				
Performance target	Waste management initiatives are supported by CVC.			

Action FM1-5: Accessible beach access

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	-
Threats addressed	T63 – Limited accessible access to beaches				
Coastal mgt areas	CUA, CEA	**B/C distribution**	100% public		

Improved beach access in the Clarence Valley was a consistent theme in community consultation to develop CVC's Disability Inclusion Action Plan 23-26 (DIAP, CVC, 2023b). The DIAP includes an objective to increase access to CVC's recreation services and facilities with an action to plan and deliver accessible beach access at Clarence Valley beaches. This will include accessible pathways to the viewing platform at Pippi Beach and accessibility improvements at Turners Beach, Yamba Main Beach and Minnie Water beach.

CVC has engaged Accessible Beaches Australia to undertake an audit of Turners Beach, Yamba Main Beach and Minnie Water beach accessibility to assess the opportunities to make them accessible to people with disability and mobility challenges. The audit report will outline:

- An assessment of all existing accessible features including parking and locations, pathways and access points, bathrooms, availability of shade and fresh water, ramps, signage, potential locations for beach matting, availability of food in the surrounding area and accessibility by public transport.
- Identified gaps that create a barrier to access.
- Actions required to address the identified gaps.
- Suggestions for further improvements to accessibility.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
FM1-5a: Implement outcomes of accessible beaches audit	CVC	DCCEEW	$50,000	CVC, CEGP
CVC will implement the outcomes of the accessible beaches audit to improve accessibility at Turners Beach, Yamba Main Beach and Minnie Water beach.				
Performance target	Accessible beach access is planned and delivered by June 2029.			

7.4 Strategy AM1 - Asset Management

The CMP Stage 2 report included an assessment of risks to CVC infrastructure and Council-managed land (Hydrosphere Consulting, 2023a) due to coastal hazards. This assessment identified assets that are vulnerable to inundation, recession/ erosion and potentially the combined hazards ranging from flooding, saltwater intrusion, undermining and collapse. While this assessment considered the location of the hazard within the hazard zone, the resulting impacts on the operation of the assets will depend on the type of asset, condition, height, construction and extent of protection available. The coastal hazard information will be incorporated into CVC's asset management plans.

Action AM1-1: Incorporate coastal hazard risks in CVC asset management planning

Priority	High	**Timeframe**	Short-term	**Stage 3 option**	SA26
Threats addressed	T1 – Beach erosion, T2 – Shoreline recession, T3 - Tidal/ coastal Inundation, T5 - Slope instability/ landslip, T6 - Erosion of foreshores				
Coastal mgt areas	CUA, CEA	**B/C distribution**	100% public		
Coastal hazards will be considered as part of future CVC asset and infrastructure management practices.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
AM1-1a: Incorporate coastal hazard risks into CVC asset management strategies and plans	CVC	DCCEEW	$90,000	CVC, CEGP

Existing asset management plans (AMPs) covering water supply, sewerage, transport, buildings, floodplain, waste, holiday parks and open space infrastructure will be updated to address vulnerability of assets to coastal hazards (guided by the Stage 2 CMP risk assessment) and identify suitable asset management approaches. This may include asset modifications, changes to maintenance regimes and routine monitoring of future condition of assets particularly following coastal hazard events. The condition of assets and infrastructure within the coastal zone will be assessed using the outcomes of coastal hazard monitoring to be undertaken for each management zone. The outcomes of other related CMP actions will be considered in the ongoing review of AMPs e.g.:

- *Action Y2-2: Additional geotechnical investigations and review of slope stability at Pilot Hill*
- *Action CB1-1: Additional geotechnical investigations and review of slope stability at Convent Beach*
- *Action BH3-1: Additional geotechnical investigations and review of slope stability at Cakora Point*
- *Action F2-1: Wooli Wooli riverbank and riparian condition assessment*
- Emergency management activities undertaken as part of the CZEAS (*Action EM1-1: Implement emergency response procedures*).

All planned asset replacements/ upgrades will factor in future coastal hazards and risks as part of resilient design, re-positioning and the future maintenance, upgrade and replacement regime to ensure the design and location of structures and future works considers coastal hazards and potential climate change impacts to reduce potential risks to vulnerable constructed assets.

Asset management requirements will also consider and feed into the development of coastal hazard adaptation strategies including:

- *Action IL1-2: Develop Iluka adaptive management strategy*
- *Action HW2-2: Develop Hickey Island adaptive management strategy*
- *Action BH1-5: Develop a preferred strategy for the management of public infrastructure and private land fronting Ocean Road, Brooms Head*
- *Action BH2-2: Develop Brooms Head adaptive management strategy*
- *Action S2-2: Develop Sandon village adaptive management strategy*
- *Action W2-2: Alternative sand sources (Wooli)*
- *Action W2-3: Develop Wooli adaptive management strategy*

Performance target	Coastal hazards are incorporated into the next review of asset management strategies and plans

Action AM1-2: Provide coastal hazard information to non-Council asset managers

Priority	Medium	**Timeframe**	Ongoing	**Stage 3 option**	SA27
Threats addressed	T1 – Beach erosion, T2 – Shoreline recession, T3 - Tidal/ coastal Inundation, T5 - Slope instability/ landslip, T6 - Erosion of foreshores				
Coastal mgt areas	CUA, CEA	**B/C distribution**	100% public		
Other managers of public assets and land within the CMP study area include DPHI–Crown Lands (Crown land), TfNSW-Maritime (marine infrastructure), NPWS (NPWS estate) and various power and telecommunications providers. Risks to assets owned by other public authorities have not yet been assessed.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
AM1-2a: Provide coastal hazard information to non-Council asset managers to enable them to incorporate coastal hazard risks in asset management strategies	CVC	DCCEEW	-	CVC
CVC will provide information to non-Council asset managers including coastal hazard assessments and the outcomes of coastal hazard monitoring undertaken for each management zone. Asset management requirements developed by other public authorities will be considered in the development of coastal hazard adaptation strategies: • *Action IL1-2: Develop Iluka adaptive management strategy* • *Action HW2-2: Develop Hickey Island adaptive management strategy* • *Action BH1-5: Develop a preferred strategy for the management of public infrastructure and private land fronting Ocean Road, Brooms Head* • *Action BH2-2: Develop Brooms Head adaptive management strategy* • *Action S2-2: Develop Sandon village adaptive management strategy* • *Action W2-2: Alternative sand sources (Wooli)* • *Action W2-3: Develop Wooli adaptive management strategy*				
Performance target	Coastal hazard information is shared with non-Council asset managers as required.			

7.5 Strategy LA1 - Licensing and Approvals

Some actions that are included in the CMP can be undertaken without development consent once the CMP is certified. However, works within the coastal zone may require a Review of Environmental Factors (REF) under Part 5 of the *Environmental Planning and Assessment Act 1979.* Coastal hazard risks are considered through the environmental assessment pathway. Other licences and approvals may also be required (e.g. from DPIRD-Fisheries or DPIRD-Marine Parks).

The *Crown Land Management Act 2016* authorises CVC to manage coastal Crown land as if it were community land under the *Local Government Act 1993* where CVC has been appointed to manage dedicated or reserved Crown land. Plans of management for reserved or dedicated coastal Crown land are a mechanism by which the strategies and actions in this CMP can be implemented. The actions and strategies

in this CMP have been integrated with the plans of management prepared over council-managed Crown land including the *Community Land, Crown Reserves and other Public Places Plan of Management* (generic PoM, CVC, 2023a) and *Plan of Management Flinders Park* (Flinders Park PoM, CVC, 2021):

- *Action FM1-2: Manage vehicular beach access.*
- *Action FM1-3: Dog management*
- *Action AM1-1: Incorporate coastal hazard risks into CVC asset management strategies and plans*
- *Action Y1-2: Replace/upgrade Yamba Main Beach seawall*
- *Action Y3-1: Raising of Yamba ocean pool*
- *Action Y3-2: Extension of the existing pathway from Yamba Main Beach to Pilot Hill*
- Coastal habitat restoration actions.

Both the generic PoM and Flinders Park PoM permit future development to safeguard against the effects of climate change and significant climatic events including:

- Climate change adaption measures.
- Implementing actions identified as part of this CMP.
- Mitigation works to reduce coastal erosion, storm surge and landslide risks.

A lease, licence, permit or other authority to occupy and/or use Crown land is required to be issued by the land manager (CVC for Council-managed Crown Land or DHPI-Crown Lands for directly managed Crown Land, including works generally below MHWM). The duration of licences is generally short-term unless the strategic priorities for the land have been demonstrated (e.g. in a CMP). Where management actions are proposed on Crown land (including Crown waterways), authorisations and approvals may need to be obtained under the *Crown Land Management Act 2016*. With respect to works and activities that are proposed in the CMP, if they occur on Crown land and CVC is the appointed Crown land manager, and the proposed works are consistent with the reserve purpose and/or a Plan of Management, then in most circumstances no other form of authorisation under the CLM Act will be required. Licence requirements will be determined on a case-by-case basis.

Management actions undertaken on Crown land will also need to consider Aboriginal Land Claims lodged under the *Aboriginal Land Rights Act 1983*. In addition, all activities relating to the use of Crown land must be consistent with the Commonwealth *Native Title Act 1993*. Native title exists over much of the Open Coast CMP area. Any activity that impacts or impairs native title is a 'future act' (specific proposals to deal with land in a way that affects native title and interests) under the *Native Title Act 1993*. Future act activities require a notice to be provided to the native title representative body for consultation and feedback.

An Indigenous Land Use Agreement (ILUA) is a voluntary agreement between native title holders and others about the use of land and waters. An ILUA addresses issues such as access to land and waters, how native title rights and interests coexist with the rights and interests of other people. An ILUA can permit activities to be undertaken over land or water that are not permitted under the Future Act provisions of the *Native Title Act 1993* (Cth) and therefore provide certainty for parties to carry out future activities on land and waters in the agreement area. Development of an ILUA can take at least 12 to 18 months depending on the complexity of issues raised.

Difficulty in obtaining approvals for current coastal management works under current arrangements and consultation with Yaegl TOAC during the development of the CMP has highlighted the need to develop a

method to incorporate native title requirements into the CMP actions and implementation (e.g. bilateral agreements or an ILUA between various parties).

Some actions will require approval from other agencies such as permits under the *Fisheries Management Act 1994* or *Marine Estate Management (Management Rules) Regulation 1999*.

Many actions immediately border or may impact on NPWS reserves and values, such as at Lake Cakora, Wooli Wooli River, Wooli Beach and Sandon River. These actions will consider relevant guidelines for development and activity approval (NPWS, 2020).

The appropriate approval pathways will be determined prior to the implementation of on-ground actions.

Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions

Priority	High	**Timeframe**	Short-term	**Stage 3 option**	SA35
Threats addressed	All				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	
Implementation of the CMP actions will require licences and approvals that can be complex and time-consuming. Mechanisms to efficiently facilitate implementation of the CMP actions will be developed in consultation with stakeholders.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
LA1-1a: Review reserve boundaries for Council-managed Crown reserve areas that are affected by coastal hazards	CVC	DPHI-Crown Lands	$2,000	CVC
Land status is a key determining factor in the identification of approval requirements. CVC will review reserve boundaries of Council-managed Crown reserves affected by hazards where works may be required. A status search maybe undertaken where required to confirm the reserve boundary for: • Iluka Beach carpark (R89464) • Moriarty's Reserve (R88421) • Flinders Park (R85724) • South Head (R82661) • Angourie Reserve (R68674) • Brooms Head (R65975) - a status search has already been requested for Brooms Head Holiday Park (Lot 2 DP1095139 part R65975). • Diggers Headland Reserve (R44430) • Minnie Water Foreshore Reserve (R84129) • Wooli public reserve and sportsground (R1003020) • South Terrace, Wooli (R41752) • Wooli Bowling Green Reserve (R56099) • Hickey Island (part R1003009) • Pippi Beach and Dolphin Park, Pippi Beach (part R58617)				
Performance target	Relevant land status searches requested by December 2025.			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
LA1-1b: Consult Yaegl TOAC on actions in the CMP that affect land where Native Title rights and interests have been recognised by the Federal Court	CVC	DCCEEW, DPHI-Crown Lands, DPIRD-Marine Parks, NPWS, Yaegl TOAC	$60,000	CEGP, CVC
CVC will consult with Yaegl TOAC to develop mechanisms to ensure native title rights, interests and obligations are incorporated into the implementation of the CMP where actions relate to land where Yaegl TOAC's Native Title rights and interests have been recognised by the Federal Court. This consultation will recognise the components of land, water and sea country management and aim to facilitate Yaegl involvement in coastal management including assessments, monitoring, revegetation, and restoration activities. The form of the agreement will be developed in consultation with Yaegl TOAC and may include agreements such as a memorandum of understanding or more formal agreements such as an ILUA and may include other relevant land and water managers including DPHI-Crown Lands, NPWS and DPIRD-Marine Parks. A working group will be established to develop the agreement including native title holders, CVC and relevant NSW Government agencies. The appropriate type of agreement may be different at each location and will depend on land management arrangements as identified in *Task LA1-1a*.				
Performance target	Working group active by August 2025.			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
LA1-1c: Develop mechanisms to facilitate landowner approvals for CMP actions	CVC	DCCEEW, DPHI-Crown Lands	$20,000	CEGP, CVC
In consultation with DPHI-Crown Lands, CVC will seek the necessary authorisations to undertake CMP actions on Crown land. These may include: • An authorisation such as a Crown licence that is consistent with the duration of the CMP action, or longer term, as appropriate. • A Crown Land licence to implement CMP actions on coastal Crown land for the duration of the CMP (10 years). This may be appropriate for ongoing, repeating actions such as beach scraping. • Subject to requirements of the *Native Title Act 1993*, CVC seek to be appointed as Crown Land Manager over parts of the foreshore and waterway to facilitate certain CMP actions. This may be appropriate for ongoing, repeating actions such as beach scraping where part of the action would be located on Minister-managed Crown land. Mechanisms will be developed with consideration of the outcomes of *Task LA1-1a* and *Task LA1-1b*.				
Performance target	Landowner's consent does not cause delay to implementation of CMP actions.			

7.6 Strategy FS1 – Funding

The CMP provides a strategic plan for management of the open coast. CMP actions are expected to be funded through CVC and state/ federal government contributions, monetary grants and volunteer works by community members and organisations. CVC operates an annual budget primarily through rates and charges as well as fees, investment revenues, loans, property management and operating grants. Some actions will be partially or fully funded under CVC's normal operating budgets or through existing programs and grants.

Significant funding is required to implement the CMP actions. It will not be possible for CVC to implement all actions without additional sources of funding. As such, identification of grants and the submission of successful funding applications will be an important component of the CMP and the development stages. For most grants, CVC is required to contribute a portion of the project cost. Additional sources of funding will be required to supplement CVC's existing operating budget.

Implementation of the CMP for the Clarence River estuary will also require financial contributions. The development of waterway and coastline management funding opportunities will be considered for the whole LGA.

Action FS1-1: Develop a CMP funding strategy

Priority	High	**Timeframe**	Short-term	**Stage 3 option**	SA34
Threats addressed	All				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	
CVC will develop a funding strategy to enable implementation of the CMP actions in accordance with the CMP vision and objectives.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
FS1-1a: Develop strategy to secure funding sources	CVC	-	$10,000	CVC
CVC will review and document potential funding sources to ensure successful implementation of the CMP including existing sources of funding (CVC general income, external grant funds and in-kind contributions) and funding gaps. Grant eligibility, co-contributions and application requirements will be identified. CVC's current coastal budget is insufficient to successfully fund and implement all CMP actions. As part of the review CVC will investigate other potential revenue sources for funding coastal works. Key considerations will include: • CVC's legislative obligations and core business activities. • Alignment with the IP&R framework and community priorities. • Community feedback during CMP development as well as ability and willingness to pay for coastal management actions. • Potential advocacy for improved coastal management outcomes in addition to CVC's core business activities. • Opportunities to leverage extra financial and other resources. • Partnerships with state government agencies, other councils, traditional owners, community groups and private landholders to achieve positive outcomes. CVC will document funding objectives, potential sources and develop recommendations for community consultation.				
Performance target	Funding sources identified and community consultation undertaken by December 2025			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
FS1-1b: Implement CMP funding strategy	CVC	-	-	CVC
CVC will implement the adopted funding strategy.				
Performance target	Funding strategy implemented by June 2026 and ongoing review for the term of the CMP			

7.7 Strategy EM1 - Emergency Management

Emergency response includes actions to address residual risk in emergency situations. Emergency response procedures have been developed for areas that are at risk from coastal hazards (where coastal protection works have not been implemented or are not always effective) to limit the consequences of large and/or unpredicted coastal events.

CVC will undertake emergency coastal protection works identified in the Coastal Zone Emergency Action Subplan (CZEAS) included in Appendix 3. This may include the placement of sand, or the placing of sandbags for a period of not more than 90 days, on a beach, or land adjacent to a beach, to mitigate the effects of coastal hazards on land. Other emergency actions may include the installation of temporary fencing and signage, closure of Council-managed roads and shutdown of water and sewer infrastructure affected by beach erosion or cliff/ slope instability/ landslip hazards. These works are exempt development as they would be carried out by or on behalf of CVC in accordance with this CMP and the CZEAS.

Action EM1-1: Implement emergency response procedures

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	SA30, SA31, SA32
Threats addressed	T1 - Beach erosion, T3 – Coastal inundation, T5 - Slope instability/ landslip				
Coastal mgt areas	CUA, CEA	**B/C distribution**	100% public		

The CZEAS (Appendix 3) outlines the roles and responsibilities of all public authorities in response to emergencies immediately preceding or during periods of beach erosion, coastal inundation or coastal cliff/ slope instability, where the beach erosion, coastal inundation or cliff instability occurs through storm activity or an extreme or irregular event. The roles and responsibilities defined in the CZEAS include the carrying out of coastal protection works and emergency coastal protection works for the protection of property and assets affected or likely to be affected by coastal emergency events. The CZEAS details actions to be implemented in the four emergency phases of emergency management (prevention, preparation, response and recovery, Figure 25) to manage coastal emergency events relating to coastal erosion, coastal inundation and coastal cliff/ slope instability.

Figure 25: Coastal management emergency response phases

Source: DPIE (2019)

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
EM1-1a: Implement CZEAS	CVC	DCCEEW, NPWS, SES	$200,000	CVC
The CZEAS will be implemented where required when beach erosion, coastal inundation or cliff instability occurs through storm activity or an extreme or irregular event.				
Performance target	Emergency response procedures implemented in accordance with the CZEAS			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
EM1-1b: Reassess CZEAS	CVC	DCCEEW, NPWS	-	CVC
CVC will reassess the coastal hazards and the emergency management strategy documented in the CZEAS following major coastal erosion events.				
Performance target	Review of emergency management strategy within 6 months of a coastal erosion event			

8. MANAGEMENT ZONE – ILUKA AREA (IL)

The strategies, actions and tasks to be implemented at Iluka are discussed in the following sections. CMP actions are listed in Table 10, shown on Figure 28 and the adaptive management approach is provided in Figure 29.

Table 10: CMP actions - Iluka

Strategies/ actions	Tasks	Threats addressed	CMP section
Strategy IL1 – Coastal Hazard Adaptation			
Action IL1-1: Monitor coastal hazards (Iluka)	IL1-1a: Implement coastal hazard monitoring program	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation	8.1
Action IL1-2: Develop Iluka adaptive management strategy	IL1-2a: Develop adaptive management strategy (Iluka)	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation	
Strategy IL2 – Coastal Habitat Restoration			
Action IL2-1: Coastal habitat restoration (Iluka)	IL2-1a: Weed management (Iluka Beach Foreshore Reserve) IL2-1b: Coastal habitat restoration (Iluka foreshore)	T9 - Invasive weeds, T12 – Coastal vegetation damage, T35 - Informal pedestrian access, T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users	8.2

8.1 Strategy IL1 – Coastal Hazard Adaptation

The mean rate of recession at Shark Bay near the 4WD access road and picnic area since 1988 is 0.3 m/year (JBP, 2023). At present, frequent to rare erosion events (10% EP) are predicted to impact the 4WD access track and picnic area while rare to very rare events (1% EP) may impact Iluka Road. Shark Bay is expected to recede further within Bundjalung National Park with erosion threatening Iluka Road (near Shark Bay picnic area) in 20 years with rare events (2% EP) and becoming more likely in the long-term with more frequent events (50% EP in 2073).

Inundation is predicted to impact on the Bundjalung National Park north of the Clarence River with inundation extents increasing over time towards Iluka Road at Shark Bay. More frequent inundation (from the Clarence River) of management trails including Saltwater Inlet management trail and the NPWS depot is expected over the next 20 years. By 2043, inundation from the Clarence River is predicted to impact parts of the Iluka village foreshore (outside this CMP study area). These inundation extents originate outside the study area (inland to the west) from the Clarence River, expanding to the study area over the long-term.

Action IL1-1: Monitor coastal hazards (Iluka)

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	SA1
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	
A coastal hazard monitoring and reporting program will be implemented for the Iluka peninsula (Iluka Road at Shark Bay and Iluka Main Beach) to assist in identifying changes to the coastal environment to inform decision making, management responses and community education.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
IL1-1a: Implement coastal hazard monitoring program	CVC	DCCEEW	$55,000	CEGP, CRIF, CVC

The coastal hazard monitoring program for the Iluka peninsula may include:

- Monitoring of beach profiles to assess impacts of erosion (volume of sand lost), the rate of shoreline recession, the effectiveness of coastal management actions, the exposed slope geometry and sand volumes and when triggers for action (*Action EM1-1: Implement emergency response procedures*) are required. The beach profile will be surveyed using land-based, UAV (drone) and hydrographic techniques on a regular basis and following significant storm events, supplemented with publicly available photogrammetry.
- Comparison of beach profiles over time with reference to previous data where available.
- Monitoring and forecasting of dangerous water levels and wave conditions using publicly available tools (e.g. tide/ water-level stations, tide prediction tables and wave forecasts).
- Community feedback relating to coastal hazard impacts.

Results of the monitoring program will be documented and reported on an annual basis to CVC and published on CVC's website (refer *Task PD1-1c: Coastal hazard webpage*). Reporting will include identification of any required management measures and/or modifications to the monitoring program.

Performance target	Coastal hazard monitoring program implemented by December 2025 and monitoring undertaken annually and following significant storm events.

Action IL1-2: Develop Iluka adaptive management strategy

Priority	High	**Timeframe**	Short-term	**Stage 3 option**	SBWB2
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	
Management of the issues facing the Iluka peninsula are complex and challenging and the development of a long-term adaptive management strategy is required to address coastal hazard risks. The strategy will incorporate the outcomes of related CMP actions and align with other management strategies including local disaster adaptation plans developed by the NSW Reconstruction Authority as part of the State Disaster Mitigation Plan.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
IL1-2a: Develop adaptive management strategy (Iluka)	CVC	DCCEEW, NPWS	$100,000	CEGP, DRF, CVC

The asset and village adaptive management strategy for the Iluka peninsula will address:

- Road access to the village and surrounding areas.
- CVC services including water supply, sewerage and waste management.
- Other public services including power and telecommunications.
- Planning and development controls.
- Cultural heritage management.
- Emergency response.

Key inputs to the strategy development will include the data and outcomes of related CMP actions:

- *Action AM1-1: Incorporate coastal hazard risks in CVC asset management planning*
- *Action IL1-1: Monitor coastal hazards*.
- *Action CH1-1: Protection of cultural heritage.*
- *Action EM1-1: Implement emergency response procedures.*
- *Action PD1-1: Review and implement planning controls to address coastal hazards*

Strategy development will include identification of risks, development of management options and consultation with stakeholders including affected property owners, asset and land managers (CVC, DPHI-Crown Lands, NPWS, utilities), Yaegl TOAC and approval agencies. A preferred strategy will be identified for further assessment (as required).

Performance target	Iluka adaptive management strategy completed by June 2028

8.2 Strategy IL2 – Coastal Habitat Restoration

Action IL2-1: Coastal habitat restoration (Iluka)

Priority	Medium	**Timeframe**	Ongoing	**Stage 3 option**	SA12, SA13, SA14
Threats addressed	T9 - Invasive weeds, T12 – Coastal vegetation damage, T35 - Informal pedestrian access, T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	

Habitat restoration activities within Council-managed Crown reserves at Iluka which may include weed management, revegetation, access control, signage and education will be undertaken when funding is available to assist in stabilising dunes, provide protection from coastal hazards and enhance the biodiversity values and recreational amenity. CVC will continue to support coordination of local environmental/ community groups undertaking dune rehabilitation, revegetation and habitat restoration activities on Council-managed land and community Landcare nurseries to undertake coastal revegetation and habitat restoration activities.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
IL2-1a: Weed management (Iluka Beach Foreshore Reserve)	CVC	DCCEEW, Landcare	$100,000	CEGP, CRIF, CVC, Landcare, ET, IAS, SOS

CVC, as the local control authority responsible for administering the *Biosecurity Act 2015,* will continue to manage weeds within Iluka Beach Foreshore Reserve, particularly lantana (*Lantana camara*) and bitou bush (*Chrysanthemoides monilifera rotundata*). This will include routine inspections to identify priority weed infestations, weed treatment and supporting the community to prevent the establishment of new weeds. CVC will continue to source funding for weed management from Government funding/ grants to supplement internal resources for weed management.

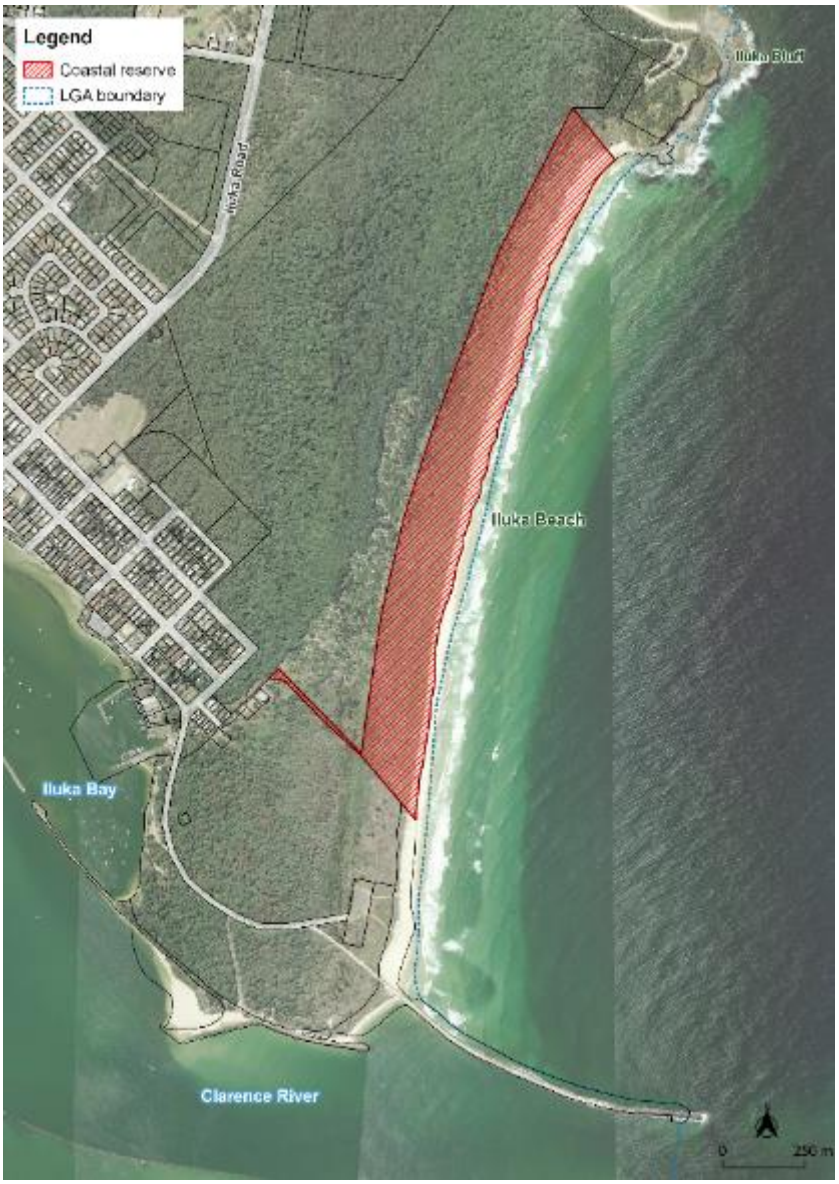

Figure 26: Priority weed management - Iluka Beach Foreshore Reserve (Lot 7003, DP92601)

Performance target	Reduction in environmental weeds within targeted areas as determined through formal and informal monitoring.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
IL2-1b: Coastal habitat restoration (Iluka foreshore)	CVC	DCCEEW, Landcare	$190,000	CVC, CEGP, CRIF

CVC will prepare and implement a coastal habitat restoration and vegetation management plan for Moriarty's reserve and Iluka Main Beach which may include works locations, a weed management regime, public access management, species to be used for revegetation, dune management works, educational signage and monitoring and maintenance requirements. Key objectives are the management of high visitation areas, maintenance of formalised pedestrian beach access and the protection of high value coastal vegetation and shorebird nesting sites.

Figure 27: Priority coastal habitat restoration area - Iluka Main Beach (Lot 7026, DP1114851) and Moriarty's Reserve (Lot 7012, DP1049745)

Performance target	Development of coastal habitat restoration and vegetation management plan to guide restoration works by June 2026. Increased coverage of native vegetation.

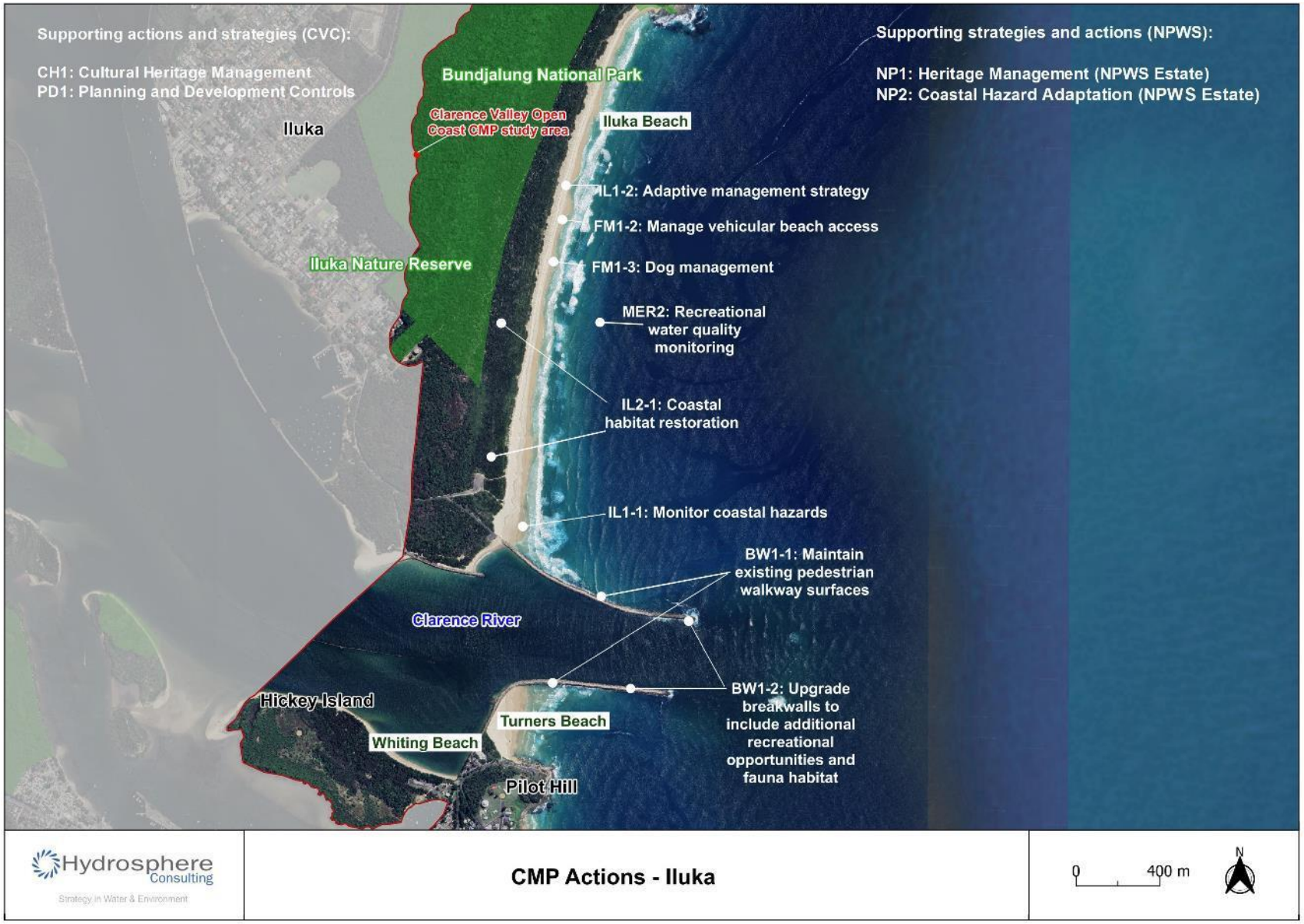

Figure 28: CMP actions – Iluka

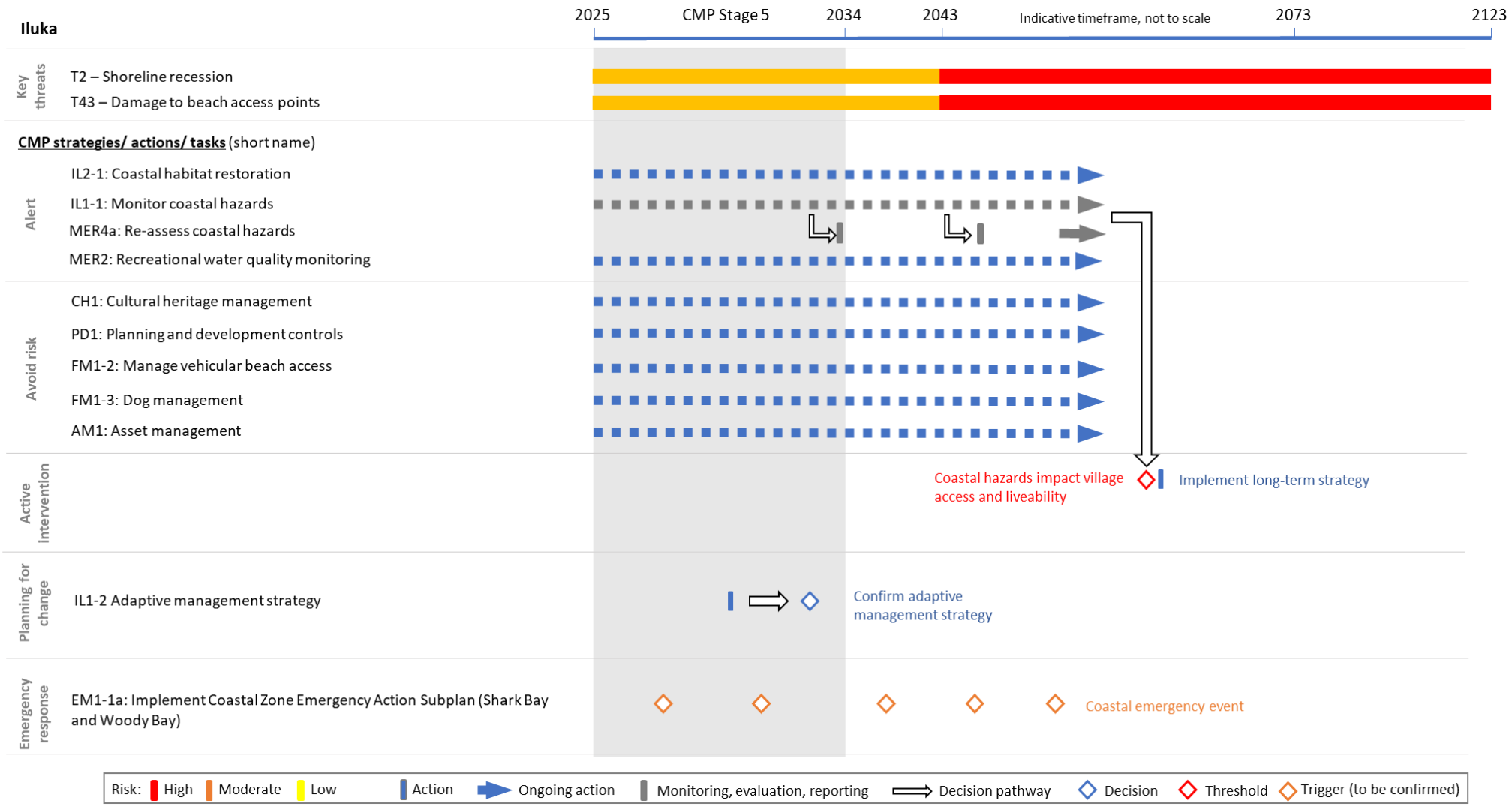

Figure 29: Adaptive management approach - Iluka

9. MANAGEMENT ZONE – HICKEY ISLAND AND WHITING BEACH

The strategies, actions and tasks to be implemented at Hickey Island/ Whiting Beach are discussed in the following sections. CMP actions are listed in Table 11, shown on Figure 33 and the adaptive management approach is provided in Figure 34.

Table 11: CMP actions – Hickey Island and Whiting Beach

Strategies/ actions	Tasks	Threats addressed	CMP section
Strategy HW1 – Mitigate Coastal Erosion			
Action HW1-1: Sand nourishment – Whiting Beach	HW1-1a: Liaison with TfNSW-Maritime regarding navigational dredging strategy HW1-1b: Investigate alternative sources for sand nourishment HW1-1c: Implement sand nourishment	T1 – Beach erosion, T2 – Shoreline recession	9.1
Strategy HW2 – Coastal Hazard Adaptation			
Action HW2-1: Monitor coastal hazards (Hickey Island and Whiting Beach)	HW2-1a: Implement coastal hazard monitoring program	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation	9.2
Action HW2-2: Develop Hickey Island adaptive management strategy	HW2-2a: Develop adaptive management strategy (Hickey Island)	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation	
Strategy HW3 – Coastal Habitat Restoration			
Action HW3-1: Coastal habitat restoration (Hickey Island)	HW3-1a: Coastal habitat restoration (Hickey Island)	T9 - Invasive weeds, T12 – Coastal vegetation damage, T35 - Informal pedestrian access, T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users	9.3

9.1 Strategy HW1 – Mitigate Coastal Erosion

Hickey Island including Whiting Beach formed as a result of changes in hydrodynamics and sediment transport in the lower Clarence River in the early 1900s, in particular the construction of Middle Training Wall. Whiting Beach was continuing to accrete until the construction of the northern and southern entrance breakwaters from 1952 to 1971. Since at least 1987, recession has resulted from the breakwaters preventing or significantly reducing the consistent supply of marine sand into the Clarence River, which had been feeding Whiting Beach and Hickey Island (Royal HaskoningDHV, 2014).

Whiting Beach experienced a severe erosion event in 2012 which threatened CVC infrastructure including the footpath, road, stormwater and sewer assets at the eastern end of the beach adjacent to the southern Clarence River entrance breakwall. A geobag revetment was constructed at the south-eastern end of the beach to protect against future erosion (Plate 5).

Plate 5: Left: geobags constructed at Whiting Beach (2012/13), right: vegetation has regrown with crest of the wall exposed by informal pedestrian access (January 2024)

Dredged material was placed on Whiting Beach in 2008 (9,400 m^3 from the Yamba Approach Channel) and also in 2016 (10,000 m^3 from dredging of the navigation channel at the tip of Dart Island, Hydrosphere Consulting, 2021). Whiting Beach is a priority area for placement of sand from future navigational dredging to be undertaken by TfNSW-Maritime (refer *Action ND1-1: Sand nourishment from navigational dredging*).

Action HW1-1: Sand nourishment – Whiting Beach

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	HIWB2
Threats addressed	T1 – Beach erosion, T2 – Shoreline recession				
Coastal mgt areas	CUA, CEA	**B/C distribution**	100% public		

Options to manage recession of Whiting Beach were investigated in 2015 (Royal HaskoningDHV, 2015a) and sources of sand were considered for beach nourishment. The opportunistic use of dredged material for the nourishment of Whiting Beach is an intermittent approach that relies on maintenance dredging occurring within the lower Clarence River estuary and the material being suitable and available for use on Whiting Beach. *Action ND1-1: Sand nourishment from navigational dredging* is an appropriate option to pursue on an opportunistic basis but repeat nourishment is required to provide ongoing benefits. Targeted dredging may be an appropriate option to pursue if navigational dredging does not provide access to sufficient volumes of sand. Further assessment of potential dredging sites and impacts would be required.

Offshore sand sources may also be feasible. The NSW Government (NSW Reconstruction Authority and DCCEEW) is planning to assess the feasibility of large-scale offshore sand reserves and other sources for beach nourishment as part of the *State Disaster Mitigation Plan 2024-2026* (NSW Reconstruction Authority, 2024).

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
HW1-1a: Liaison with TfNSW-Maritime regarding navigational dredging strategy	CVC	TfNSW-Maritime	-	CVC
CVC will liaise with TfNSW-Maritime regarding dredging of Clarence River navigation channels and use of the dredged sand for nourishment of Whiting Beach including development of the navigational dredging strategy (timing, dredging locations, sand characteristics and expected volumes), the development of a sand placement plan for Whiting Beach and any required approvals.				
Performance target	CVC supports the TfNSW dredging strategy and sand placement plan			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
HW1-1b: Investigate alternative sources for sand nourishment	CVC	DCCEEW, DPHI-Planning	$80,000	CEGP, DRF, CVC

CVC will investigate other potential sand sources through review of previous studies (Royal HaskoningDHV, 2015a; 2015b), the proposed NSW government investigations into the feasibility of offshore sand reserves and other opportunities to identify an alternative source of sand to nourish Whiting Beach. Based on the dredging strategy being developed by TfNSW-Maritime (*Action ND1-1: Sand nourishment from navigational dredging*) and data collected from coastal hazard monitoring (*Action HW2-1: Monitor coastal hazards*), the efficacy of the sand nourishment activities will be assessed and triggers for introduction of alternative sand sources for beach nourishment will be developed (e.g. erosion of the Whiting Beach dune scarp is within 10 m of public infrastructure). Where a feasible alternative sand source has been identified, design and approval documentation will be prepared to enable implementation once triggers are reached:

- Environmental assessment (REF) and determination under Part 5 of the *Environmental Planning and Assessment Act 1979.*
- A Crown land licence for any works outside of the Council-managed Crown Reserve or for proposals that are not consistent with the reserve purpose (refer *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions*).
- Approval/ concurrence from relevant agencies (DPIRD-Fisheries, DPIRD-Marine Parks, NPWS) as required.
- Management of native title rights and interests (refer *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions*).

Performance target	Alternative sand sources are identified for implementation as required.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
HW1-1c: Implement sand nourishment	CVC	DCCEEW	$600,000	CEGP, DRF, CVC

The sand nourishment strategy identified in *Task HW1-1a* and/or *Task HW1-1b* will be implemented once triggers are reached and funding is obtained (refer *Action FS1-1: Develop a CMP funding strategy*). The priority for sand placement is as follows:

- Zone 1 (highest priority) – the primary objective is to protect public infrastructure (road, carpark, footpath, amenities, beach access etc.) but also to restore beach amenity of the most utilised section of the beach.
- Zone 2 – the primary objective would be to provide protection and stability to the rest of the island which has high conservation values and cultural heritage values and to restore beach access and amenity.

The indicative sand placement areas are shown in Figure 30 and will depend on the condition of the beach following an erosion event and the requirement for sand nourishment.

Figure 30: Indicative sand nourishment locations – Whiting Beach

Performance target	Sand nourishment strategy implemented as required.

9.2 Strategy HW2 – Coastal Hazard Adaptation

Hickey Island is vulnerable to tidal and coastal inundation at present with tidal inundation over the south-eastern portion of the island and inundation extents increasing over time. The carpark area is predicted to be inundated by 2043 in rare coastal inundation events. While *Strategy HW1 – Mitigate Coastal Erosion* aims to address the shoreline recession on the northern side of the island, tidal and coastal inundation are predicted to impact the island over time, largely originating from the estuary south of the island. Therefore, a beach nourishment regime would be ineffective in protecting the island from more frequent inundation into the future.

Hickey Island contains areas mapped as CWLRA comprising estuarine vegetation communities (i.e. mangrove and saltmarsh), coastal swamp forest, Wallum and coastal heath communities. Coastal erosion and future inundation of coastal wetland areas is expected to impact these vegetation communities through increasing inundation depth and saline intrusion causing changes to species composition and/or potential die-off of some plant community types. In the short to medium-term, coastal wetlands on Hickey Island are likely to expand and migrate upslope with increasing tidal inundation into areas of freshwater wetland and coastal heath vegetation types. There are minimal hard structures and/or barriers on the island and the coastal wetland areas will be modified through species composition changes with increasing water levels and saline influence. In the long-term, the continued retreat of the northern shoreline of Hickey Island through shoreline recession will reduce the amount of habitat available for wetland upslope vegetation migration. Sea level rise and the loss of the protective dunes through erosion will lead to greater exposure of wetland areas to wave action and unstable geomorphology. The predicted net loss of coastal wetland habitat at Hickey Island may be offset by providing opportunities for habitat creation at other locations and reducing the impact of other disturbance factors identified through *Action F1-1: Intertidal marine vegetation strategies*. *Action PD1-1: Review and implement planning controls to address coastal hazards* will ensure that development is controlled in known hazard areas and the risk of impacts on coastal wetlands from inappropriate development is reduced.

Hickey Island currently shelters established moorings, oyster leases, commercial fishing areas, a holiday park and reserves. Over the long-term, coastal hazards are predicted to diminish this protection provided and further consideration of management options for these sites would need to be undertaken (potentially in the next review of the CMP).

Action HW2-1: Monitor coastal hazards (Hickey Island and Whiting Beach)

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	SA1
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation				
Coastal mgt areas	CUA, CEA, CWLRA		**B/C distribution**	100% public	
A coastal hazard monitoring and reporting program will be implemented for Hickey Island and Whiting Beach to assist in identifying changes to the coastal environment to inform decision making, management responses and community education.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
HW2-1a: Implement coastal hazard monitoring program	CVC	DCCEEW	$55,000	CEGP, CRIF, CVC

The coastal hazard monitoring program for Hickey Island/Whiting Beach may include:

- Monitoring of beach profiles to assess impacts of erosion (volume of sand lost), the rate of shoreline recession, the effectiveness of coastal management actions, the exposed slope geometry and sand volumes and when triggers for action (*Action HW1-1: Sand nourishment – Whiting Beach, Action EM1-1: Implement emergency response procedures*) are required. The beach profile will be surveyed using land-based, UAV (drone) and hydrographic techniques on a regular basis and following significant storm events, supplemented with publicly available photogrammetry.
- Comparison of beach profiles over time with reference to previous data.
- Monitoring and forecasting of dangerous water levels and wave conditions using publicly available tools (e.g. tide/ water level stations, tide prediction tables and wave forecasts).
- Community feedback relating to coastal hazard impacts.

Results of the monitoring program will be documented and reported on an annual basis to CVC and published on CVC's website (refer *Task PD1-1c: Coastal hazard webpage*). Reporting will include identification of any required management measures and/or modifications to the monitoring program.

Performance target	Coastal hazard monitoring program implemented by December 2025 and monitoring undertaken annually and following significant storm events.

Action HW2-2: Develop Hickey Island adaptive management strategy

Priority	Medium	**Timeframe**	Long-term	**Stage 3 option**	HIWB9
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation				
Coastal mgt areas	CUA, CEA, CWLRA		**B/C distribution**	100% public	

Management of the issues facing Hickey Island are complex and challenging and the development of a long-term strategy is required to address coastal hazard risks over the long-term. The strategy will incorporate the outcomes of related CMP actions and align with other management strategies including local disaster adaptation plans developed by the NSW Reconstruction Authority as part of the State Disaster Mitigation Plan.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
HW2-2a: Develop adaptive management strategy (Hickey Island)	CVC	DCCEEW	$100,000	CEGP, DRF, CVC

The adaptive management strategy for Hickey Island will identify:

- CVC services (water supply, sewerage and waste management) and other public services (power and telecommunications) that are vulnerable to coastal hazards.
- Predicted impacts on public assets and development on the island due to coastal hazards.
- Triggers/ thresholds for adaptive management, access arrangements and methods.
- Planning and development controls required to support the long-term strategy.
- Cultural heritage management.
- Emergency response.

Key inputs to the strategy development will include the data and outcomes of related CMP actions:

- *Action AM1-1: Incorporate coastal hazard risks in CVC asset management planning*
- *Action HW1-1: Sand nourishment – Whiting Beach* and *Action ND1-1: Sand nourishment from navigational dredging* and the protection afforded by the sand nourishment works.
- *Action HW2-1: Monitor coastal hazards.*
- *Action CH1-1: Protection of cultural heritage.*
- *Action EM1-1: Implement emergency response procedures.*
- *Action PD1-1: Review and implement planning controls to address coastal hazards*
- *Action F1-1: Intertidal marine vegetation strategy (Clarence River Estuary).*

Strategy development will include identification of risks, development of management options and consultation with stakeholders including affected private property owners, asset and land managers (CVC, DPHI-Crown Lands, NPWS, utilities), Yaegl TOAC and potential approval agencies (DPIRD-Fisheries). A preferred strategy will be identified for further assessment (as required).

Performance target	Hickey Island adaptive management strategy completed by June 2035

9.3 Strategy HW3 – Coastal Habitat Restoration

Action HW3-1: Coastal habitat restoration (Hickey Island)

Priority	Medium	**Timeframe**	Ongoing	**Stage 3 option**	SA12, SA13, SA14
Threats addressed	T9 - Invasive weeds, T12 – Coastal vegetation damage, T35 - Informal pedestrian access, T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users				
Coastal mgt areas	CUA, CEA, CWLRA	**B/C distribution**	100% public		

Habitat restoration activities within Council-managed Crown reserves on Hickey Island which may include weed management, revegetation, access control, signage and education will be undertaken when funding is available to assist in stabilising dunes, provide protection from coastal hazards and enhance the biodiversity values and recreational amenity. CVC will continue to support coordination of local environmental/ community groups undertaking dune rehabilitation, revegetation and habitat restoration activities on Council-managed land and community Landcare nurseries to undertake coastal revegetation and habitat restoration activities.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
HW3-1a: Coastal habitat restoration (Hickey Island)	CVC	DCCEEW, Landcare	$370,000	CEGP, CRIF, CVC, Landcare, ET, IAS, SOS

CVC will prepare and implement a coastal habitat restoration and vegetation management plan for Hickey Island which may include but is not limited to works locations, implementation details such as a weed management regime, species to be used for revegetation, public access management, dune stabilisation works, educational signage and monitoring and maintenance requirements. Key objectives are the management of high visitation areas, maintenance of formalised pedestrian beach access and the protection of high value coastal vegetation (saltmarsh, mangrove and *Callitris* (coastal cypress pine) forest). Coastal habitat restoration works may include environmental protection works (works associated with the rehabilitation of land towards its natural state or any work to protect land from environmental degradation, and includes bush regeneration works, wetland protection works, erosion protection works, dune restoration works and the like, but does not include coastal protection works) in areas that are also mapped as CWLRA shown on Figure 32.

Figure 31: Priority coastal habitat restoration area – Hickey Island (Lot 7319, DP1162093)

Figure 32: Potential coastal habitat restoration on Council-managed land in areas mapped as CWLRA – Hickey Island

Performance target	Development of coastal habitat restoration and vegetation management plan to guide restoration works by June 2028. Increased coverage of native vegetation.

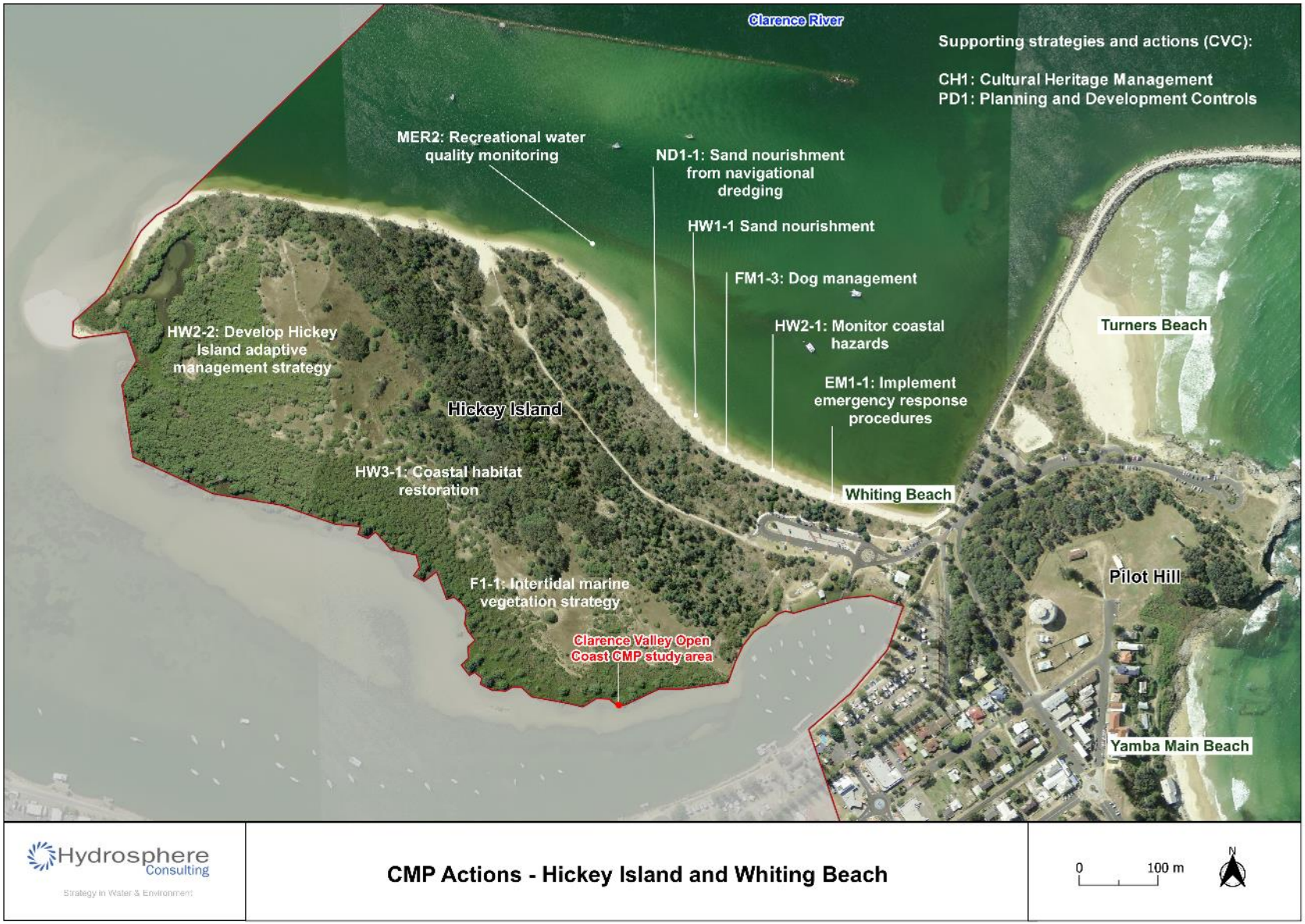

Figure 33: CMP actions – Hickey Island and Whiting Beach

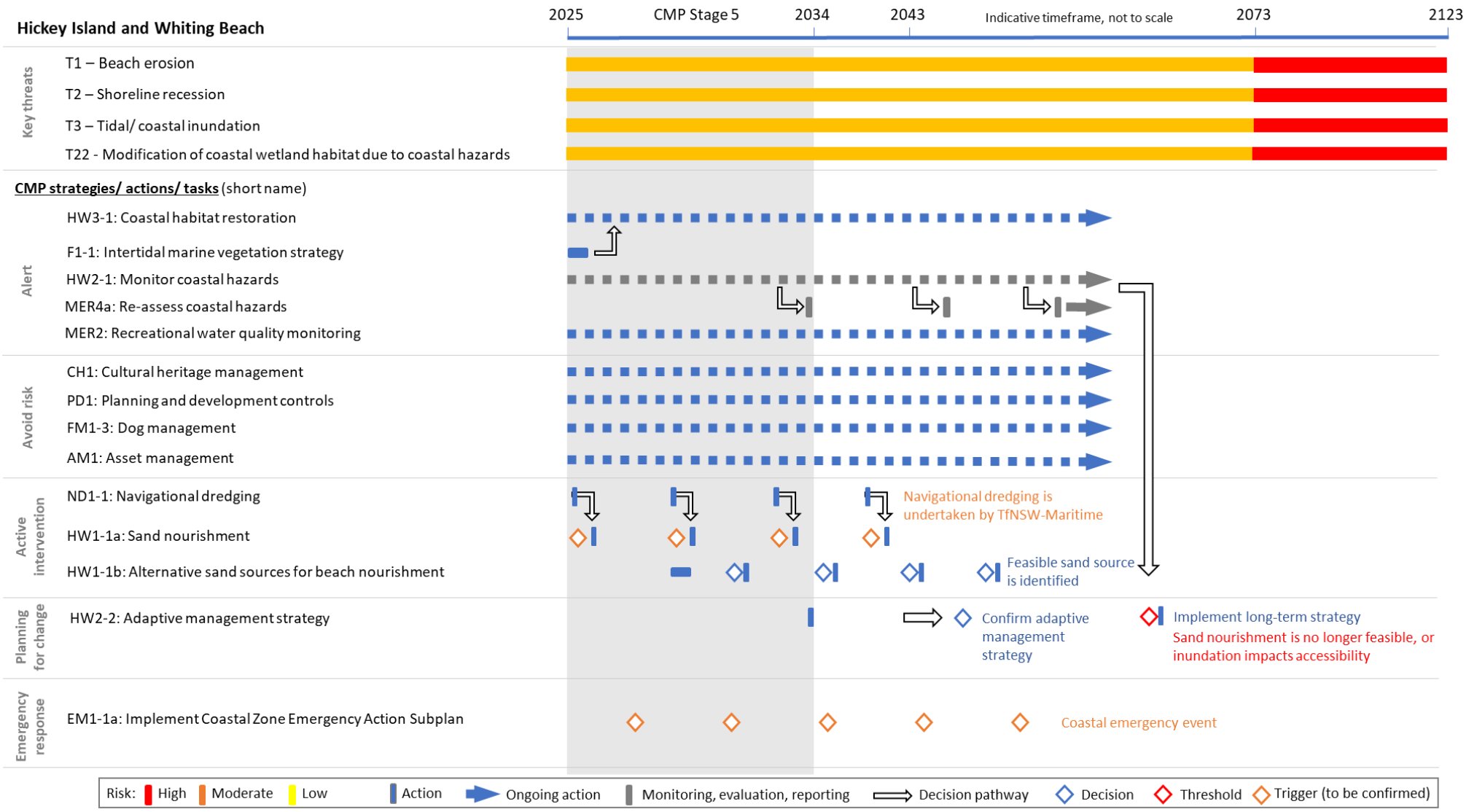

Figure 34: Adaptive management approach - Hickey Island and Whiting Beach

10. MANAGEMENT ZONE – YAMBA MAIN BEACH AND PILOT HILL

The strategies, actions and tasks to be implemented at Yamba Main Beach and Pilot Hill are discussed in the following sections. CMP actions are listed in Table 12, shown on Figure 41 and the adaptive management approach is provided in Figure 42.

Table 12: CMP actions – Yamba Main Beach and Pilot Hill

Strategies/ actions	Tasks	Threats addressed	CMP section
Strategy Y1 – Mitigate Coastal Erosion			
Action Y1-1: Sand nourishment (Yamba Main Beach)	Y1-1a: Liaison with TfNSW-Maritime regarding navigational dredging strategy Y1-1b: Investigate alternative sources for sand nourishment Y1-1c: Implement sand nourishment	T1 – Beach erosion, T2 – Shoreline recession	10.1
Action Y1-2: Replace/upgrade Yamba Main Beach seawall	Y1-2a: Review and update design and environmental assessment for replacement of Yamba Main Beach seawall Y1-2b: Construct Yamba Main Beach seawall	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation, T47 - Reduced accessible beach at high tide due to coastal protection works	
Strategy Y2 - Manage Slope Instability			
Action Y2-1: Yamba Interim Coastline Emergency Management Strategy	Y2-1a: Continue to implement the Yamba Coastline Interim Emergency Management Strategy	T5 - Slope instability/ landslip	10.2
Action Y2-2: Additional geotechnical investigations and review of slope stability at Pilot Hill	Y2-2a: Implement instrumentation and monitoring improvements Y2-2b: Undertake geotechnical investigations	T5 - Slope instability/ landslip	
Action Y2-3: Slope stability improvements at Pilot Hill	Y2-3a: Implement slope stability measures at Pilot Hill	T5 - Slope instability/ landslip	

Strategies/ actions	Tasks	Threats addressed	CMP section
Strategy Y3 – Recreational Improvements			
Action Y3-1: Raising of Yamba ocean pool	Y3-1a: Design and approvals for raising of Yamba ocean pool Y3-1b: Construct raised eastern wall of Yamba ocean pool	T3 - Tidal/ coastal Inundation	10.3
Action Y3-2: Extension of the existing pathway from Yamba Main Beach to Pilot Hill	Y3-2a: Develop the "missing link" pathway design and prepare environmental assessment and approval documentation Y3-2b: Construct the "missing link" pathway	T34 - Limited pedestrian access, T35 - Informal pedestrian access	
Strategy Y4 – Coastal Hazard Adaptation			
Action Y4-1: Monitor coastal hazards (Yamba Main Beach)	Y4-1a: Implement coastal hazard monitoring program Y4-1b: Liaise with Yamba SLSC regarding operations at Yamba Main Beach and Turners Beach and management of coastal hazards	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation	10.4
Action Y4-2: Ongoing upgrade of Yamba Main Beach seawall	Y4-2a: Maintain upgraded seawall	T1 - Beach erosion, T2 - Shoreline recession	
Strategy Y5 – Coastal Habitat Restoration			
Action Y5-1: Coastal habitat restoration (Yamba)	Y5-1a: Weed management and coastal habitat restoration (Pilot Hill)	T9 - Invasive weeds, T12 – Coastal vegetation damage, T35 - Informal pedestrian access, T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users	10.5

10.1 Strategy Y1 – Mitigate Coastal Erosion

The Main Beach revetment wall was constructed in 1975 following storm damage to Yamba Surf Life Saving Club (SLSC) assets in 1974, with repairs undertaken in subsequent years after flood/ storm damage. The seawall consists of rock and concrete and extends from the ocean pool to just north of the SLSC with a length of approximately 160 m (Plate 6). The existing seawall is in poor condition and does not provide adequate protection for the Yamba SLSC from coastal impacts including inundation during severe storm events (MHL, 2003). During storm events the beach has undergone severe erosion, exposing the SLSC foundations and allowing water to wash through the building (Royal HaskoningDHV, 2012). The sand on Yamba Main Beach may be completely removed from the sub-aerial beach during a significant storm. Short-term fluctuations also result in occasional sub-optimal levels of sand on the beach for the purpose of recreational amenity and protection against coastal hazards (MHL, 2002).

Plate 6: Yamba SLSC and Yamba Main Beach revetment wall (February 2022)

Action Y1-1: Sand nourishment (Yamba Main Beach)

Priority	Medium	**Timeframe**	Ongoing	**Stage 3 option**	Y2
Threats addressed	T1 – Beach erosion, T2 – Shoreline recession				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	

Beach nourishment will be undertaken at Yamba Main Beach to buffer against erosion and improve amenity. The opportunistic use of dredged material for the nourishment of Yamba Main Beach is an intermittent approach that relies on maintenance dredging occurring within the lower Clarence River estuary and the material being suitable and available for use on Yamba Main Beach. *Action ND1-1: Sand nourishment from navigational dredging* is an appropriate option to pursue on an opportunistic basis but repeat nourishment is required to provide ongoing benefits. Targeted dredging may be an appropriate option to pursue if navigational dredging does not provide access to sufficient volumes of sand. Further assessment of potential dredging sites and impacts would be required.

Offshore sand sources may also be feasible. The NSW Government (NSW Reconstruction Authority and DCCEEW) is planning to assess the feasibility of large-scale offshore sand reserves and other sources for beach nourishment as part of the *State Disaster Mitigation Plan 2024-2026* (NSW Reconstruction Authority, 2024).

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
Y1-1a: Liaison with TfNSW-Maritime regarding navigational dredging strategy	CVC	TfNSW-Maritime	-	CVC
CVC will liaise with TfNSW-Maritime regarding dredging of Clarence River navigation channels and use of the dredged sand for nourishment of Yamba Main Beach including development of the navigational dredging strategy (timing, dredging locations, sand characteristics and expected volumes) and the development of a sand placement plan for Yamba Main Beach and any required approvals.				
Performance target	CVC supports the dredging strategy and sand placement plan			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
Y1-1b: Investigate alternative sources for sand nourishment	CVC	DCCEEW, DPHI-Planning	$80,000	CEGP, CRIF, DRF, CVC
CVC will investigate other potential sand sources through review of previous studies, the proposed NSW government investigations into the feasibility of offshore sand reserves and other opportunities to identify an alternative source of sand to nourish Yamba Main Beach. Based on the dredging strategy being developed by TfNSW-Maritime (*Action ND1-1: Sand nourishment from navigational dredging*) and data collected from coastal hazard monitoring (*Action Y4-1: Monitor coastal hazards*), the efficacy of any sand nourishment activities implemented will be assessed and triggers for introduction of alternative sand sources for beach nourishment will be developed (e.g. the extent of dry sand is reduced to 20 m wide at high tide). Where a feasible alternative sand source has been identified, design and approval documentation will be prepared to enable implementation once triggers are reached: • Environmental assessment (REF) and determination under Part 5 of the *Environmental Planning and Assessment Act 1979.* • A Crown land licence for any works outside of the Council-managed Crown Reserve or for proposals that are not consistent with the reserve purpose (refer *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions*). • Approval/ concurrence from relevant agencies (DPIRD-Fisheries, DPIRD-Marine Parks, NPWS) as required. • Management of native title rights and interests (refer *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions*).				
Performance target	Alternative sand sources are identified for implementation as required.			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
Y1-1c: Implement sand nourishment	CVC	DCCEEW	$600,000	CEGP, CRIF, DRF, CVC

The sand nourishment strategy identified in *TaskY1-1a* and/or *Task Y1-1b* will be implemented once triggers are reached and funding is obtained (refer *Action FS1-1: Develop a CMP funding strategy*). An indicative sand placement area is shown in Figure 35 and will depend on the condition of the beach following an erosion event and the requirement for sand nourishment.

Figure 35: Indicative sand nourishment location – Yamba Main Beach

Performance target	Sand nourishment strategy implemented as required.

Action Y1-2: Replace/upgrade Yamba Main Beach seawall

Priority	High	**Timeframe**	Short - medium-term	**Stage 3 option**	Y8
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation, T47 - Reduced accessible beach at high tide due to coastal protection works				
Coastal mgt areas	CUA, CEA	**B/C distribution**	100% public		

Following concerns raised by the Yamba SLSC about the condition and suitability of the existing rock/ concrete revetment wall at Yamba Main Beach and damage caused to the wall during a storm event in 2009, CVC commissioned a report to investigate options for the replacement of the wall. The report (Royal HaskoningDHV, 2012) recommended a replacement rock armoured revetment with discrete banks of suspended concrete bleachers (large steps) incorporated in the face to provide for seating. To provide for seating and sunbaking (a preference of the SLSC members is to have stepped structures), the design proposes to incorporate discrete banks of suspended concrete bleachers into the face of the revetment (Figure 37 and Figure 38). This design will be reviewed and updated for community consultation and feedback.

Figure 36: Existing rock revetment – Yamba Main Beach

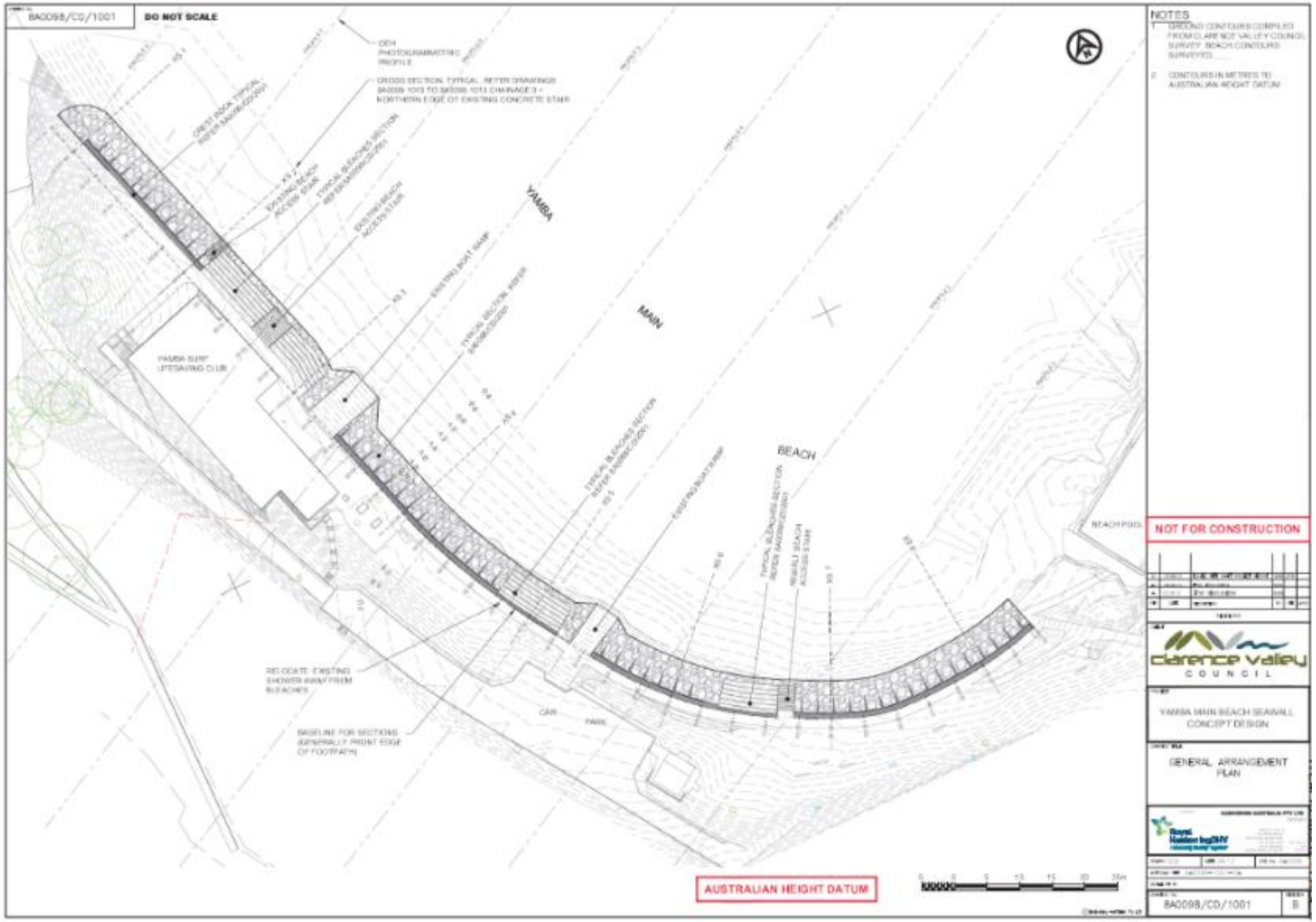

Figure 37: Yamba Main Beach seawall replacement - general arrangement plan
Source: Royal HaskoningDHV (2012)

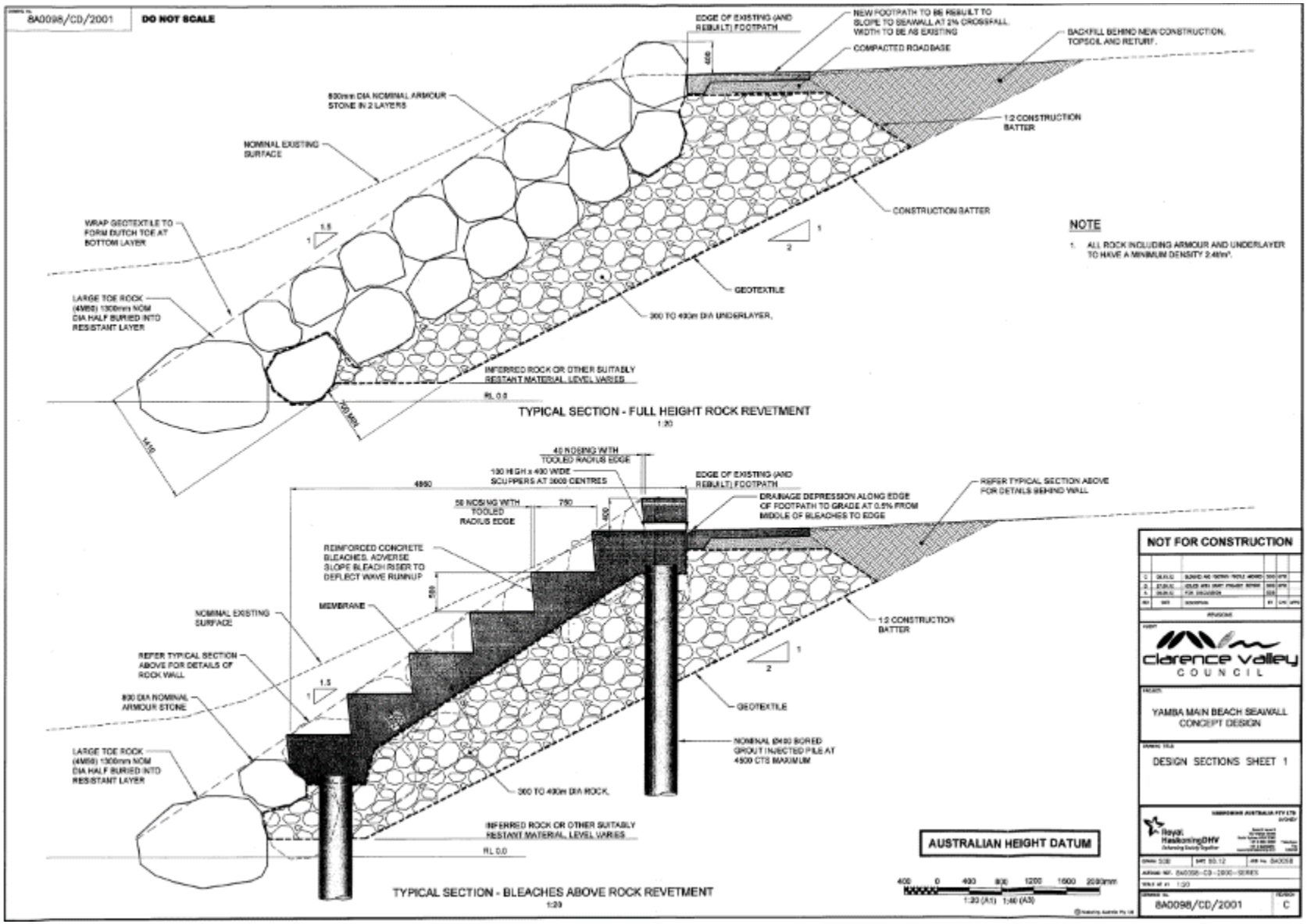

Figure 38: Yamba Main Beach seawall replacement – design sections

Source: Royal HaskoningDHV (2012)

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
Y1-2a: Review and update design and environmental assessment for replacement of Yamba Main Beach seawall	CVC	DCCEEW	$300,000	CVC, CEGP, CRIF

The design of the proposed coastal protection works (Royal HaskoningDHV, 2012) incorporates:

- A design back-beach breaking wave height of 2.4 m and associated peak wave period of approximately 14 seconds.
- Design wave runup level of RL 6.0 m.
- A typical structure slope of 1:1.5 (vertical to horizontal)
- Seawall toe excavated to a minimum of 0.5 m below the resistant surfaces
- Bleachers (stepped structures) intermittently located along the revetment (750 mm wide, separated by 500 mm high steps)
- Retention of the two sets of stairs near the SLSC with the existing stairs south of the carpark and amenities block replaced in the same location and incorporated into the bleachers.
- Continued use of the existing boat ramp for pedestrian access in the central area of the revetment.
- Stormwater drainage improvements.
- Relocation of the beach shower.

The design will be reviewed and updated in consultation with stakeholders (relevant agencies – DPHI-Crown Lands and DPIRD-Fisheries, the local community, Yamba SLSC and Yaegl TOAC). Opportunities for recreational enhancement including accessible pathways to the beach will be incorporated in the design. The replacement revetment wall design will also consider the raising of the ocean pool to manage ingress of sand and marine vegetation, and to fill the pool by pumping of fresh sea water (*Action Y3-1: Raising of Yamba ocean pool*). A preferred seawall concept design and maintenance regime will be developed. The necessary approvals for the replacement seawall will be obtained including:

- Environmental assessment and determination under Part 5 of the *Environmental Planning and Assessment Act 1979.*
- A Crown land licence for any works outside of the Council-managed Crown Reserve or for proposals that are not consistent with the reserve purpose (refer *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions*).
- Approval/ concurrence from relevant agencies (DPIRD-Fisheries, DPIRD-Marine Parks, NPWS) as required.
- Management of native title rights and interests (refer *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions*).

Performance target	Design review/ update and REF for replacement of Yamba Main Beach seawall completed by 30 June 2028.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
Y1-2b: Construct Yamba Main Beach seawall	CVC	DCCEEW	$2,400,000	CVC, CEGP, CRIF
The coastal protection works will be constructed in accordance with the design and approvals (Task Y1-2a) and sources of funding identified (refer *Action FS1-1: Develop a CMP funding strategy*).				
Performance target	Construction of Yamba Main Beach coastal protection works within 12 months of confirmed funding.			

10.2 Strategy Y2 - Manage Slope Instability

Geotechnical landslide hazards in the Yamba Point/ Pilot Hill area result from slope instability and the effects of coastal actions on the beach and dunes. Historical landslide events have been recorded since May 1921. CVC currently implements the Yamba Coastline Emergency Management Strategy to respond to the risks associated with rainfall events, which is aimed at identifying possible rainfall conditions that may trigger a landslide event. Some Pilot Hill landowners have raised concerns at the appropriateness of restrictions imposed by that strategy, which date back to the adoption of the *Yamba Coastline Management Study* in 1999. The last formal review of geotechnical risk at Pilot Hill was undertaken in 2018.

During Stage 2 of the CMP development, FSG Geotechnics and Foundations (2022) undertook a desktop study to collate the available information relating to land instability issues at Pilot Hill. The ongoing failures or movement that is being observed at Pilot Hill is a combination of superficial scouring and oversteepening due to concentrated stormwater flows, saturation, and failure of the upper sand materials due to perched water tables and slow creep movement of the entire sand dune mass, most likely on the interface with either the silty sand or sandy clay layer (FSG Geotechnics & Foundations, 2022). The site is subject to ongoing geological processes and in the long-term it is expected that the slope would continue to regress. Any rise in sea level is likely to accelerate this regression, particularly if waves are able to break directly onto the toe of the dune sand slope (FSG Geotechnics & Foundations, 2022).

Following the heavy rain during February and March 2022, a landslip occurred at the base of the embankment north of the SLSC and downslope of the Pacific Hotel. The spoil that slipped to the bottom of the embankment was found to contain waste materials (bricks, concrete, timber and asbestos). Fencing and signage were installed around the spoil area. Geotechnical advice is required before the area can be remediated (e.g. through stabilisation and encapsulation or bulk excavation).

Flinders Reserve was initially selectively cleared of the original vegetation to allow for camping and views of the ocean in the early 1900s. Since the 1990s the area has undergone regeneration, with revegetation undertaken to increase biodiversity and habitat and assist in stabilisation of the landslide risk zone. Some vegetation loss is attributed to poisoning by adjacent residences to maintain unrestricted ocean views, and subsequent clearing of dead and dangerous trees/ limbs to reduce risks to park users. This has left the associated bushland in poor condition, has enabled establishment of environmental weeds and poses a serious threat to stability of the slope and an elevated risk of erosion (CVC, 2021). Further vegetation removal may increase the landslide and erosion hazard potential in this area of the reserve. In 2017, CVC resolved to revegetate these areas of Flinders Park through a combination of natural and formalised

plantings that preserve the view. Landscaping plans for revegetation and slope treatment have been progressively implemented at Yamba Point (CVC, 2021).

CVC has also undertaken stormwater and sewerage improvements at Pilot Hill to reduce surface runoff and rehabilitate the overland drainage pathways with revegetation. CVC also recently extended the stormwater pipes from 2-8 Pilot Street down to the beach rock to reduce scour below these properties on Marine Parade.

The slope failure mechanisms are expected to be ongoing and while the current slope stability management strategy (rainfall monitoring) provides warning of antecedent rainfall indicating a high risk of slope failure (albeit not in real time), it does not provide resolution for CVC or stakeholders on how the slope can ultimately be stabilised or managed.

Action Y2-1: Yamba Interim Coastline Emergency Management Strategy

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	Y9
Threats addressed	T5 - Slope instability/ landslip				
Coastal mgt areas	CUA, CEA			**B/C distribution**	100% public

CVC currently implements the existing Yamba Interim Coastline Emergency Management Strategy (CVC, 2015) to respond to the risks associated with rainfall events, which is aimed at identifying possible rainfall conditions that may trigger a landslide event. Rainfall is monitored to identify conditions that may give rise to an emergency as follows:

- A period of prolonged high rainfall, up to periods of 90 days.
- A period of high daily rainfall after previous wet periods.
- High intensity rainfall over short periods of say 1 day or less.

Emergency rainfall warning levels were set up based on analysis of historic rainfall data. Two warning levels are assigned - an Orange Alert Level which was based on a 1 in 3-year rainfall event, and a Red Alert Level which is based on a 1 in 10-year rainfall. The levels are revised based on actual rainfall. The current warning levels are shown in Table 13. The warning levels apply to land within landslide risk zones extending from 2 Pilot Street south to the Pacific Hotel.

Table 13: Rainfall warning levels

Antecedent Rainfall Period (days)	Orange Alert Level (mm)	Red Alert Level (mm)
1	180	200
2	200	280
5	215	325
8	250	370
15	310	425
30	425	560
45	500	675
60	600	800
90	740	955

Source: JK Geotechnics (2021)

CVC monitors the rainfall and alerts landowners and occupants if rainfall levels meeting the orange or red levels are experienced or expected. It is the landowners' responsibility to monitor their premises for any evidence of movement once an alert advice has been notified and based on those observations and their own assessment of their building's structural design, make their own assessments as to whether further action is necessary. CVC also advises emergency service representatives who are responsible for evacuation advice. If the orange or red levels are reached, CVC will inspect drainage infrastructure to ensure that it is functioning properly. If the red alert level is reached, Marine Parade will be closed to vehicular traffic, the zig zag path will be closed to pedestrians and the Yamba SLSC, Main Beach and ocean pool will also be closed.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
Y2-1a: Continue to implement the Yamba Coastline Interim Emergency Management Strategy	CVC	DCCEEW	-	CVC
CVC will continue to implement the existing Yamba Coastline Interim Emergency Management Strategy for Pilot Hill until alternative management strategies are identified and implemented through *Action Y2-2: Additional geotechnical investigations and review of slope stability at Pilot Hill and Action Y2-3: Slope stability improvements at Pilot Hill.* Based on the results of the monitoring program review, additional geotechnical investigations, updated slope stability analysis and risk assessment and the status of remediation measures, the emergency management strategy (alert levels and application area) will be reviewed and updated to reflect the revised risk information.				
Performance target	Yamba Coastline Interim Emergency Management Strategy is implemented until alternative management strategies are implemented			

Action Y2-2: Additional geotechnical investigations and review of slope stability at Pilot Hill

Priority	High	**Timeframe**	Short-term	**Stage 3 option**	Y10
Threats addressed	T5 - Slope instability/ landslip				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	
During Stage 2, FSG Geotechnics and Foundations (2022) undertook a desktop study to collate the available information relating to land instability issues at Pilot Hill. The recommendations from that report will be implemented including desktop analysis, mapping, regular inspections/ surveys and review of the slope risk assessment.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
Y2-2a: Implement instrumentation and monitoring improvements	CVC	DCCEEW	$100,000	CEGP, CRIF, DRF, CVC
At the meeting of September 2022, CVC resolved (07.22.221) to implement the instrumentation and monitoring improvements identified in FSG Geotechnics and Foundations (2022) which include: • Review and repair of existing instrumentation - a review of the condition of the inclinometers using a small diameter pipe camera to assess whether the blockage within the inclinometers is the result of deflection, sedimentation and/or vandalism. The instruments will be rehabilitated. • Review monitoring program for piezometers and inclinometers. Repair of the existing inclinometers will be attempted, however, if this is not successful, then new devices will be installed (either manual, or automated in-place inclinometers linked to a cloud database). Remotely monitored GPS sensors will also be considered to monitor structure movements or surface movements at critical locations on the slope surface.				
Performance target	Instrumentation and monitoring improvements implemented by June 2026.			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
Y2-2b: Undertake geotechnical investigations	CVC	DCCEEW	$30,000	CEGP, CRIF, DRF, CVC

At the meeting of September 2022, CVC resolved (07.22.221) to implement the additional geotechnical investigations, analysis and assessment identified in FSG Geotechnics and Foundations (2022). The existing slope stability models for Pilot Hill have used circular failure mechanisms to model non-circular failure modes. Furthermore, the interface of the larger-scale failure mechanism requires further review. Additional geotechnical investigations targeting the location and strength of this interface will be undertaken including borehole and dilatometer testing (DMT). The boreholes can be used to collect samples of the interface materials for further laboratory testing, while the DMT can be used to determine in situ strength properties and zones of historical movement. These can be undertaken in conjunction with *Task Y2-2a*.

Following further geotechnical investigations, the slope stability analysis will be reviewed for updated subsurface profiles, strength and considering non-circular failure mechanisms. The slope risk assessment will be updated with:

- Review of monitoring data available.
- Consideration of slope drainage improvements and remediation works undertaken to underpin the Pacific Hotel.
- Consideration of any available geotechnical information (e.g. bore logs) available for the study area.
- Feedback from property owners regarding property information, any specialist geotechnical advice received, and improvements implemented.
- Damage to property and infrastructure in the study area.

The slope stability analysis and slope risk assessment will consider whether the rapid failure mechanism has sufficient thickness and extent to impact persons or property.

The required modifications to *Action Y2-1: Yamba Interim Coastline Emergency Management Strategy* will be identified based on the updated risk assessment. Any required mitigation measures to manage slope instability risks will be identified including remediation measures and planning controls (*Action PD1-1: Review and implement planning controls to address coastal hazards*).

In accordance with CVC resolution 07.22.221, this task will include assessment of the feasibility of releasing properties zoned LRZ2 “acceptable/tolerable risk” from the Yamba Coastline Interim Emergency Management Strategy for Pilot Hill, if these properties have submitted geotechnical reports to CVC.

The CZEAS will be amended to incorporate any modifications to the Yamba Interim Coastline Emergency Management Strategy.

Performance target	Geotechnical investigations completed by December 2027.

Action Y2-3: Slope stability improvements at Pilot Hill

Priority	High	**Timeframe**	Medium term	**Stage 3 option**	Y10
Threats addressed	T5 - Slope instability/ landslip				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	

At the meeting of September 2022, CVC resolved (07.22.221) to implement the recommended stormwater and landscaping remediation measures. The remediation measures identified by FSG Geotechnics and Foundations (2022) and other measures identified in *Action Y2-2: Additional geotechnical investigations and review of slope stability at Pilot Hill* will be implemented.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
Y2-3a: Implement slope stability measures at Pilot Hill	CVC	DCCEEW	$200,000	CEGP, CRIF, DRF, CVC

Measures to be implemented may include:

- Remediation of areas impacted by previous landslides.
- Short term slope remediation measures to manage stormwater flows. Damage from the 2022 rain events appear to be largely due to scour resulting from concentrated flows. Due to the sandy, non-cohesive nature of the subsurface materials, concentrated flows from stormwater pipes or roadways can rapidly eroded the subgrade, resulting in the shallow slope failures that have been observed. The following works may be undertaken:
  - Identification of sources of concentrated flows. Stormwater outlets and drainage paths may be lined with outlets to appropriate locations at the base of the slope.
  - There is currently no provision to capture and divert surface water drainage along Marine Parade and associated walking tracks. Surface water is concentrated along these alignments leading to scour of the subgrade and adjacent batter slopes. Kerbs directed to lined stormwater drains may be considered to minimise the risk of scouring and infiltration into the slope.
- Review landscaping on the headland and dunes to improve surface stability as part of *Action Y5-1: Coastal habitat restoration (Yamba)*. Historical photos of Pilot Hill show dense native vegetation covering the sand dunes. Over time these trees have been cleared for development and this has been a likely contributor to the slope instability that has been observed. For slope stability purposes, the vegetation provides important benefits including cohesion of the upper 0.5 m to 1.0 m of the slope profile, where the roots are present and provide protection against instability caused by surface scouring. In the short term the existing vegetation cover will be maintained as far as reasonably practicable, but in the long-term, advice will be sought on suitable, deep root species, to repopulate the dune system and improve the surface stability.
- Other measures identified in *Action Y2-2: Additional geotechnical investigations and review of slope stability at Pilot Hill.*

Performance target	Slope stability measures implemented by June 2029

10.3 Strategy Y3 – Recreational Improvements

Action Y3-1: Raising of Yamba ocean pool

Priority	Medium	**Timeframe**	Medium term	**Stage 3 option**	-
Threats addressed	T3 - Tidal/ coastal Inundation				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	

The Yamba ocean pool is located on the rock platform at the southern end of Main Beach (Plate 7). It is partly within Flinders Park reserve and partly on adjoining Crown land. The pool walls are made of concrete slabs and the structure rendered. Refurbishment of the pool was undertaken in 2019 to repair holes and cracks in the slab floor causing water level to drain, and sand to penetrate the base. The pool is currently in fair overall condition, however the concrete wall on the eastern side of the pool is too low which allows sand, aquatic vegetation and marine animals to be washed into the pool during high tides and wave events. This is an expensive operational and maintenance issue for CVC (CVC, 2021). The eastern wall (approximately 40 m) will be raised (nominally 1.5 m) as identified in the Flinders Park PoM (CVC, 2021). Coastal hazard assessment information prepared for the CMP will be considered in the design.

Plate 7: Yamba ocean pool (November 2021)

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
Y3-1a: Design and approvals for raising of Yamba ocean pool	CVC	DCCEEW	$100,000	CEGP, CBP, CRIF, CVC
The design will be prepared in consultation with stakeholders (relevant agencies – DPHI-Crown Lands and DPIRD-Fisheries, the local community, Yamba SLSC and Yaegl TOAC). The design will consider the replacement seawall (*Action Y1-2: Replace/upgrade Yamba Main Beach seawall*) and accommodate pool and ocean access requirements. The necessary approvals for the works will be obtained including: • Environmental assessment (REF) and determination under Part 5 of the *Environmental Planning and Assessment Act 1979.* • A Crown land licence for any works outside of the Council-managed Crown Reserve or for proposals that are not consistent with the reserve purpose (refer *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions*). • Approval/ concurrence from relevant agencies (DPIRD-Fisheries, DPIRD-Marine Parks, NPWS) as required. • Management of native title rights and interests (refer *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions*).				
Performance target	Design and REF for raising of Yamba ocean pool completed by 30 June 2029.			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
Y3-1b: Construct raised eastern wall of Yamba ocean pool	CVC	DCCEEW	$500,000	CEGP, CBP, CRIF, CVC
The raising will be constructed in accordance with the design and approvals (Task Y3-1a) and sources of funding identified (refer *Action FS1-1: Develop a CMP funding strategy*).				
Performance target	Construction of pool raising within 12 months of confirmed funding.			

Action Y3-2: Extension of the existing pathway from Yamba Main Beach to Pilot Hill

Priority	Medium	**Timeframe**	Long-term	**Stage 3 option**	Y11
Threats addressed	T34 - Limited pedestrian access, T35 - Informal pedestrian access				
Coastal mgt areas	CUA, CEA			**B/C distribution**	100% public

Existing public accessways between Pilot Hill and Yamba Main Beach are (Figure 39):

- Footpath/ shared use paths along the western side of Pilot Street and in front of the Pacific Hotel on the eastern side of Pilot Street.
- The zig-zag path from Pilot Street down to Main Beach.
- Vehicular access along Marine Parade to the Yamba SLSC.
- A pathway and stairs from Marine Parade to the Yamba SLSC.
- Footpath/ shared use paths from Marine Parade and Queen Street to Convent Beach and Yamba Point.
- An emergency vehicular access track/ walking track from the SLSC north to no 12 Pilot Street and the unformed section (grass bench) of Marine Parade.
- An informal walking track from the unformed end of Marine Parade to Pilot Hill which is mown.

There is currently no formal pedestrian access from Pilot Hill to Yamba Main Beach (the “missing link” on Figure 39). In 2011, CVC investigated the development of a coastal walkway from Turners Beach at Yamba south to Angourie Reserve and Yuraygir National Park at Angourie Point (Gondwana Consulting, 2011) as an initial step in the development of a concept plan for a Yamba to Angourie Coastal Walk. This study presented the issues and constraints associated with a walking track from Pilot Hill to Main Beach including access and routing constraints associated with high tides or large swells, the need to provide emergency management/ service access, slope/ land stability issues and terrain constraints.

The section north of the Pilot Street properties on Pilot Hill is part of Flinders Park Reserve with CVC as Crown Land Manager. The section below the Pilot Street and Marine Parade properties is road reserve. The bushland to the south of Pilot Hill above Yamba Main Beach is within the Yamba Hill Landslide Risk Zone and is subject to *Action Y2-1: Yamba Interim Coastline Emergency Management Strategy*. The *Plan of Management - Community Land, Crown Reserves and other Public Places* (CVC, 2023a) includes an action to construct tracks/ paths to provide pedestrian linkages to enable connectivity with multiple parks/ reserves throughout the LGA (e.g. Angourie/ Yamba Coastal walk). The *Plan of Management for Flinders Park* (CVC, 2021) includes an action to design and construct the section of the coastal walkway between Pilot Hill and Turners Beach along the escarpment (Action 2.4.4, CVC, 2021) based on the Gondwana Consulting (2011) study. The pathway from Main Beach to Pilot Hill would assist in achieving the objectives for the reserves and facilitate a coastal recreational pathway in this part of Yamba which will link and provide improved access between Main Beach, Pilot Hill and Turners Beach.

Improved beach access in the Clarence Valley was a consistent theme in community consultation to develop CVC’s *Disability Inclusion Action Plan 2023-2026.* However, due to the grade, this section of the path is likely to require steps and therefore may not accommodate disabled or bike access.

Figure 39: Existing accessways at Main Beach and Pilot Hill, Yamba

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
Y3-2a: Develop the "missing link" pathway design and prepare environmental assessment and approval documentation	CVC	DCCEEW	$50,000	CEGP, CBP, CRIF, CVC
Options to complete the "missing link" will be reviewed and updated in consultation with stakeholders (relevant agencies – DPHI-Crown Lands and DPIRD-Fisheries, adjacent landholders, the local community, Yamba SLSC and Yaegl TOAC). A preferred option will be developed. The necessary approvals will be determined and obtained which may include: • Environmental assessment (REF) and determination under Part 5 of the *Environmental Planning and Assessment Act 1979.* • A Crown land licence for any works outside of the Council-managed Crown Reserve or road reserve or for proposals that are not consistent with the reserve purpose (refer *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions*). • Approval/ concurrence from relevant agencies (DPIRD-Fisheries, DPIRD-Marine Parks, NPWS) as required. • Management of native title rights and interests (refer *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions*).				
Performance target	Design and REF for pathway extension completed by 30 June 2033.			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
Y3-2b: Construct the "missing link" pathway	CVC	DCCEEW	$500,000	CEGP, CBP, CRIF, CVC
The pathway link will be constructed in accordance with the design and approvals (Task Y3-1a) and sources of funding identified (refer *Action FS1-1: Develop a CMP funding strategy*).				
Performance target	Construction of pathway extension within 12 months of confirmed funding and approvals.			

10.4 Strategy Y4 – Coastal Hazard Adaptation

While the primary coastal hazard at Yamba Main Beach is the stability of the high-crested cliffs, beach erosion and recession may occur with sea level rise and/or extreme wave events at the base of the cliffs. Although there is limited contemporary information to enable assessment of these hazards, previous studies have noted the beach erosion and subsequent inundation has occurred.

Action Y4-1: Monitor coastal hazards (Yamba Main Beach)

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	SA1, Y12
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	
A coastal hazard monitoring and reporting program will be implemented for Yamba Main Beach to assist in identifying changes to the coastal environment to inform decision making, management responses and community education.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
Y4-1a: Implement coastal hazard monitoring program	CVC	DCCEEW	$55,000	CEGP, CRIF, CVC

The coastal hazard monitoring program for Yamba Main Beach may include:

- Monitoring of beach profiles to assess impacts of erosion (volume of sand lost), the rate of shoreline recession, the effectiveness of coastal management actions, the exposed slope geometry and sand volumes and when triggers for action (*Action Y1-1: Sand nourishment (Yamba Main Beach)*, *Action EM1-1: Implement emergency response procedures*) are required. The beach profile will be surveyed using land-based, UAV (drone) and hydrographic techniques on a regular basis and following significant storm events, supplemented with publicly available photogrammetry.
- Comparison of beach profiles over time with reference to previous data.
- Monitoring and forecasting of dangerous water levels and wave conditions using publicly available tools (e.g. tide/ water level stations, tide prediction tables and wave forecasts).
- Ongoing monitoring and assessment of slope geometry including drone photography and LiDAR survey to catalogue changes in slope geometry and also potentially identify areas that may not be immediately noticeable by manual/ visual means. The flight path and photo locations (with the same orientation) from the February 2022 survey will be utilised to allow detailed assessment of the coastal processes, slope regression and movement. The monitoring regime will be reviewed based on the outcomes of *Task Y2-2a*.
- Community feedback relating to coastal hazard impacts.

Results of the monitoring program will be documented and reported on an annual basis to CVC and published on CVC's website (refer *Task PD1-1c: Coastal hazard webpage*). Reporting will include identification of any required management measures and/or modifications to the monitoring program.

Performance target	Coastal hazard monitoring program implemented by December 2025 and monitoring undertaken annually and following significant storm events.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
Y4-1b: Liaise with Yamba SLSC regarding operations at Yamba Main Beach and Turners Beach and management of coastal hazards	CVC	DCCEEW	-	CVC
CVC will liaise with Yamba SLSC regarding operations at Yamba Main Beach and Turners Beach and management of coastal hazards including outcomes from related CMP actions: • *Action Y1-1: Sand nourishment (Yamba Main Beach)* • *Action Y1-2: Replace/upgrade Yamba Main Beach seawall* • *Action Y2-1: Yamba Interim Coastline Emergency Management Strategy* • *Action Y2-2: Additional geotechnical investigations and review of slope stability at Pilot Hill* • *Action Y2-3: Slope stability improvements at Pilot Hill* • *Action Y3-1: Raising of Yamba ocean pool* • *Action Y3-2: Extension of the existing pathway from Yamba Main Beach to Pilot Hill* • *Action Y4-1: Monitor coastal hazards*				
Performance target	Consultation with Yamba SLSC as required.			

Action Y4-2: Ongoing upgrade of Yamba Main Beach seawall

Priority	Medium	**Timeframe**	Ongoing	**Stage 3 option**	SA28
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession				
Coastal mgt areas	CUA, CEA	**B/C distribution**	100% public		
Ongoing upgrade of the existing seawall is required to maintain the design performance and adapt to climate change including increases in sea level until the replacement seawall is constructed.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
Y4-2a: Maintain upgraded seawall	CVC	DCCEEW, DPHI-Crown Land	$200,000	CEGP, CRIF, CVC
Implement the upgrade regime identified in *Task Y1-2a*.				
Performance target	Ongoing upgrade of seawall as required.			

10.5 Strategy Y5 – Coastal Habitat Restoration

Action Y5-1: Coastal habitat restoration (Yamba)

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	SA12, SA13, SA14
Threats addressed	T9 - Invasive weeds, T12 – Coastal vegetation damage, T35 - Informal pedestrian access, T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users				
Coastal mgt areas	CUA, CEA			**B/C distribution**	100% public
Habitat restoration activities within Council-managed Crown reserves at Yamba which may include weed management, revegetation, access control, signage and education will be undertaken when funding is available to assist in stabilising the headland and dunes, provide protection from coastal hazards and enhance the biodiversity values and recreational amenity. CVC will continue to support coordination of local environmental/ community groups undertaking dune rehabilitation, revegetation and habitat restoration activities on Council-managed land and community Landcare nurseries to undertake coastal revegetation and habitat restoration activities.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
Y5-1a: Weed management and coastal habitat restoration (Pilot Hill)	CVC	DCCEEW, Landcare	$440,000	CEGP, CRIF, CVC, Landcare, ET, IAS, SOS

CVC, as the local control authority responsible for administering the *Biosecurity Act 2015,* will continue to manage weeds at Flinders Park and Pilot Hill (Figure 40), particularly lantana (*Lantana camara*) and bitou bush (*Chrysanthemoides monilifera rotundata*). This will include routine inspections to identify priority weed infestations, weed treatment and supporting the community to prevent the establishment of new weeds. CVC will continue to source funding for weed management from Government funding/ grants to supplement internal resources for weed management.

CVC will prepare and implement a coastal habitat restoration and vegetation management plan for Pilot Hill which may include but is not limited to works locations, implementation details such as a weed management regime, species to be used for revegetation, public access management, dune stabilisation, educational signage, monitoring and maintenance requirements. Key objectives are the management of high visitation areas, preservation of the iconic outlook location, maintenance of formalised pedestrian access and the protection of high value coastal vegetation (*Themeda* (native grasses) on the headland.

Figure 40: Priority coastal habitat restoration area – Flinders Park and Pilot Hill (Lot 7307, DP1147276)

Performance target	Reduction in environmental weeds within targeted areas as determined through formal and informal monitoring.

Figure 41: CMP actions – Yamba Main Beach and Pilot Hill

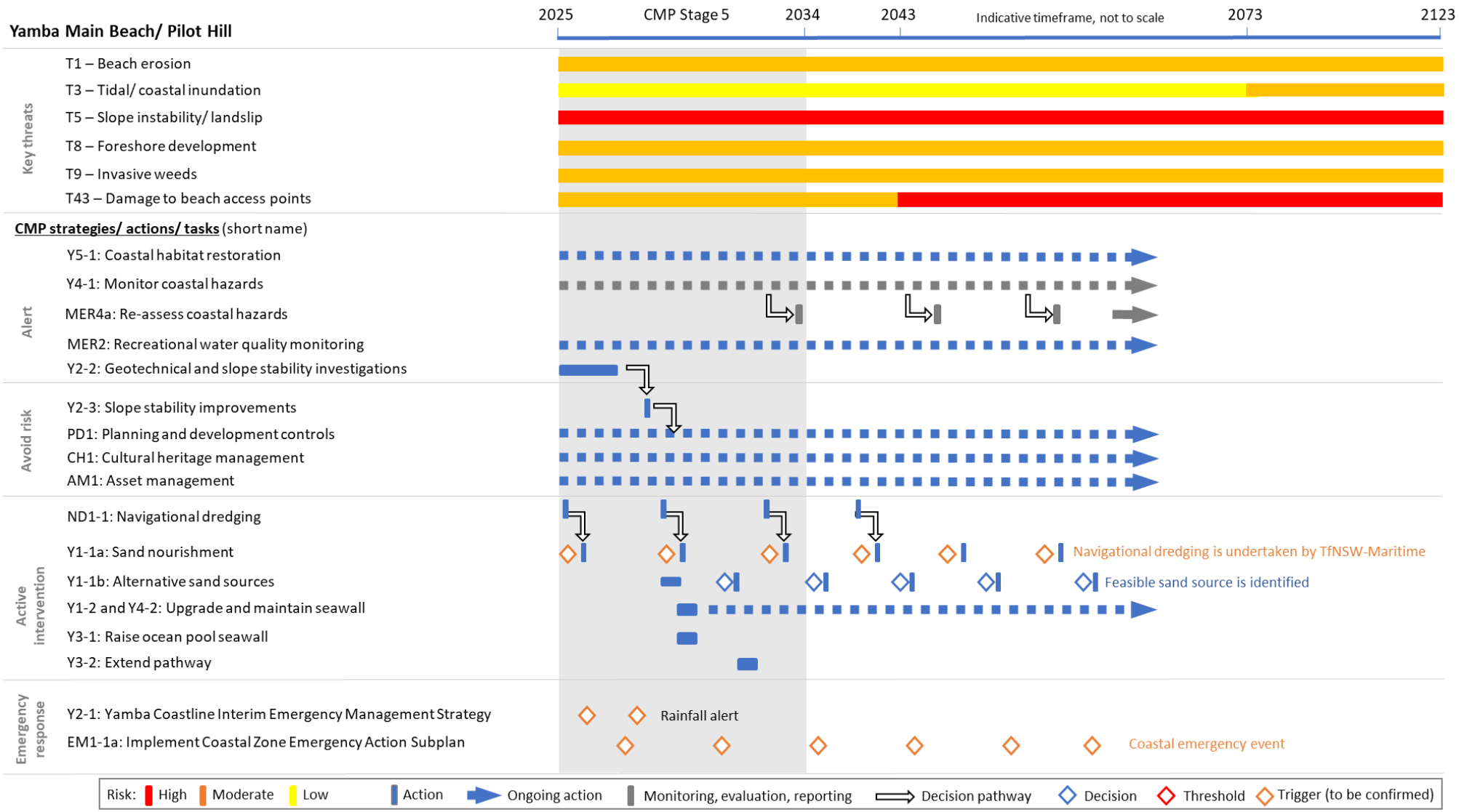

Figure 42: Adaptive management approach - Yamba Main Beach and Pilot Hill

11. MANAGEMENT ZONE – CONVENT BEACH (CB)

The strategies, actions and tasks to be implemented at Convent Beach are discussed in the following sections. CMP actions are listed in Table 14, shown on Figure 44 and the adaptive management approach is provided in Figure 45.

Table 14: CMP actions – Convent Beach

Strategies/ actions	Tasks	Threats addressed	CMP section
Strategy CB1 - Manage Slope Instability			
Action CB1-1: Additional geotechnical investigations and review of slope stability at Convent Beach	CB1-1a: Undertake geotechnical investigations	T5 - Slope instability/ landslip	11.1
Strategy CB2 – Coastal Hazard Adaptation			
Action CB2-1: Monitor coastal hazards (Convent Beach)	CB2-1a: Implement coastal hazard monitoring program	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation	11.2
Strategy CB3 – Coastal Habitat Restoration			
Action CB3-1: Coastal habitat restoration (Lovers Point and Pippi Beach)	CB3-1a: Coastal habitat restoration (Lovers Point and Pippi Beach)	T9 - Invasive weeds, T12 – Coastal vegetation damage, T35 - Informal pedestrian access, T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users	11.3

11.1 Strategy CB1 - Manage Slope Instability

Infrastructure at Convent Beach includes houses/ apartments, pathways and Ocean Street. A large historical landslide occurred in the slope in front of the Craigmore Apartments in 1999 and the entire section of the slope is subject to ongoing hillside erosion processes that may lead to localised or more significant instability (JK Geotechnics, 2021). No instrumentation, monitoring data or investigation data are available for Convent Beach and *Action Y2-1: Continue to implement the Yamba Coastline Emergency Management Strategy* does not apply to Convent Beach.

Action CB1-1: Additional geotechnical investigations and review of slope stability at Convent Beach

Priority	Medium	**Timeframe**	Short-term	**Stage 3 option**	CB8
Threats addressed	T5 - Slope instability/ landslip				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	
Action description and expected outcome					
During Stage 2, FSG Geotechnics and Foundations (2022) undertook a desktop study to collate the available information relating to land instability issues at Convent Beach. The recommendations from that report will be implemented including desktop analysis, mapping, regular inspections/ surveys and review of the slope risk assessment.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
CB1-1a: Undertake geotechnical investigations	CVC	DCCEEW	$30,000	CEGP, CRIF, CVC
Geotechnical investigations will include (FSG Geotechnics and Foundations, 2022): • Slope risk assessment for damage to property and infrastructure in the area. • Identification of any required mitigation measures to manage slope instability risks. Planning controls (*Action PD1-1: Review and implement planning controls to address coastal hazards*) will ensure that future construction conforms with the site requirements and that any new structures contain elements that will resist damage to the structure from earth movements in the slope.				
Performance target	Geotechnical investigations completed by June 2027.			

11.2 Strategy CB2 – Coastal Hazard Adaptation

While the primary coastal hazard at Convent Beach is the stability of the high-crested cliffs, beach erosion and recession may occur with sea level rise and/or extreme wave events at the base of the cliffs. Although there is limited contemporary information to enable assessment of these hazards, previous studies have noted that beach erosion has occurred.

Action CB2-1: Monitor coastal hazards (Convent Beach)

Priority	Medium	**Timeframe**	Ongoing	**Stage 3 option**	SA1
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	
A coastal hazard monitoring and reporting program will be implemented for Convent Beach to assist in identifying changes to the coastal environment to inform decision making, management responses and community education.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
CB2-1a: Implement coastal hazard monitoring program	CVC	DCCEEW	$45,000	CEGP, CRIF, CVC

The coastal hazard monitoring program for Convent Beach may include:

- Monitoring of beach profiles to assess impacts of erosion (volume of sand lost), the rate of shoreline recession, the effectiveness of coastal management actions, the exposed slope geometry and sand volumes and when triggers for action are required (*Action EM1-1: Implement emergency response procedures)*. The beach profile will be surveyed using land-based, UAV (drone) and hydrographic techniques on a regular basis and following significant storm events, supplemented with publicly available photogrammetry.
- Comparison of beach profiles over time with reference to previous data.
- Monitoring and forecasting of dangerous water levels and wave conditions using publicly available tools (e.g. tide/ water level stations, tide prediction tables and wave forecasts).
- Ongoing monitoring and assessment of slope geometry including drone photography and LiDAR survey to catalogue changes in the slope geometry and also potentially identify areas that may not be immediately noticeable by manual/visual means. The flight path and photo locations (with the same orientation) from the February 2022 survey will be utilised to allow detailed assessment of the coastal processes, slope regression and movement.
- Community feedback relating to coastal hazard impacts.

Results of the monitoring program will be documented and reported on an annual basis to CVC and published on CVC's website (refer *Task PD1-1c: Coastal hazard webpage*). Reporting will include identification of any required management measures and/or modifications to the monitoring program.

Performance target	Coastal hazard monitoring program implemented by December 2027 and monitoring undertaken annually and following significant storm events.

11.3 Strategy CB3 – Coastal Habitat Restoration

Action CB3-1: Coastal habitat restoration (Lovers Point and Pippi Beach)

Priority	Medium	**Timeframe**	Ongoing	**Stage 3 option**	SA12, SA13, SA14
Threats addressed	T9 - Invasive weeds, T12 – Coastal vegetation damage, T35 - Informal pedestrian access, T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users				
Coastal mgt areas	CUA, CEA	**B/C distribution**	100% public		

Habitat restoration activities within Council-managed Crown reserves at Lovers Point and Pippi Beach, which may include weed management, revegetation, access control, signage and education will be undertaken when funding is available to assist in stabilising dunes, provide protection from coastal hazards and enhance the biodiversity values and recreational amenity. CVC will continue to support coordination of local environmental/ community groups undertaking dune rehabilitation, revegetation and habitat restoration activities on Council-managed land and community Landcare nurseries to undertake coastal revegetation and habitat restoration activities.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
CB3-1a: Weed management and coastal habitat restoration (Lovers Point and Pippi Beach)	CVC	DCCEEW, Landcare	$470,000	CEGP, CRIF, CVC, Landcare, ET, IAS, SOS

CVC, as the local control authority responsible for administering the *Biosecurity Act 2015,* will continue to manage weeds at South Head Park (Lovers Point), Pippi Beach Reserve and Dolphin Park (Figure 43), particularly lantana (*Lantana camara*) and bitou bush (*Chrysanthemoides monilifera rotundata*). This will include routine inspections to identify priority weed infestations, weed treatment and supporting the community to prevent the establishment of new weeds. CVC will continue to source funding for weed management from Government funding/ grants to supplement internal resources for weed management.

CVC will prepare and implement a coastal habitat restoration and vegetation management plan for South Head Park (Lovers Point), Pippi Beach Reserve and Dolphin Park which may include but is not limited to works locations, implementation details such as a weed management regime, species to be used for revegetation, public access management, dune stabilisation, educational signage and monitoring and maintenance requirements. Key objectives are the management of high visitation areas, preservation of the iconic outlook location, maintenance of formalised pedestrian access, management of bushfire risks, banksia dieback and the protection of high value coastal vegetation (*Themeda* (native grasses) on the headland.

Figure 43: Priority coastal habitat restoration area – Lovers Point (Lot 7072, DP 1116124), Pippi Beach and Dolphin Park (Lot 7026 and 7027, DP1114310)

Performance target	Development of coastal habitat restoration and vegetation management plan to guide restoration works by June 2027. Increased coverage of native vegetation.

Figure 44: CMP actions – Convent Beach

Figure 45: Adaptive management approach - Convent Beach

12. MANAGEMENT ZONE – ANGOURIE (AN)

The strategies, actions and tasks to be implemented at Angourie are discussed in the following sections. CMP actions are listed in Table 15, shown on Figure 47 and the adaptive management approach is provided in Figure 48.

Table 15: CMP actions – Angourie

Strategies/ actions	Tasks	Threats addressed	CMP section
Strategy AN1 – Water Quality Management (Blue and Green Pools)			
Action AN1-1: Algal monitoring and education (Angourie pools)	AN1-1a: Algae monitoring (Angourie pools) AN1-1b: Review and update water quality signage (Angourie pools) AN1-1c: Investigate potential measures to manage algal blooms (Angourie pools)	T29 - Land/ waterway contamination	12.1
Strategy AN2 – Coastal Habitat Restoration			
Action AN2-1: Coastal habitat restoration (Angourie)	AN2-1b: Coastal habitat restoration (Angourie)	T9 - Invasive weeds, T12 – Coastal vegetation damage, T35 - Informal pedestrian access, T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users	12.2
Strategy AN3 – Coastal Hazard Adaptation			
Action AN3-1: Monitor coastal hazards (Spooky Beach)	AN3-1a: Implement coastal hazard monitoring program	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation	12.3

12.1 Strategy AN1 – Water Quality Management (Blue and Green Pools)

The Blue and Green Pools located within Angourie Reserve between Spooky Beach and Angourie Beach are two former quarry sites that are filled with fresh water. These pools are a popular recreational location and have been used for swimming and diving for well over a century. However, the pools are subject to blue-green algal blooms particularly over the warmer months, which can be toxic and the pools may not be suitable for swimming at all times. CVC used to monitor the level of algae in the Blue and Green Pools at Angourie on a regular basis over the summer months including signs on site (and a webpage) to indicate if

the pools are open to swimming. This program was discontinued due to the high level of staff resourcing required and the frequent occurrence of algal blooms. Signage is now used at the pools to warn swimmers of the risk of algal blooms during the warmer months.

Action AN1-1: Algal monitoring and education (Angourie pools)

Priority	High	**Timeframe**	Short-term	**Stage 3 option**	SA4
Threats addressed	T29 - Land/ waterway contamination				
Coastal mgt areas	CUA, CEA	**B/C distribution**	100% public		
An algae monitoring and education program will be reinstated to assess the risks associated with algal blooms with a view to reducing risks to swimmers during high-risk periods.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
AN1-1a: Algae monitoring (Angourie pools)	CVC	DCCEEW	$90,000	CVC, CEGP, CRIF
CVC will implement an algal monitoring program based on the following: • A review of historic water quality data. • Parameters: species, density (cells/100mL), biovolume (mm^3/L), Chlorophyll *a*, water temperature, nutrients, air temperature, antecedent rainfall. • Sampling period: October – April. • Sampling frequency: weekly. • Sampling locations: composite sample from three locations in each pool. Monitoring results will be compared with published guideline values (NHMRC, 2008). The program will initially be undertaken for a trial period of 2-3 years.				
Performance target	Algal monitoring program provides information to assess risks associated with algal blooms.			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
AN1-1b: Review and update water quality signage (Angourie pools)	CVC	DCCEEW	$6,000	CVC, CEGP, CRIF
Recommended improvements to signage will be implemented to more effectively communicate public health risks associated with blue green algae blooms as well as complementary actions to promote and educate pool users about the risks of blooms. Procedures for installation of signage will be developed based on results of algae monitoring (*Task AN1-1a*) or surrogate indicators as appropriate. CVC will review and update signage to convey risks associated with primary contact recreation at the Angourie pools including general risks and algal alerts (established through *Task AN1-1a*). Considerations will include text, images, symbols as well as placement and sizing to ensure effective communication of public health risks.				
Performance target	Signage provides adequate information on risks associated with algal blooms.			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
AN1-1c: Investigate potential measures to manage algal blooms (Angourie pools)	CVC	DCCEEW	$30,000	CVC, CEGP, CRIF
Based on the outcomes of monitoring undertaken in *Task AN1-1a*, CVC will investigate potential measures to manage algal blooms within the Angourie pools which may include continuation of the signage approach or other measures that minimise algal blooms.				
Performance target	Potential measures to manage algal blooms are investigated by June 2029.			

12.2 Strategy AN2 – Coastal Habitat Restoration

Action AN2-1: Coastal habitat restoration (Angourie)

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	SA12, SA13, SA14
Threats addressed	T9 - Invasive weeds, T12 – Coastal vegetation damage, T35 - Informal pedestrian access, T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users				
Coastal mgt areas	CUA, CEA			**B/C distribution**	100% public
Habitat restoration activities within Council-managed Crown reserves at Angourie which may include weed management, revegetation, access control, signage and education will be undertaken when funding is available to assist in stabilising slopes, provide protection from coastal hazards and enhance the biodiversity values and recreational amenity. CVC will continue to support coordination of local environmental/ community groups undertaking dune rehabilitation, revegetation and habitat restoration activities on Council-managed land and community Landcare nurseries to undertake coastal revegetation and habitat restoration activities.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
AN2-1b: Coastal habitat restoration (Angourie)	CVC	DCCEEW, Landcare	$310,000	CEGP, CRIF, CVC, Landcare, ET, IAS, SOS

CVC will prepare and implement a coastal habitat restoration and vegetation management plan for Angourie Blue/ Green pools (Figure 46) which may include but is not limited to works locations, implementation details such as a weed management regime, species to be used for revegetation, public access management, dune stabilisation, educational signage and monitoring and maintenance requirements. Key objectives are the management of high visitation areas, maintenance of formalised pedestrian access and the protection of high value coastal vegetation (threatened species).

Figure 46: Priority coastal habitat restoration area – Angourie pools (Lot 7316, DP1147960)

Performance target	Development of coastal habitat restoration and vegetation management plan to guide restoration works by June 2027. Increased coverage of native vegetation.

12.3 Strategy AN3 – Coastal Hazard Adaptation

Green point and the Angourie headlands provide a degree of protection to Spooky Beach from coastal hazards. Although there is limited contemporary information to enable assessment of coastal hazards at Spooky Beach, previous studies have noted that beach erosion has occurred.

Action AN3-1: Monitor coastal hazards (Spooky Beach)

Priority	Medium	**Timeframe**	Ongoing	**Stage 3 option**	SA1
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	
A coastal hazard monitoring and reporting program will be implemented for Spooky Beach to assist in identifying changes to the coastal environment to inform decision making, management responses and community education.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
AN3-1a: Implement coastal hazard monitoring program	CVC	DCCEEW	$45,000	CEGP, CRIF, CVC

The coastal hazard monitoring program for Spooky Beach may include:

- Monitoring of beach profiles to assess impacts of erosion (volume of sand lost), the rate of shoreline recession, the effectiveness of coastal management actions, the exposed slope geometry and sand volumes and when triggers for action (*Action EM1-1: Implement emergency response procedures*) are required. The beach profile will be surveyed using land-based, UAV (drone) and hydrographic techniques on a regular basis and following significant storm events, supplemented with publicly available photogrammetry.
- Comparison of beach profiles over time with reference to previous data where available.
- Monitoring and forecasting of dangerous water levels and wave conditions using publicly available tools (e.g. tide/ water level stations, tide prediction tables and wave forecasts).
- Community feedback relating to coastal hazard impacts.

Results of the monitoring program will be documented and reported on an annual basis to CVC and published on CVC's website (refer *Task PD1-1c: Coastal hazard webpage*). Reporting will include identification of any required management measures and/or modifications to the monitoring program.

Performance target	Coastal hazard monitoring program implemented by December 2027 and monitoring undertaken bi-annually and following significant storm events.

Figure 47: CMP actions – Angourie

Figure 48: Adaptive management approach - Angourie

13. MANAGEMENT ZONE - BROOMS HEAD AND LAKE CAKORA (BH)

The strategies, actions and tasks to be implemented at Brooms Head and Lake Cakora are discussed in the following sections. CMP actions are listed in Table 16, shown on Figure 64 and the adaptive management approach is provided in Figure 65 and Figure 66.

Table 16: CMP actions – Brooms Head and Lake Cakora

Strategies/ actions	Tasks	Threats addressed	CMP section
Strategy BH1 – Mitigate Coastal Erosion/ Shoreline Recession			
Action BH1-1: Formalise Brooms Head reserve dune rehabilitation works	BH1-1a: Dune fencing and revegetation	T1 - Beach erosion, T2 - Shoreline recession	13.1
Action BH1-2: Beach scraping (Brooms Head reserve)	BH1-2a: Investigate the feasibility of beach scraping and obtain the necessary approvals BH1-2b: Beach scraping and rehabilitation	T1 - Beach erosion, T2 - Shoreline recession, T47 - Reduced accessible beach at high tide due to coastal protection works	
Action BH1-3: Coastal protection works (stage 1, temporary)	BH1-3a: Stage 1 coastal protection works (temporary) – design and approvals BH1-3b: Acquisition of stage 1 coastal protection works (temporary) materials and equipment BH1-3c: Install stage 1 coastal protection works (temporary) BH1-3d: Decommission stage 1 coastal protection works (temporary)	T1 - Beach erosion, T2 - Shoreline recession, T47 - Reduced accessible beach at high tide due to coastal protection works	
Action BH1-4: Extension of Brooms Head Reserve revetment	BH1-4a: Review and update design and environmental assessment for Brooms Head reserve revetment extension BH1-4b: Construct extension of Brooms Head reserve revetment	T1 - Beach erosion, T2 - Shoreline recession, T47 - Reduced accessible beach at high tide due to coastal protection works	
Action BH1-5: Develop a preferred strategy for the management of public infrastructure and private land fronting Ocean Road, Brooms Head	BH1-5a: Investigate existing coastal protection works fronting Ocean Road private properties BH1-5b: Stakeholder consultation to identify the preferred strategy BH1-5c: Development and assessment of the preferred strategy	T1 - Beach erosion, T2 - Shoreline recession	

Strategies/ actions	Tasks	Threats addressed	CMP section
Strategy BH2 – Coastal Hazard Adaptation			
Action BH2-1: Monitor coastal hazards (Brooms Head)	BH2-1a: Implement coastal hazard monitoring program	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation, T4 - Entrance instability, T6 - Erosion of foreshores	13.2
Action BH2-2: Develop Brooms Head adaptive management strategy	BH2-2a: Develop adaptive management strategy (Brooms Head)	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation	
Action BH2-3: Ongoing upgrade of existing Brooms Head Reserve revetment	BH2-3a: Investigate existing revetment BH2-3b: Upgrade existing revetment	T1 - Beach erosion, T2 - Shoreline recession	
Strategy BH3 – Manage Slope Instability			
Action BH3-1: Additional geotechnical investigations and review of slope stability at Cakora Point	BH3-1a: Geotechnical investigations	T5 - Slope instability/ landslip	13.3
Strategy BH4 – ICOLL Management (Lake Cakora)			
Action BH4-1: On-site sewerage management (Brooms Head)	BH4-1a: OSSM inspection and compliance program BH4-1b: Investigate sustainable methods of effluent management	T24 - Pollution from on-site wastewater systems, T25 - Poor flushing of ICOLLs	13.4
Action BH4-2: ICOLL management strategy (Lake Cakora)	BH4-2a: Microbial source tracking BH4-2b: Investigate feasibility of artificial entrance management and develop an interim management regime BH4-2c: ICOLL management strategy	T24 - Pollution from on-site wastewater systems, T25 - Poor flushing of ICOLLs	

Strategies/ actions	Tasks	Threats addressed	CMP section
Strategy BH5 – Coastal Habitat Restoration			
Action BH5-1: Coastal habitat restoration (Brooms Head)	BH5-1a: Weed management (Lake Cakora) BH5-1b: Coastal habitat restoration (Brooms Head) BH5-1c: Coastal habitat restoration (Brooms Head Back Beach)	T9 - Invasive weeds, T12 – Coastal vegetation damage, T35 - Informal pedestrian access, T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users	13.5
Strategy BH6 – Recreational Improvements			
Action BH6-1: Enhance waterway access (Lake Cakora)	W5-1b: Enhance waterway access	T6 - Erosion of foreshores, T7 - Historic clearing of riparian vegetation and adjacent habitat	13.6

13.1 Strategy BH1 – Mitigate Coastal Erosion/ Shoreline Recession

Coastal erosion and shoreline recession are significant coastal hazards at Brooms Head. The Brooms Head Reserve (Council-managed Crown Reserve 65975) includes Brooms Head Holiday Park, public open space and surrounding natural areas (Lots 1 and 2 DP1095139). The southern portion of Brooms Head Reserve is flanked by a rock revetment constructed within the reserve. High tides and large swell continue to cause erosion at the northern end of Brooms Head Holiday Park (Plate 8). The erosion is exacerbated by seawall end effects downdrift of the existing seawall (Figure 49). The shoreline of the Brooms Head foreshore north of the existing seawall is expected to recede further through the holiday park towards Ocean Road and the southern bridge abutment with each storm event. This will threaten Ocean Road and the northern bridge abutment in frequent to rare events (10% EP) at present and frequent events in future (50% EP in 2043).

Plate 8: Erosion along northern end of Brooms Head Holiday Park (June 2022)

Figure 49: Existing rock revetment – Brooms Head foreshore

Fourteen houses along the eastern side of Ocean Road (Lots 1 - 14 Section 5 DP758167) are located within the lake entrance behind informal revetment works. These protection works appear to have been constructed by the private property owners on directly managed Crown land (Lot 7301 DP1140380) and include rock walls, sheeting, placement of waste materials, vegetation and vertical concrete walls along sections of the bank (Plate 9). The residential properties along Ocean Road foreshore are at risk from coastal erosion at present with frequent (50% EP) events and Ocean Road and the northern abutment of the bridge across Lake Cakora are at risk at present with rare (2% EP) events (assuming the existing revetment will not provide protection).

Plate 9: Informal protection works and private properties between the foreshore and Ocean Road

Action BH1-1: Formalise Brooms Head reserve dune rehabilitation works

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	BH6
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	

Loss of the dune system and vegetation between the reserve and the beach has exposed the foreshore to direct impacts of onshore wind (wind, salt spray, sand ingress) and associated loss of amenity value. During Spring 2023, there was significant community concern about sand being blown from the beach to the reserve, roads and residential properties with the strong north-easterly winds. On-ground works (including a combination of sand trap and barrier fencing) were constructed by CVC during November/December 2023. The existing dune stabilisation works at the northern end of the reserve (Plate 10) will be upgraded.

Plate 10: Dune rehabilitation at Brooms Head Reserve (January 2024)

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH1-1a: Dune fencing and revegetation	CVC	DCCEEW	$60,000	CEGP, CRIF, CVC

Install fencing to protect dune restoration area from damage due to pedestrian traffic. Remove weeds to allow native plants to establish and implement additional revegetation with endemic local species. Replace sand trap fencing with tight weave jute mesh further shoreward (Figure 50). Maintenance of rehabilitation works will be required until the extension of the foreshore revetment is completed.

Figure 50: Dune rehabilitation (Brooms Head foreshore)

Performance target	Dune fencing and revegetation completed by 30 June 2026. Ongoing maintenance as required to restore the affected areas of the foreshore

Action BH1-2: Beach scraping (Brooms Head reserve)

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	BH2
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T47 - Reduced accessible beach at high tide due to coastal protection works				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	

A significant amount of sand has accumulated along the beach in front of the Brooms Head Reserve since the erosion event in 2022. The volume of sand in the intertidal zone along Brooms Head beach fluctuates but based on recent beach profiles, small volumes of sand from the intertidal zone of Brooms Head beach seaward of the Brooms Head reserve are expected to be available for scraping every 2-4 years. The potential scraping zone (Figure 51) is located within Lot 7017 DP1108436 and below mean high water mark (MHWM). Further investigation and approvals are required to facilitate beach scraping works. Once the necessary approvals are in place and the required quantity of sand is available, beach scraping would be undertaken as an interim approach while *Action BH1-4: Extension of Brooms Head Reserve revetment* is progressed. The aim is to replenish the beach and the erosion escarpment seaward of the northern end of the Brooms Head reserve in the short-term while planning for the extension of the foreshore revetment is completed. Any beach scraping works should complement the other coastal erosion mitigation actions to be implemented in this area.

Figure 51: Indicative beach scraping at Brooms Head to be accompanied by dune fencing and rehabilitation

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH1-2a: Investigate the feasibility of beach scraping and obtain the necessary approvals	CVC	DCCEEW	$50,000	CEGP, CRIF, DRF, CVC

The feasibility of beach scraping will be developed through survey of the beach profile and development of a concept including sand borrow and placement locations, sand quantities and characteristics, construction access, methods and equipment, dune rehabilitation, assessment of environmental, cultural and social impacts and stakeholder consultation with relevant agencies (DPHI-Crown Lands and DPIRD-Fisheries), the local community and Yaegl TOAC. A trigger to implement beach scraping would be developed based on analysis of the beach profiles e.g. when at least 10 m^3/m is available in the potential borrow zone. Ongoing monitoring of the beach profile will be required to identify when triggers are reached and assess coastal hazards and impacts (refer *Action BH2-1: Monitor coastal hazards*).

The necessary approvals will be determined and obtained which may include:

- Environmental assessment (REF) and determination under Part 5 of the *Environmental Planning and Assessment Act 1979.*
- A Crown land licence for any works outside of the Council-managed Crown Reserve or for proposals that are not consistent with the reserve purpose. CVC has requested a Crown Land status search to confirm the boundaries of the Brooms Head Reserve (refer *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions*).
- Management of native title rights and interests (refer *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions*).

Performance target	Beach scraping methodology and REF completed by December 2025

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH1-2b: Beach scraping and rehabilitation	CVC	DCCEEW	$200,000	CEGP, CRIF, DRF, CVC

Undertake beach scraping as developed in Task BH1-2a once defined triggers are reached. Beach scraping may also be required for reconstruction of the eroded foredune as part of *Action BH1-3: Coastal protection works (stage 1, temporary)* and *Action BH1-4: Extension of Brooms Head Reserve revetment*.

Performance target	Beach scraping is implemented in accordance with agreed sand scraping strategy.

Action BH1-3: Coastal protection works (stage 1, temporary)

Priority	High	**Timeframe**	Short-term	**Stage 3 option**	SA31, SA32
Threats addressed	T1 - Beach erosion				
Coastal mgt areas	CUA, CEA	**B/C distribution**	100% public		

The current risk of coastal erosion at Brooms Head reserve and Lake Cakora entrance is high (refer Section 5.5). Current erosion north of the existing rock revetment has caused the loss of sections of the Brooms Head Holiday Park and further recession through the holiday park towards Ocean Road is expected unless coastal protection works are in place. Ocean Road, including the bridge over Lake Cakora, is the only vehicular access to Brooms Head and is threatened by frequent to rare erosion events (10% EP) at present. Coastal hazards may also impact services within the road corridor.

The primary strategy for protection of Brooms Head reserve and the Lake Cakora entrance is *Action BH1-4: Extension of Brooms Head Reserve revetment* although it is acknowledged that design and approvals for the coastal protection works and confirmation of funding is required before the revetment extension can be completed. *Action BH1-1: Formalise Brooms Head reserve dune rehabilitation works* and *Action BH1-2: Beach scraping (Brooms Head reserve)* are the adopted interim approaches to restore the beach while the permanent coastal protection works are progressed. Despite these measures, there remains a risk that a coastal erosion event will result in additional loss of the foreshore reserve while these actions are progressed and may also reduce the effectiveness of the interim dune rehabilitation or beach scraping works if they have been implemented.

The impacts of extreme events will be managed in the short-term through *Action EM1-1: Implement emergency response procedures* including emergency coastal protection works (the installation of sandbags for 90 days) as identified in the CZEAS (Appendix 3). Stage 1 coastal protection works (temporary) including rock bags or sandbags may be required to protect the foreshore reserve and Ocean Road under the following circumstances (depending on the requirements at the time):

- Beach erosion threatens public assets for longer than 90 days.
- The design, approvals and funding and approvals and funding are not yet in place to undertake beach scraping (Task BH1-2b).
- *Action BH1-2: Beach scraping (Brooms Head reserve)* and other softer measures (*Action BH1-1: Formalise Brooms Head reserve dune rehabilitation works*) have been undertaken but public assets remain at risk from coastal hazards.
- The design, approvals and funding are not yet in place to construct the permanent coastal protection works (*Action BH1-4: Extension of Brooms Head Reserve revetment*).

The stage 1 coastal protection works (temporary) will effectively buy sufficient time to enable the permanent coastal protection works to be installed. Planning and design will be undertaken so that an acceptable stage 1 protection solution can be implemented when required. The installation of stage 1 coastal protection works (temporary) will trigger the finalisation of the planning and design of permanent (stage 2) coastal protection works (if not already completed). The stage 1 coastal protection works (temporary) will remain in place while the revetment extension, end control structure and new southern bridge abutment revetment (*Action BH1-4: Extension of Brooms Head Reserve revetment*) are constructed. The stage 1 coastal protection works (temporary) would be designed to be removable, and if permanent coastal protection works are not in place within 5 years, the stage 1 works will be removed.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH1-3a: Stage 1 coastal protection works (temporary) – design and approvals	CVC	DCCEEW	$40,000	CEGP, CRIF, DRF, CVC

Investigations and design of the stage 1 coastal protection works (temporary) including infrastructure protection requirements, confirmation of installation triggers, placement location, materials, placement surface, gradient, stockpile location and decommissioning triggers will be undertaken, guided by an appropriately qualified coastal or geotechnical engineer.

Approximate locations where stage 1 coastal protection works (temporary) will be considered are shown on Figure 52. These locations provide for protection of the foreshore reserve assets and Ocean Road. The exact location may be refined if an erosion scarp forms landward of the nominated locations, as guided by an appropriately qualified coastal and/or geotechnical engineer. An initial trigger for installation of the stage 1 coastal protection works (temporary) along the foreshore reserve is an active erosion scarp within 5 m of the Brooms Head Holiday park reserve access road (Figure 52). A temporary revetment may also be required if the southern abutment of Ocean Road bridge is undermined or outflanked by erosion within the entrance compartment. A temporary end control structure is also expected to be required to minimise the effects of wave reflection towards the properties within the Lake Cakora entrance compartment (north of the bridge) and the extent of any end effect by capturing northerly longshore sediment transport, similar to the permanent works (RHDHV, 2024). The potential locations of the stage 1 (temporary) coastal protection works generally mirror the design of the permanent coastal protection works and can remain in place while the permanent works are constructed (or other decommissioning triggers are reached, refer *Task BH1-3d*).

Typical design details are provided in Figure 53 (sandbags) and Figure 54 (rock bags). An initial minimum design standard is a 20-year average recurrence interval (ARI) storm event for a 5-year design life. The installation trigger, design criteria and construction method will be confirmed as part of this task.

Approvals for the Stage 1 coastal protection works (temporary) will be obtained which may include but are not limited to:

- Environmental assessment (REF) and determination under Part 5 of the *Environmental Planning and Assessment Act 1979.*
- A Crown land licence for any works outside of the Council-managed Crown Reserve or for proposals that are not consistent with the reserve purpose (refer *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions*).
- Approval/ concurrence from relevant agencies (DPIRD-Fisheries) as required.

Management of native title rights and interests (refer *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions*).

Figure 52: Potential locations for stage 1 coastal protection works (temporary) to be confirmed through design and approvals – Brooms Head

Source: Modified from RoyalHaskoningDHV (2024)

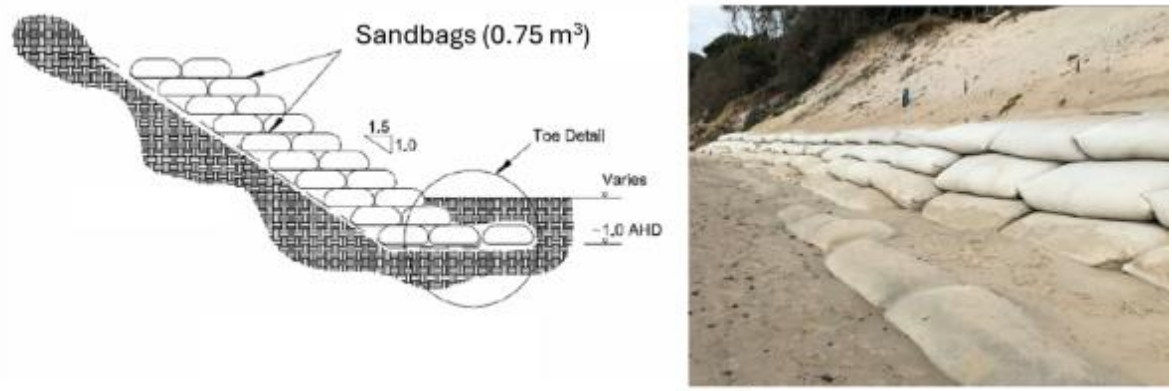

Figure 53: Sandbag revetment wall – left: typical cross-section (revetment height varies, adapted from Coghlan *et al.* (2009)), right: sandbag revetment wall at Clarkes Beach, Byron Bay (image: J. Carley)

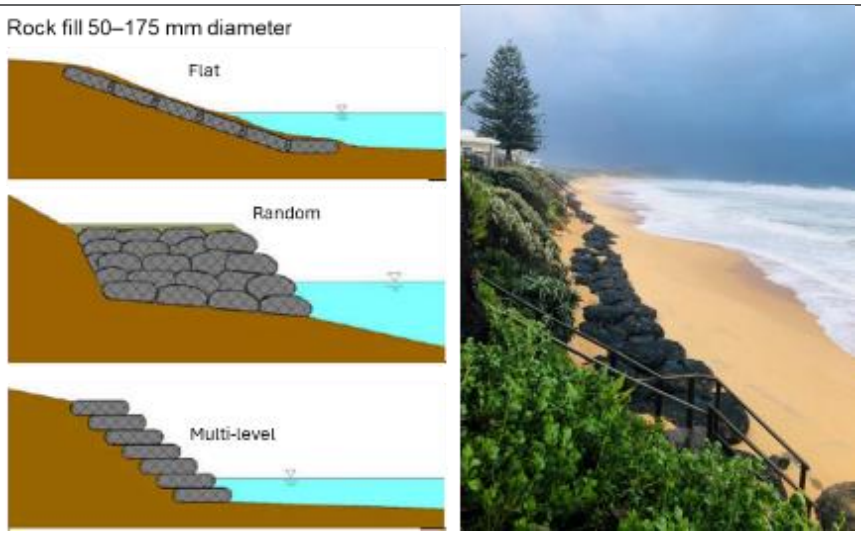

Figure 54: Rock bag revetment wall, left: typical rock bag deployment methods (Bluemont), right: rock bags at Wamberal Beach (image: Bluemont)

Performance target	Design and approval documentation for stage 1 coastal protection works (temporary) completed by June 2026 if permanent works have not yet commenced

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH1-3b: Acquisition of stage 1 coastal protection works (temporary) materials and equipment	CVC	DCCEEW	$75,000	CEGP, CRIF, DRF, CVC

CVC will acquire equipment and materials required for stage 1 coastal protection works (temporary) identified in *Task BH1-3a* which may include:

- Rock bags - bags, fill material and production frame.
- Sandbags - bags, sand fill (compatible with the placement location), filling frame and hand-held sewing machine.

The materials and equipment will be stockpiled in the locations determined through *Task BH1-3a.*

Performance target	Stage 1 coastal protection works (temporary) equipment and materials acquired by June 2026

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH1-3c: Install stage 1 coastal protection works	CVC	DCCEEW	$60,000	CEGP, CRIF, DRF, CVC

CVC will install stage 1 coastal protection works (temporary) as required when triggers confirmed through *Task BH1-3a* are reached. The sandbags/ rock bags will be filled either at the stockpile location (*Task BH1-3b*) or at the deployment site. The erosion scarp will be profiled to a slope of 1V:5H with a flat/ horizontal foundation for placement of the first course of sandbags/ rock bags. The sandbags/ rock bags will be moved into place with an excavator with a modified rock grab.

Coastal hazards will continue to be monitored in accordance with *Action BH2-1: Monitor coastal hazards (Brooms Head)*. In addition, an ongoing inspection and maintenance regime and impact management strategy will be implemented.

Recent numerical modelling of the permanent coastal protection works (RoyalHaskoningDHV, 2024) indicates that the proposed structures will have minimal adverse impact on beach erosion and similar outcomes are expected from the stage 1 coastal protection works. Impacts of the stage 1 coastal protection works (temporary) will be managed as follows:

- Safe public access to Brooms Head beach will be maintained. Access will be available via the realigned beach access track near the end control structure and the reserve between the foreshore reserve stage 1 protection works and the end control structure (Figure 52).
- Repairs to the stage 1 coastal protection works (temporary) will be undertaken when required and may include replacement of displaced or damaged sandbags/ rock bags, maintenance of the wall crest (if required due to slumping), grading of the surrounding escarpment to provide incipient stability, dune rebuilding and/or revegetation as advised by a qualified coastal or geotechnical engineer.
- Dune rehabilitation similar to *Action BH1-1: Formalise Brooms Head reserve dune rehabilitation works* within areas affected by coastal erosion will be undertaken if required.
- Reconstruction of the eroded foredune using beach scraping in accordance with *Action BH1-2: Beach scraping (Brooms Head reserve)* will be undertaken if required.
- Any works damaged by tides or waves will be repaired as soon as practicable after any storm conditions cease.

Performance target	Stage 1 coastal protection works (temporary) installed as required in response to triggers

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH1-3d: Decommission stage 1 coastal protection works	CVC	DCCEEW	$15,000	CEGP, CRIF, DRF, CVC
The stage 1 coastal protection works (temporary) are intended to remain in place until the erosion threat has abated (up to 5 years). CVC will decommission any stage 1 coastal protection works, with the concurrence of a geotechnical and/or structural engineer, if any of the following decommissioning triggers are reached: • A coastal event causes significant failure of the stage 1 coastal protection works (temporary) and where reinstatement is not feasible. • The Brooms Head foreshore reserve and beach has sufficiently recovered/ accreted. • *Action BH2-2: Develop Brooms Head adaptive management strategy* is implemented and the coastal protection works are no longer required. • Permanent coastal protection works (*Action BH1-4: Extension of Brooms Head Reserve revetment*) are installed. Advice from a geotechnical and/or structural engineer will be obtained, noting that removal of the coastal protection works may cause instability. If sandbags have been installed, all sandbags will be opened and the sand distributed on the beach, resulting in a reasonably even beach terrain, and sandbags will be removed from the beach. All rock bags and associated rocks will be removed. All areas disturbed during the placement, maintenance and removal of the works will be restored to a condition as close as possible to the condition that existed before the works were placed. Land, assets or vegetation damaged directly or indirectly by the stage 1 coastal protection works (temporary) will be restored to a condition as close as possible to the condition that existed before the works were installed.				
Performance target	Stage 1 coastal protection works (temporary) are decommissioned as required in response to decommissioning triggers			

Action BH1-4: Extension of Brooms Head Reserve revetment

Priority	High	**Timeframe**	Short-term	**Stage 3 option**	BH1
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T47 - Reduced accessible beach at high tide due to coastal protection works				
Coastal mgt areas	CUA, CEA	**B/C distribution**	100% public		

Due to the risk to public assets from storm erosion and long-term recession (including the reserve assets, road and bridge), the *Brooms Head and Lake Cakora Coastal Zone Management Plan* (CVC, 2017) included a priority action to extend the existing foreshore revetment at the northern end of Brooms Head Reserve to the southern bridge abutment (in the entrance compartment of Lake Cakora). These risks would not be mitigated by the low impact non-structural measures that only restore or enhance natural defences. *Action BH1-1: Formalise Brooms Head reserve dune rehabilitation works* and *Action BH1-2: Beach scraping (Brooms Head reserve)* would not replace the need for coastal protection works to protect the northern section of the Brooms Head Reserve. Dune rehabilitation and beach scraping are an interim approach to restore the beach while the extension of the revetment is progressed. *Action BH1-3: Coastal protection works (stage 1, temporary)* may be required to provide sufficient protection for a period of time to allow appropriate investigations, design, approvals and construction of the permanent coastal protection works at the same locations.

CVC has nominated the extension of the revetment wall north of the existing wall to Ocean Road bridge as a Significant Priority Project to be implemented once external funding is available. The existing rock revetment at the northern end of the reserve will be extended approximately 90 m along the foreshore (within R65975). The foredune would be protected by the rock revetment with a crest elevation at approximately 3.5 m AHD. Aluminium and fibre reinforced plastic beach access stairs would be constructed to improve public amenity. The existing 4WD beach access will be realigned to provide ongoing beach access.

A rock bag end control structure (within R65975 and potentially extending to Lot 7017 DP1108436) and rock revetment from the point to the southern bridge abutment is proposed to mitigate the risk of the bridge abutment being undermined or outflanked by erosion within the Lake Cakora entrance compartment. This has the following functions:

- To form a ‘pocket beach’ between the end control structure and the revetment to the south and to minimise the extent of any end effect by capturing northerly longshore sediment transport.
- To maintain beach amenity to the south, including the vegetated dune system in the entrance compartment ensuring pedestrian and vehicle beach accessway locations are secured.
- To minimise the effects of wave reflection from the constructed works towards the properties within the Lake Cakora entrance compartment (north of the bridge).

The length and orientation of the end control structure is complex and, as such, the end control structure is intended to be a ‘trial’ structure constructed using rock bags. This would ensure that the structure can be readily removed (and reused) or repositioned without leaving traces of rock on the beach, if unexpected detrimental impacts are observed. If it performs as expected, it would remain in place indefinitely.

A design of the proposed coastal protection works, including allowance for public foreshore access and stormwater management and an associated environmental impact assessment have been prepared (Royal HaskoningDHV, 2021b, Figure 55 to Figure 57). This design will be reviewed and updated based on the outcomes of numerical (RHDHV, 2024) and physical modelling being undertaken during 2024.

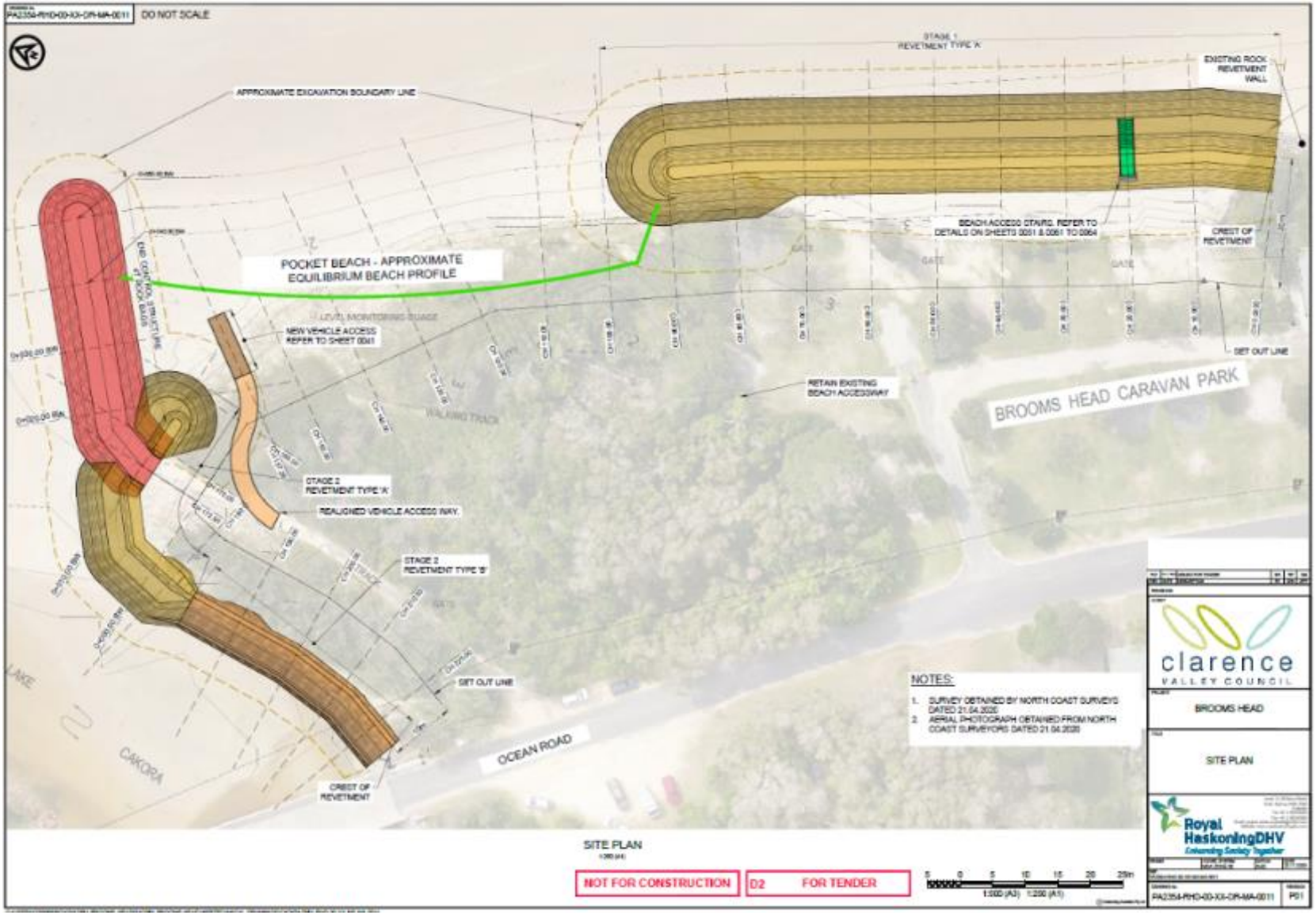

Figure 55: Brooms Head revetment extension - site plan

Source: Royal HaskoningDHV (2021a, 2021b)

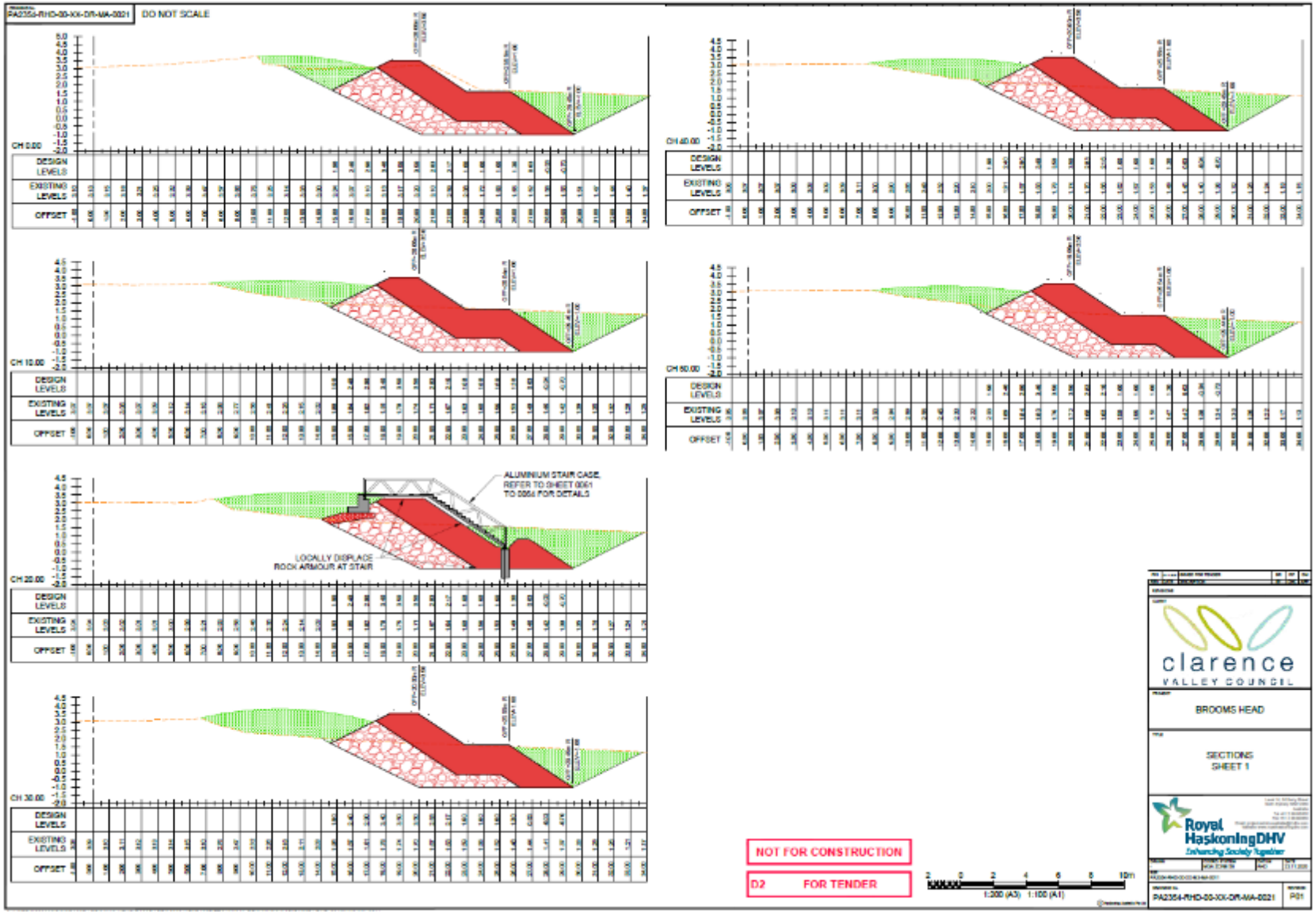

Figure 56: Brooms Head revetment extension – sections sheet 1

Source: Royal HaskoningDHV (2021a, 2021b)

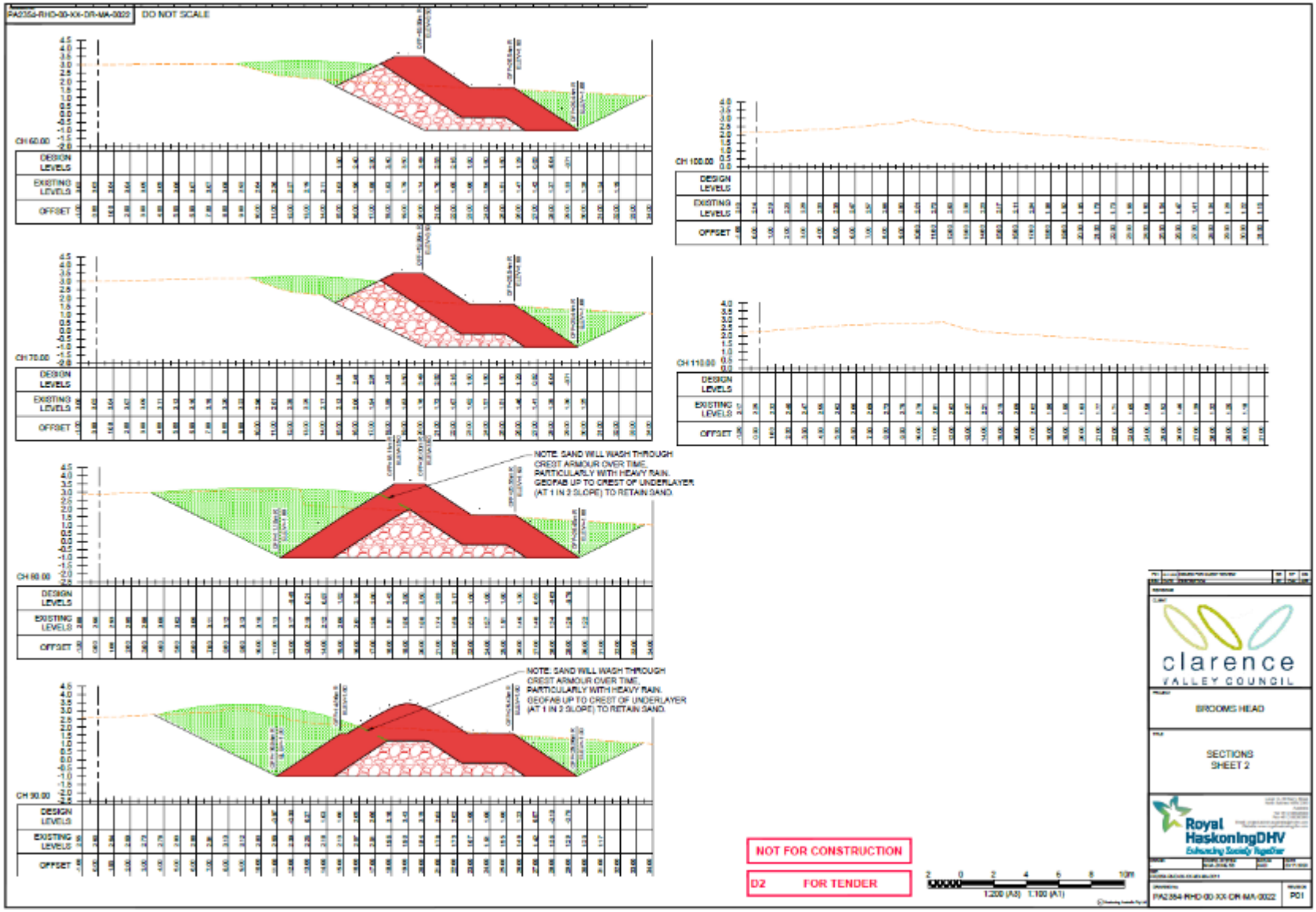

Figure 57: Brooms Head revetment extension – sections sheet 2

Source: Royal HaskoningDHV (2021a, 2021b)

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH1-4a: Review and update design and environmental assessment for Brooms Head Reserve revetment extension	CVC	DCCEEW	$200,000	CEGP, DRF, CRIF, CVC

CVC has commenced numerical and physical modelling of the proposed coastal protection works at Brooms Head. The principal objective of the modelling is to test the proposed engineering design and assist in furthering the understanding of the hydrodynamic processes and provide insights into whether the structure will perform as expected under extreme wave conditions, or whether any design modifications or optimisation should be made. The modelling will:

- Test the design and performance of the proposed structure, to ensure the delivery of the key design objectives:
  - Protection of at-risk areas of the holiday park and foreshore areas.
  - Minimise environmental and beach user impacts.
  - Minimise impacts on the Lake Cakora entrance.
  - Not give rise to increased coastal hazard risks to properties and infrastructure to the north of the Lake Cakora entrance.
- Identify improvements that could be made to the proposed design and in particular optimisation of the length and orientation of the proposed end control structure with regard to the design objectives.
- Confirm the performance of any proposed changes or improvements (if required) in meeting the key design objectives.

Recent numerical modelling of the permanent coastal protection works (RoyalHaskoningDHV, 2024) indicates that the proposed structures will have minimal adverse impact on beach erosion. CVC intends to commence physical modelling during 2024/25. Based on the outcomes of the modelling, the design of the proposed coastal protection works (Figure 55) will be reviewed and updated in consultation with stakeholders (relevant agencies – DPHI-Crown Lands and DPIRD-Fisheries and Yaegl TOAC).

The necessary approvals for the revised design will be determined and obtained which may include:

- Environmental assessment (REF) and determination under Part 5 of the *Environmental Planning and Assessment Act 1979.*
- A Crown land licence for any works outside of the Council-managed Crown Reserve or for proposals that are not consistent with the reserve purpose. CVC has requested a Crown Land status search to confirm the boundaries of the Brooms Head Reserve, refer *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions*).
- Approval/ concurrence from relevant agencies (DCCEEW, DPIRD-Fisheries, DPIRD-Marine Parks, NPWS) as required.
- Management of native title rights and interests (refer *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions*).

Performance target	Design review/ update and REF for Brooms Head Reserve revetment extension completed by 30 June 2026.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH1-4b: Construct extension of Brooms Head Reserve revetment	CVC	DCCEEW	$3,000,000	CEGP, CRIF, DRF, CVC,
The coastal protection works will be constructed in accordance with the design and approvals (Task BH1-3a) and sources of funding identified (refer *Action FS1-1: Develop a CMP funding strategy*). Coastal hazards will continue to be monitored in accordance with *Action BH2-1: Monitor coastal hazards (Brooms Head)*. In addition, an ongoing inspection and maintenance regime and impact management strategy will be implemented. Impacts of the coastal protection works will be managed as follows: • Safe public access to Brooms Head beach will be maintained. Access will be available via the realigned beach access track near the end control structure and the reserve between the foreshore reserve coastal protection works and the end control structure (Figure 55). • Repairs to the coastal protection works will be undertaken when required and may include replacement of displaced or damaged rock/ rock bags, maintenance of the wall crest (if required due to slumping), grading of the surrounding escarpment to provide incipient stability, dune rebuilding and/or revegetation as advised by a qualified coastal or geotechnical engineer. • Dune rehabilitation similar to *Action BH1-1: Formalise Brooms Head reserve dune rehabilitation works* within areas affected by coastal erosion will be undertaken if required. • Reconstruction of the eroded foredune using beach scraping in accordance with *Action BH1-2: Beach scraping (Brooms Head reserve)* will be undertaken if required. • Any works damaged by tides or waves will be repaired as soon as practicable after any storm conditions cease.				
Performance target	Construction of coastal protection works within 12 months of confirmed funding.			

Action BH1-5: Develop a preferred strategy for the management of public infrastructure and private land fronting Ocean Road, Brooms Head

Priority	High	**Timeframe**	Short – medium-term	**Stage 3 option**	BH4
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession				
Coastal mgt areas	CUA, CEA	**B/C distribution**	80% private, 20% public		

There has been no assessment of the efficacy of the existing informal revetment fronting the Ocean Road properties. The revetment provides a limited but important foreshore protection function. However, because of its relatively low crest level, inadequate design and underlying ground conditions, the wall is unlikely to provide protection from significant storm erosion events (SMEC, 2013). Future design of any coastal protection works needs to consider relevant guidelines including mitigation of impacts on coastal processes and maintenance of public access to the foreshore.

The current CEGP funding guidelines (DPE, 2023e) require information on the key beneficiaries of coastal protection structures on the open coast. Where the primary beneficiaries of the work are private landholders and there is no public infrastructure located between residential properties and the beach, 80% of the total project cost is to be funded by the private beneficiaries, 13% funded by NSW Government and 7% funded by local government.

Due to the complexity, challenges, community interest, potential high cost and uncertainty of funding, further assessment and the development of a strategy with stakeholders is required before committing to any approach for the management of public and private assets fronting Ocean Road, the required funding and funding mechanisms/ sources.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH1-5a: Investigate existing coastal protection works fronting Ocean Road private properties	CVC	DCCEEW, DPHI-Crown Lands	$100,000	Private landowners, CEGP, DRF, CVC

The efficacy of the existing coastal protection works will be investigated including assessment of ground conditions, and vulnerability to erosion, undermining and wave overtopping under the hazard scenarios considered in this CMP and will consider the outcomes of the numerical and physical modelling of the reserve revetment extension (refer *Action BH1-4: Extension of Brooms Head Reserve revetment*). Stage 2 of the CMP identified risks to public and private assets due to coastal erosion. Further assessment will be undertaken including costs of maintenance, repair or replacement according to the assessed risks. Based on this assessment, potential options for maintenance and/or upgrade of the coastal protection works and alternative management strategies will be identified including preliminary costs, social, cultural and environmental impacts, approval requirements and identification of beneficiaries, suitable for initial stakeholder consultation (*Task BH1-5b*) and further assessment (*Task BH1-5c*).

Performance target	Investigation into existing coastal protection works completed by December 2025

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH1-5b: Stakeholder consultation to identify the preferred strategy	CVC	DCCEEW, DPHI-Crown Lands	$20,000	CEGP, DRF, CVC
The outcomes of *Task BH1-5a* will be presented to stakeholders including affected property owners, land managers (CVC and DPHI-Crown Lands), Yaegl TOAC and potential approval agencies (DPIRD-Fisheries). A preferred strategy for the management of public infrastructure and private land fronting Ocean Road will be identified for further assessment (*Task BH1-5c*).				
Performance target	Stakeholder consultation completed by June 2026			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH1-5c: Development and assessment of the preferred strategy	CVC	DCCEEW, DPHI-Crown Lands	$200,000	Private landowners, CEGP, DRF, CVC
The preferred strategy for the management of public infrastructure and private land fronting Ocean Road identified in *Task BH1-5b* will be developed including design and approvals.				
Performance target	Preferred strategy for the management of public infrastructure and private land fronting Ocean Road completed by June 2027			

13.2 Strategy BH2 – Coastal Hazard Adaptation

The village of Brooms Head (south of Lake Cakora entrance) is vulnerable to coastal inundation with inundation extents increasing over time within the northern and eastern boundaries of the residential areas. However impacts in the short-term are expected to be manageable through emergency response measures. North of the entrance, inundation may potentially impact Ocean Road and residential areas at present with inundation becoming more frequent over time. By 2073, inundation of large parts of the village north and south of the entrance is expected to be more frequent. If inundation extents were allowed to increase, eventually the road access to Brooms 'head would be impacted. Impacts will be monitored to determine whether additional intervention is required.

Brooms Head is threatened by erosion/ recession from the east and inundation from the estuary to the west. While *Strategy BH1 – Mitigate Coastal Erosion/ Shoreline Recession* will address the shoreline recession to the east, inundation is predicted to impact the village over time, largely originating from the estuary. Beach erosion and entrance management measures such as the foreshore revetment would be ineffective in protecting the western and northern fringes of the village from inundation.

Action BH2-1: Monitor coastal hazards (Brooms Head)

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	SA1
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation, T4 - Entrance instability, T6 - Erosion of foreshores				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	
A coastal hazard monitoring and reporting program will be implemented for Brooms Head to assist in identifying changes to the coastal environment to inform decision making, management responses and community education.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH2-1a: Implement coastal hazard monitoring program	CVC	DCCEEW	$55,000	CVC, CEGP, CRIF

The coastal hazard monitoring program for Brooms Head may include:

- Monitoring of beach profiles to assess impacts of erosion (volume of sand lost), the rate of shoreline recession, the effectiveness of coastal management actions, the exposed slope geometry and sand volumes and when triggers for action (e.g. *Action BH1-2: Beach scraping (Brooms Head reserve), Action EM1-1: Implement emergency response procedures*) are required. The beach profile will be surveyed using land-based, UAV (drone) and hydrographic techniques on a regular basis and following significant storm events, supplemented with publicly available photogrammetry.
- Comparison of beach profiles over time with reference to topographic survey undertaken in 2022 and previous photogrammetry.
- Monitoring and forecasting of dangerous water levels and wave conditions using publicly available tools (e.g. tide/ water level stations, tide prediction tables and wave forecasts).
- Monitoring of water level in Lake Cakora using a water level monitoring station to assist with *Action BH4-2: ICOLL management strategy (Lake Cakora)*, monitoring of potential triggers for artificial intervention and to assist with community education. A suitable method will be developed and implemented e.g. a water level gauge installed on the bridge for manual reading or a level sensor with data logging capability.
- Stability of the Lake Cakora entrance including position and status (open/closed).
- Condition of the Lake Cakora banks including mapping of bank condition and erosion sites.
- Drone survey to map the slope geometry of Cakora Point and identify areas that may not be immediately noticeable during the inspection including the undercut areas of the cliff. The flight path and photo locations will be documented to allow detailed assessment of the coastal processes and historical rock fall that occurs over time.
- Community feedback relating to coastal hazard impacts.

Results of the monitoring program will be documented and reported on an annual basis to CVC and published on CVC's website (refer *Task PD1-1c: Coastal hazard webpage*). Reporting will include identification of any required management measures and/or modifications to the monitoring program.

Performance target	Coastal hazard monitoring program implemented by December 2025 and monitoring undertaken annually and following significant storm events.

Action BH2-2: Develop Brooms Head adaptive management strategy

Priority	High	**Timeframe**	Long-term	**Stage 3 option**	BH4
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation				
Coastal mgt areas	CUA, CEA, CWLRA		**B/C distribution**	100% public	

Management of the issues facing Brooms head village are complex and challenging and the development of a long-term strategy is required to address coastal hazard risks over the long-term. The strategy will incorporate the outcomes of related CMP actions and align with other management strategies including local disaster adaptation plans developed by the NSW Reconstruction Authority as part of the State Disaster Mitigation Plan.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH2-2a: Develop adaptive management strategy (Brooms Head)	CVC	DCCEEW, DPHI-Crown Land	$100,000	CEGP, DRF, CVC

The asset and village adaptive management strategy for Brooms Head will address:

- Road access to the village and surrounding areas.
- CVC services including water supply, sewerage and waste management.
- Other public services including power and telecommunications.
- Predicted impacts on public assets and development on the island due to coastal hazards.
- Triggers/ thresholds for adaptive management, access arrangements and methods.
- Planning and development controls.
- Cultural heritage management.
- Emergency response.

Key inputs to the strategy development will include the data and outcomes of the Brooms Head Reserve Plan of Management (in preparation) and related CMP actions:

- *Action AM1-1: Incorporate coastal hazard risks in CVC asset management planning*
- *Strategy BH1 – Mitigate Coastal Erosion/ Shoreline Recession* including *Action BH1-5: Develop a preferred strategy for the management of public infrastructure and private land fronting Ocean Road, Brooms Head* and the protection afforded by the adopted coastal protection works.
- *Action BH2-1: Monitor coastal hazards*.
- *Action BH4-1: On-site sewerage management (Brooms Head)*
- *Action BH4-2: ICOLL management strategy (Lake Cakora).*
- *Action CH1-1: Protection of cultural heritage.*
- *Action EM1-1: Implement emergency response procedures.*
- *Action PD1-1: Review and implement planning controls to address coastal hazards*
- *Action F1-1: Intertidal marine vegetation strategy (Clarence River Estuary).*
- *Action BH3-1: Additional geotechnical investigations and review of slope stability at Cakora Point.*

Strategy development will include identification of risks, development of management options and consultation with stakeholders including affected property owners, asset and land managers (CVC, DPHI-Crown Lands, NPWS, utilities), Yaegl TOAC and potential approval agencies (DPIRD-Fisheries). A preferred strategy will be identified for further assessment (as required).

Performance target	Brooms Head adaptive management strategy completed by June 2035

Action BH2-3: Ongoing upgrade of existing Brooms Head Reserve revetment

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	SA28
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	

Ongoing upgrade of the Brooms Head foreshore rock revetment (along the reserve to 1.1 km north of Cakora headland, Figure 49) is required to maintain the design performance and adapt to climate change including increases in sea level. No design details for the original revetment fronting the reserve are available and there has been no assessment of its efficacy. However, sections have failed in the past in conditions more benign than would be expected during a major storm event. Dislodged/ loose rocks have also been observed which suggest the rock armour is undersized. Although most of the original revetment has been rebuilt using locally available rock, the rock armour size and quality would not meet current design standards and hence the structure would be likely to fail during a major storm event (CVC, 2017).

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH2-3a: Investigate existing revetment	CVC	DCCEEW	$30,000	CEGP, CRIF, CVC

The efficacy of the existing revetment will be investigated including assessment of ground conditions, and vulnerability to erosion, undermining and wave overtopping under the hazard scenarios considered in this CMP and will consider the outcomes of numerical and physical modelling (refer *Action BH1-4: Extension of Brooms Head Reserve revetment*). Further assessment will be undertaken including nomination of a design standard, costs of repair or replacement according to the assessed risks. Based on this assessment, the required upgrade works will be identified including costs, social, cultural and environmental impacts and approval requirements. An ongoing inspection and upgrade regime will be developed.

Performance target	Efficacy of existing revetment completed by June 2026

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH2-3b: Upgrade existing revetment	CVC	DCCEEW, DPHI-Crown Land	$300,000	CVC, CEGP, CRIF

Implement the upgrade regime identified in *Task BH2-3a*.

Performance target	Initial upgrade undertaken by June 2037. Ongoing implementation as required.

13.3 Strategy BH3 – Manage Slope Instability

Cakora Point headland is exposed to ongoing geological processes from direct wave attack. This has resulted in the development of an extensive wave cut platform with cliffs and coves through the erosion of the headland. This method of erosion is the result of wave action on the rock that is concentrated on the tidal range resulting in undercutting of the slope which subsequently results in toppling failures and rock falls that develop along natural fractures (FSG Geotechnics and Foundations, 2022). Infrastructure at Cakora Point includes public pathways and a carpark with the nearest private property located 140 m from the headland. A previous study (SMEC, 2012) reported that previous rockfall events have occurred at the site as evidenced by scree material accumulated at the toe of the slope, but no specific landslide events have been identified. No instrumentation, monitoring data or investigation data is available for Cakora Point. A slope risk assessment was undertaken by SMEC (2012) and some recommendations have been implemented including warning signs and walkway barriers. *Action Y2-1: Continue to implement the Yamba Coastline Emergency Management Strategy* does not apply to Cakora Point.

Action BH3-1: Additional geotechnical investigations and review of slope stability at Cakora Point

Priority	Medium	**Timeframe**	Medium-term	**Stage 3 option**	BH5
Threats addressed	T5 - Slope instability/ landslip				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	
Action description and expected outcome					
During Stage 2, FSG Geotechnics and Foundations (2022) undertook a desktop study to collate the available information relating to land instability issues at Cakora Point. The recommendations from that report will be implemented including desktop analysis, mapping, regular inspections/ surveys and review of the slope risk assessment.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH3-1a: Geotechnical investigations	CVC	DCCEEW	$50,000	CEGP, CRIF, DRF CVC
Geotechnical investigations will include: • Desktop study using geo-located historical aerial photographs to assess and estimate the rate of slope regression, rock falls, and erosion of scree material at the toe of the slope when exposed to wave action and the probability of these events. Due to the nature of these images, it will only be applicable to regression of the crest as the toe regression will be hidden from view. • Inspection of the site to assess the progression of any previously identified slope hazards and to identify any new hazards. • Detailed mapping of the site and the creation of a catalogue of specific hazards on the site. Once specific hazards are identified any progression towards failure can be tracked through periodic inspections so that a proactive approach can be made towards management of hazards. • Review of the slope risk assessment provided in SMEC (2012) with actual failure rates identified through the regression analysis and site inspections. • Identification of any required mitigation measures to manage slope instability risks to the pathways and carpark.				
Performance target	Geotechnical investigations completed by June 2029.			

13.4 Strategy BH4 – ICOLL Management (Lake Cakora)

Lake Cakora is an ICOLL with an untrained entrance (Plate 11). Estuary processes were documented in various studies (e.g. SMEC, 2013) as part of the certified CZMP for Brooms Head and Lake Cakora (CVC, 2017). The water level in Lake Cakora is controlled by the height of the entrance berm. While the entrance is closed, the influence of tides on water level in the lake compared to catchment influences is unclear, and the entrance berm appears to be overtopped during high tides. Natural entrance breakouts are dependent on rainfall, lake volume, ocean tide levels, waves and berm height. During natural breakout, a meandering channel can form along the Ocean Road foreshore with breakout at the northern end of the entrance compartment or a more direct scour channel can form at the southern end of the entrance compartment.

Plate 11: Lake Cakora entrance (June 2022)

When the lake has been closed for long periods and water inundates yards and the oval, members of the community believe that artificial opening of the lake entrance is required. Informal opening of the entrance has been undertaken periodically by members of the public, typically when the water level is perceived to be too high within the lake or the water quality is perceived to be poor, particularly when this coincides with the summer holiday period (Hydrosphere Consulting, 2021). During summer 2023/24, the lake water level steadily increased resulting in flooding of the yards of residential properties along the southern shoreline as well as the northern section of the oval (Plate 12). The entrance opened in April 2024 (Plate 12) following a period of rainfall and potentially some assistance from members of the public. Although entrance opening and flushing of the lake by ocean waters may provide perceived water quality benefits for recreational use, there are expected to be impacts to the health of estuarine vegetation, fish and other aquatic species. Both artificial and natural opening can result in fish kills. Other members of the community support natural ICOLL fluctuations and do not want artificial openings to occur.

Plate 12: Top left: Lake Cakora and flooding of Brooms Head oval (April 2024), top right: artificial breakout in April 2024, bottom: low lake levels in April 2024 following artificial breakout

Source: top left and right - Derry Moroney Photography

The main reason for artificially opening an ICOLL entrance is to mitigate and reduce the impacts of flooding. When water levels rise in a closed ICOLL following rainfall this can lead to flooding of urban and rural development adjacent to the lake foreshore, including private properties, sewerage systems and open space areas. Artificial breaching of the entrance barrier may be undertaken to 'drain' the ICOLL to the ocean and lower water levels to relieve existing flooding of foreshore development and infrastructure or avoid the likely threat of flooding which would occur before the ICOLL entrance opens naturally. The trigger for artificially opening many ICOLLs (rather than let nature takes it course) is often a consequence of past developments located in low lying areas too close to the edge of the lake (DPIRD, 2024).

As the lake entrance is on Crown land, if the entrance was to be artificially opened by a public authority, a licence from DPHI-Crown Lands would be required under the *Crown Lands Management Act 2016* and approval/ concurrence from DPIRD-Fisheries would be required under the *Fisheries Management Act 1994*. DPIRD-Fisheries supports minimal interference with ICOLL entrance barriers and advocates natural processes being allowed to operate to the greatest extent possible. Artificial opening of the lake would not be supported by approval agencies unless CVC can demonstrate that the social, environmental and economic benefits greatly outweigh any potential adverse impacts.

For other ICOLLs, e.g. Belongil and Tallow Creeks in Byron Shire, the entrance management regime aims to mimic the opening and closing regime of the creeks as close as possible to natural. At those locations,

approval agencies do not support mechanical opening of the creeks, rather lowering the beach berm (using an excavator) is permitted to allow overtopping during a rainfall event.

Water level and salinity were previously (2010-2011) monitored using an automatic recorder in the lake. SMEC (2013) reported that the lowest dwelling floor level (south-west of the Ocean Road bridge) is approximately 2.6 m AHD and no dwellings are at risk from over-floor flooding. However, nuisance flooding affects yards and septic tank absorption trenches (e.g. when the lake level is 1.75 m AHD, water levels approach the yards of properties south of the entrance, west of Ocean Road). The elevated groundwater levels are likely to impact on the effectiveness of OSSM absorption trenches. The Stage 2 coastal hazard assessments included tidal and coastal inundation mapping (JBP, 2022) which indicate areas subject to tidal and coastal inundation from Lake Cakora.

Water quality in the lake is influenced by catchment runoff, the shallowness of the lake, entrance conditions and the degree of mixing and flushing of the lake waters. The community considers poor water quality to be a significant issue within Lake Cakora. Based on previous monitoring in 2009/10 and 2013, there are indications of poor water quality in the lagoon including elevated nutrient levels, poor clarity, algae and turbidity (Ryder *et al.,* 2014; SEED, 2023). Potential causes of poor water quality have been identified as:

- Functionality of village on-site wastewater management systems affected by intermittent flooding of effluent disposal sites adjacent to the lake. The risk to water quality from on-site wastewater management systems in the lake is likely to increase into the future due to climate change (increased inundation due to sea level rise) and further degraded systems.
- Urban stormwater runoff.
- Amplification of the effects of poor flushing. When the entrance to Lake Cakora is closed, higher water levels and reduced flushing times leads to poor water quality in the estuary due to the above pollutant sources.

The estuary health risk mapping (Dela-Cruz *et al*., 2019) suggests there are likely very high nutrient (total phosphorous and total nitrogen) loads from the south-east of the catchment.

An entrance management regime was proposed in the CZMP involving artificial breakout of Lake Cakora entrance during swimming season for recreational purposes if heavy rainfall continues over three or more days or the lake water level reaches 1.6 m AHD (400 mm from the underside of the bridge) without breaking out naturally. An entrance management strategy has not been developed for Lake Cakora.

Given the history of flooding, poor water quality episodes and incidence of illegal openings by members of the public, an ICOLL management strategy for the lake will be prepared to document estuary health, water quality objectives, flood mitigation measures, legislative requirements and improvement measures.

Action BH4-1: On-site sewerage management (Brooms Head)

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	LC2, LC3
Threats addressed	T24 - Pollution from on-site wastewater systems, T25 - Poor flushing of ICOLLs				
Coastal mgt areas	CUA, CEA, CWLRA		**B/C distribution**	100% public	

CVC implements an OSSM strategy within the study area which includes regular inspections of on-site systems at Brooms Head based on risk and issuing of follow up notices and requirements for further actions (e.g. either an 'Approval to Operate' where systems pass inspection or an 'Improvement Notice' where systems fail the inspection). Further investigations of OSSM systems in coastal villages with sensitive waterways such as Brooms Head will also be undertaken to determine a sustainable level of effluent disposal and the most suitable wastewater management methods for these specific areas.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH4-1a: OSSM inspection and compliance program	CVC	DCCEEW	-	CVC

The OSSM inspection and compliance program will continue to be implemented in accordance with CVC's OSSM Strategy.

Performance target	Full implementation of CVC's OSSM Strategy at Brooms Head.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH4-1b: Investigate sustainable methods of effluent management	CVC	DCCEEW	$30,000	CVC, CEGP

Further investigation into the sustainability of the effluent disposal regime at present and over the long-term will be undertaken considering sea level rise, OSSM design and location, lot sizes, effluent management, receiving water quality and uses to identify environmental and health implications and the most suitable wastewater management methods. Key inputs will include the data and outcomes of *Task BH4-1a*, *Action BH2-1: Monitor coastal hazards, Action BH4-2: ICOLL management strategy (Lake Cakora), Action* MER1: Estuary health monitoring program and *Action MER2: Monitoring of recreational water quality.* Areas at risk of flooding during elevated lake levels will be reviewed and potential OSSM upgrades will be identified for implementation once funding is obtained.

Performance target	Investigation into the sustainability of the effluent disposal regime completed by June 2027

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH4-1c: Implement OSSM upgrades	CVC	DCCEEW	$150,000	CVC, CEGP

The recommended OSSM strategy from *Task BH4-1b* will be implemented once funding is obtained.

Performance target	OSSM upgrades completed by June 2028

Action BH4-2: ICOLL management strategy (Lake Cakora)

Priority	High	**Timeframe**	Short-medium term	**Stage 3 option**	LC5
Threats addressed	T24 - Pollution from on-site wastewater systems, T25 - Poor flushing of ICOLLs				
Coastal mgt areas	CUA, CEA, CWLRA	**B/C distribution**	100% public		
The ICOLL management strategy will be developed to address potential risks from catchment flooding, urban stormwater and wastewater management systems. The strategy will incorporate the outcomes of related CMP actions and other management strategies and will include a targeted water quality assessment.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH4-2a: Microbial source tracking	CVC	DCCEEW	$10,000	CVC
Faecal indicator bacteria used in estuary health and recreational monitoring are common to all warm-blooded animals and it is not possible to differentiate between the animal sources of faecal matter (e.g. from humans, cattle, dogs, birds and other wildlife etc.). To conclusively attribute bacteria to any one source, microbial source tracking (e.g. DNA analysis) is required. A short-term microbial source tracking program will be undertaken to identify the extent and sources of faecal pollution and assist in directing management action. This will include sampling and analysis using DNA extraction and faecal source tracking for human-only sources of faecal matter. If sources are of human origin, this may indicate issues with sewerage infrastructure or potentially illegal camping/ parties etc.				
Performance target	Microbial source tracking completed by December 2026			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH4-2b: Investigate feasibility of artificial entrance management and develop an interim management regime	CVC	DCCEEW, NPWS, DPIRD-Fisheries, DPHI-Crown Lands	$60,000	CEGP, CVC

CVC will investigate whether an entrance management regime is feasible (i.e. whether artificial entrance management would be effective in managing community concerns and environmental management objectives for the lake). This will consider data from monitoring of lake water levels (*Task BH4-2b*), the nature and extent of associated flooding impacts and evidence of changes to water quality (especially nutrient and bacterial levels) obtained through *Task BH4-2a*, *Action BH2-1: Monitor coastal hazards (Brooms Head)*, *Action* MER1: Estuary health monitoring program and *Action MER2: Recreational water quality*. An interim strategy will be formulated for consultation with affected landholders, the community and approval agencies to provide a clear guide to where, when and under what conditions artificial open the lake entrance could be undertaken. Potential triggers for artificial intervention may include:

- A water level above which a breach is recommended (e.g. 1.6 m AHD).
- A water level range between which a breach is recommended if heavy rainfall is predicted (1.5 – 1.6 m AHD).
- A duration of high-water level and/or inundation over which a breach may be recommended (e.g. > 2 weeks).

Other considerations will include:

- Outcomes of *Action BH4-1: On-site sewerage management (Brooms Head*).
- Environmental considerations (e.g. impacts on foreshore ecology and shorebirds).
- Community education to guard against Illegal openings e.g. signs near the entrance warning people that unauthorised opening is illegal and may result in prosecution.

In the long-term, CVC will aim to reduce the need for artificial manipulation of the entrance by managing low-lying infrastructure surrounding the lake (e.g. OSSM systems) and adopting catchment management practices that:

- Reduce the inputs of nutrients and pollutants from point and diffuse sources.
- Prevent transfer of flood prone and riparian land on the margins of the lake into private ownership.
- Prevent the future development or subdivision of flood-prone and riparian lands by adopting appropriate zonings and buffers in planning instruments.
- Implement community awareness campaigns to gain broad based understanding and support for the environmentally responsible management of ICOLLs.

Performance target	Interim management regime developed by June 2028

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH4-2c: ICOLL management strategy	CVC	DCCEEW, NPWS, DPIRD-Fisheries, DPHI-Crown Lands	$70,000	CEGP, CVC

An ICOLL management strategy will be developed to document estuary health, water quality objectives, flood mitigation measures, legislative requirements, sea level rise adaptation and improvement measures. Key inputs will include the data and outcomes of *Action BH4-1: On-site sewerage management (Brooms Head)*, *Action BH2-1: Monitor coastal hazards, Task BH4-2a, Action MER2: Monitoring of recreational water quality* and the interim entrance management strategy identified in *Task BH4-2c.* The works may include environmental protection works (works associated with the rehabilitation of land towards its natural state or any work to protect land from environmental degradation, and includes bush regeneration works, wetland protection works, erosion protection works, dune restoration works and the like, but does not include coastal protection works) in areas that are also mapped as CWLRA shown on Figure 58.

Figure 58: Potential environmental protection works on Council-managed land in areas mapped as CWLRA – Lake Cakora

Performance target	ICOLL management strategy for Lake Cakora developed by June 2029

13.5 Strategy BH5 – Coastal Habitat Restoration

Action BH5-1: Coastal habitat restoration (Brooms Head)

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	SA12, SA13, SA14
Threats addressed	T9 - Invasive weeds, T12 – Coastal vegetation damage, T35 - Informal pedestrian access, T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users				
Coastal mgt areas	CUA, CEA, CWLRA	**B/C distribution**	100% public		
Habitat restoration activities within Council-managed Crown reserves at Brooms Head which may include weed management, revegetation, access control, signage and education will be undertaken when funding is available to assist in stabilising dunes, provide protection from coastal hazards and enhance the biodiversity values and recreational amenity. CVC will continue to support coordination of local environmental/ community groups undertaking dune rehabilitation, revegetation and habitat restoration activities on Council-managed land and community Landcare nurseries to undertake coastal revegetation and habitat restoration activities.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH5-1a: Weed management (Lake Cakora)	CVC	DCCEEW, Landcare	$100,000	CEGP, CRIF, CVC, Landcare, ET, IAS, SOS
CVC, as the local control authority responsible for administering the *Biosecurity Act 2015,* will continue to manage weeds at the Crown reserve north of Lake Cakora entrance (Figure 59), particularly lantana (*Lantana camara*) and bitou bush (*Chrysanthemoides monilifera rotundata*). This will include routine inspections to identify priority weed infestations, weed treatment and supporting the community to prevent the establishment of new weeds. CVC will continue to source funding for weed management from Government funding/ grants to supplement internal resources for weed management. Weed management works may include environmental protection works (works associated with the rehabilitation of land towards its natural state or any work to protect land from environmental degradation, and includes bush regeneration works, wetland protection works, erosion protection works, dune restoration works and the like, but does not include coastal protection works) in areas that are also mapped as CWLRA shown on Figure 60.				

Figure 59: Priority weed management – Lake Cakora (Lot 7302, DP1140380)

Figure 60: Potential coastal habitat restoration on Council-managed land in areas mapped as CWLRA – Lake Cakora

Performance target	Reduction in environmental weeds within targeted areas as determined through formal and informal monitoring.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH5-1b: Coastal habitat restoration (Brooms Head)	CVC	DCCEEW, Landcare	$540,000	CEGP, CRIF, CVC, Landcare, ET, IAS, SOS

CVC will prepare and implement a coastal habitat restoration and vegetation management plan for Brooms Head Reserve and adjoining reserves (Figure 61) which may include but is not limited to works locations, implementation details such as a weed management regime, species to be used for revegetation, public access management, dune stabilisation, educational signage (including information about the adjacent lagoon/intertidal rocky habitats) and monitoring and maintenance requirements. Key objectives are the management of high visitation areas, preservation of the iconic outlook location, maintenance of formalised pedestrian access and the protection of high value coastal vegetation and shorebird habitat. Coastal habitat restoration works may include environmental protection works (works associated with the rehabilitation of land towards its natural state or any work to protect land from environmental degradation, and includes bush regeneration works, wetland protection works, erosion protection works, dune restoration works and the like, but does not include coastal protection works) in areas that are also mapped as CWLRA shown on Figure 62.

Figure 61: Priority coastal habitat restoration area – Brooms Head Reserve (Lot 2, DP1095139)

Figure 62: Potential coastal habitat restoration on Council-managed land in areas mapped as CWLRA – Brooms Head

Performance target	Development of coastal habitat restoration and vegetation management plan to guide restoration works by June 2026. Increased coverage of native vegetation.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH5-1c: Coastal habitat restoration (Brooms Head Back Beach)	CVC	DCCEEW, Landcare	$310,000	CEGP, CRIF, CVC, Landcare, ET, IAS, SOS

CVC will prepare and implement a coastal habitat restoration and vegetation management plan for Brooms Head Back Beach (Figure 63) which may include works locations, implementation details such as a weed management regime, species to be used for revegetation, public access management, dune stabilisation, educational signage and monitoring and maintenance requirements. Key objectives are the restoration of sand blowout areas and the protection of high value coastal vegetation and associated access controls.

Figure 63: Priority coastal habitat restoration area – Brooms Head Back Beach (Lot 7015, DP1081893)

Performance target	Development of coastal habitat restoration and vegetation management plan to guide restoration works by June 2026. Increased coverage of native vegetation.

13.6 Strategy BH6 – Recreational Improvements

CVC is preparing a Plan of Management for Brooms Head Reserve. It is acknowledged that public access to the foreshore at Brooms Head can be improved and there has been community feedback on this issue. However, detailed site planning for the reserve and Brooms Head Holiday Park will be addressed in the Plan of Management, including pathways, car parking and amenities.

The community has also indicated the need for improved access to Lake Cakora which is addressed in this strategy.

Action BH6-1: Enhance waterway access (Lake Cakora)

Priority	Medium	**Timeframe**	Medium-term	**Stage 3 option**	-
Threats addressed	T6 - Erosion of foreshores, T7 - Historic clearing of riparian vegetation and adjacent habitat				
Coastal mgt areas	CUA, CEA	**B/C distribution**	100% public		
CVC will investigate opportunities to formalise and upgrade access to Lake Cakora (e.g. swimming, canoes) to enhance recreational opportunities and minimise bank erosion.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BH6-1a: Enhance waterway access	CVC	DCCEEW, NPWS, DPIRD-Fisheries	$70,000	CEGP, CBP, CRIF, CVC

CVC will investigate opportunities to enhance recreational access and activities in and adjacent to Lake Cakora. This will include:

- Consultation with approval agencies and the community.
- Analysis of needs and potential opportunities.
- Identification and design for priority locations for waterway access enhancement and associated facilities.
- Environmental assessment (REF) and determination under Part 5 of the *Environmental Planning and Assessment Act 1979.*
- Approval/ concurrence from relevant agencies (DPIRD-Fisheries, NPWS, DPHI-Crown Lands) as required.
- Management of native title rights and interests (refer *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions*).

The works will be constructed in accordance with the design and approvals (NPWS or other approval bodies) and sources of funding identified (refer *Action FS1-1: Develop a CMP funding strategy*).

Performance target	Priority works to enhance waterway access are implemented by June 2029.

Figure 64: CMP actions – Brooms Head and Lake Cakora

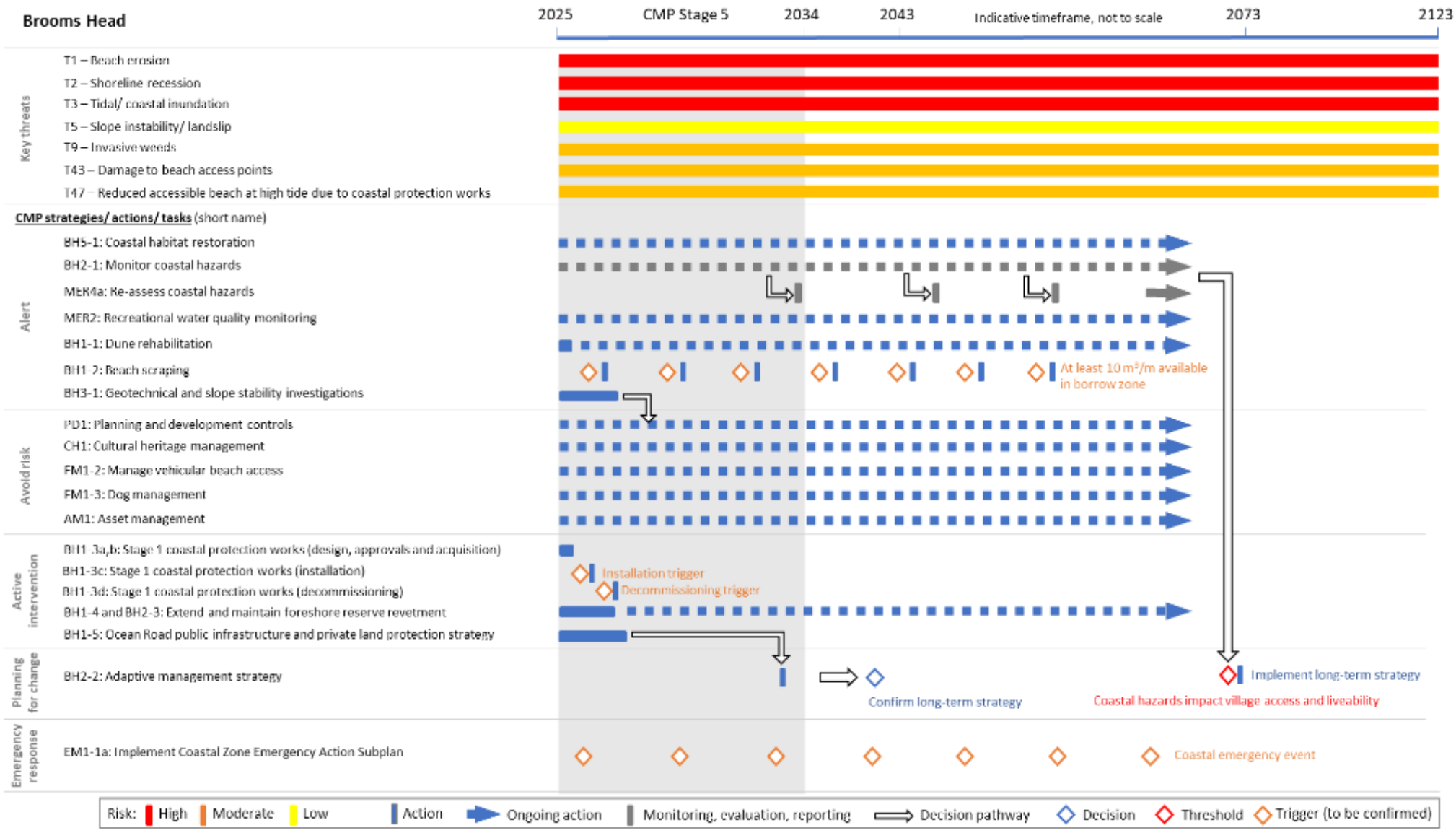

Figure 65: Adaptive management approach - Brooms Head

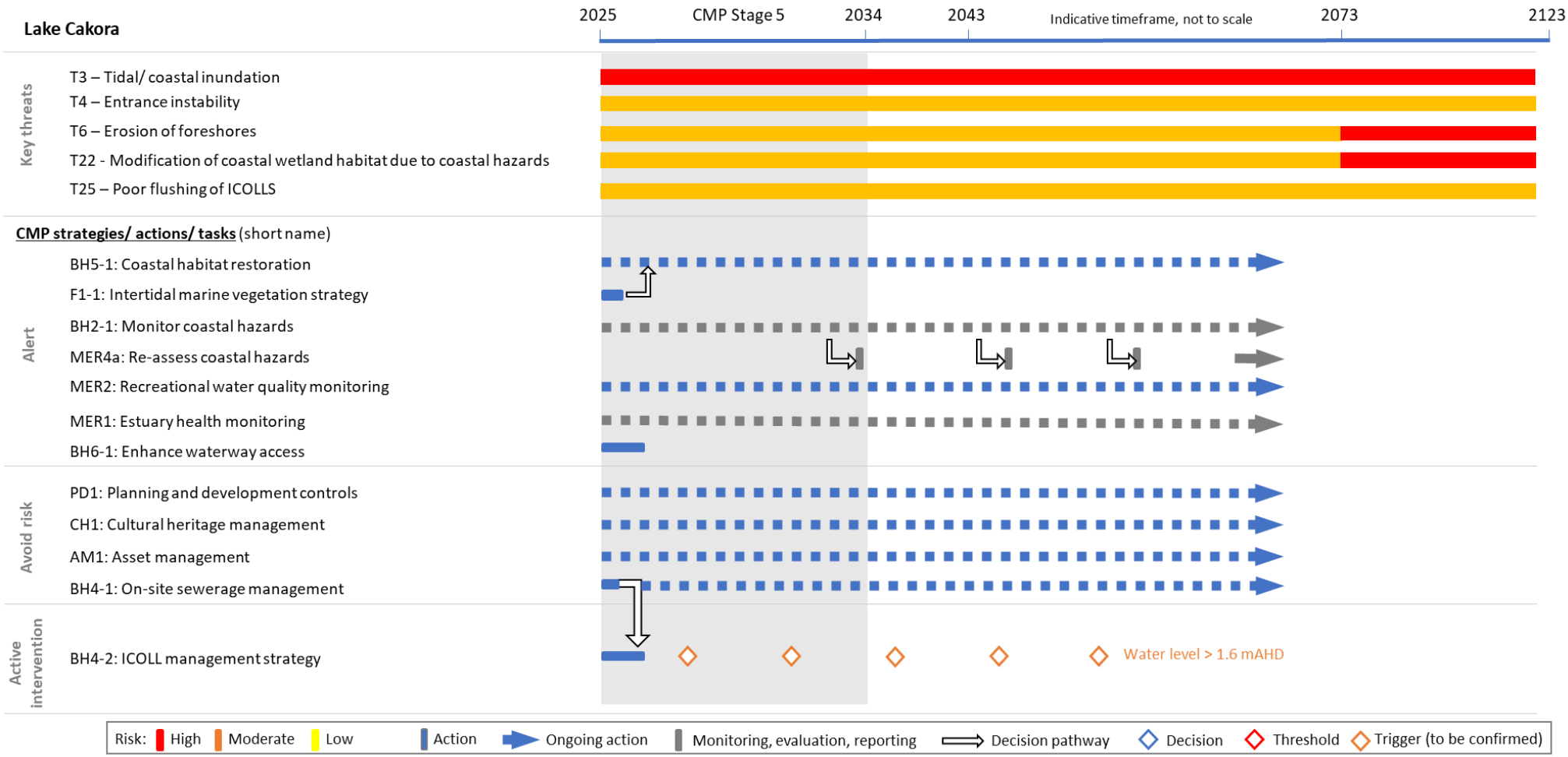

Figure 66: Adaptive management approach – Lake Cakora

14. MANAGEMENT ZONE – SANDON

The strategies, actions and tasks to be implemented at Sandon are discussed in the following sections. CMP actions are listed in Table 17, shown on Figure 68 and the adaptive management approach is provided in Figure 69.

Table 17: CMP actions – Sandon

Strategies/ actions	Tasks	Threats addressed	CMP section
Strategy S1 – Water Quality Management (Sandon River)			
Action S1-1: On-site sewerage management (Sandon village)	S1-1a: OSSM inspection and compliance program S1-1b: Microbial source tracking S1-1c: Investigate sustainable methods of effluent management S1-1d: Implement OSSM upgrades	T24 - Pollution from on-site wastewater systems, T25 - Poor flushing of ICOLLs	14.1
Strategy S2 – Coastal Hazard Adaptation			
Action S2-1: Monitor coastal hazards (Sandon village)	S2-1a: Implement coastal hazard monitoring program	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation, T4 - Entrance instability, T6 - Erosion of foreshores	14.2
Action S2-2: Develop Sandon village adaptive management strategy	S2-2a: Develop adaptive management strategy (Sandon village)	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation	
Strategy S3 – Coastal Habitat Restoration			
Action S3-1: Coastal habitat restoration (Sandon)	S3-1a: Coastal habitat restoration (Sandon public reserve)	T9 - Invasive weeds, T12 – Coastal vegetation damage, T35 - Informal pedestrian access, T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users	14.3

14.1 Strategy S1 – Water Quality Management (Sandon River)

The Sandon River flows through Yuraygir National Park into the sea at Sandon. The entrance is flanked by two rocky headlands which act as natural training walls. The Sandon River estuary has a net upstream movement of marine sands by tidal currents resulting in the formation of shoals in the lower estuary. Based on previous monitoring in 1997, 2000 and 2010, there are indications of poor water quality in the river including elevated nutrient levels, faecal coliforms and low dissolved oxygen levels.

The estuary health risk mapping (Dela-Cruz *et al*., 2019) suggests there are likely slightly elevated total nitrogen loads from south-west of the catchment and low total phosphorous loads throughout the catchment.

Septic systems have been identified as a possible source of poor water quality (Hydrosphere Consulting, 2021). The risk to water quality from on-site wastewater management systems in the Sandon River estuary is likely to increase into the future due to sea level rise, further degraded systems and more intensive use.

Action S1-1: On-site sewerage management (Sandon village)

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	SR3, SR4, SA5
Threats addressed	T24 - Pollution from on-site wastewater systems, T25 - Poor flushing of ICOLLs				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	
CVC implements an OSSM strategy within the study area which includes regular inspections of on-site systems at Sandon village based on risk and issuing of follow up notices and requirements for further actions (e.g. either an 'Approval to Operate' where systems pass inspection or an 'Improvement Notice' where systems fail the inspection). Further investigations of OSSM systems in coastal villages with sensitive waterways such as Sandon River will also be undertaken to determine a sustainable level of effluent disposal and the most suitable wastewater management methods for these specific areas.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
S1-1a: OSSM inspection and compliance program	CVC	DCCEEW	-	CVC
The OSSM inspection and compliance program will continue to be implemented in accordance with CVC's OSSM Strategy.				
Performance target	Full implementation of CVC's OSSM Strategy at Sandon.			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
S1-1b: Microbial source tracking	CVC	DCCEEW	$10,000	CVC
Faecal indicator bacteria used in estuary health and recreational monitoring are common to all warm-blooded animals and it is not possible to differentiate between the animal sources of faecal matter (e.g. from humans, cattle, dogs, birds and other wildlife etc.). To conclusively attribute bacteria to any one source, microbial source tracking (e.g. DNA analysis) is required. A short-term microbial source tracking program will be undertaken to identify the extent and sources of faecal pollution and assist in directing management action. This will include sampling and analysis using DNA extraction and Faecal Source Tracking for human-only sources of faecal matter. If sources are of human origin, this may indicate issues with sewerage infrastructure or potentially illegal camping/ parties etc.				
Performance target	Microbial source tracking completed by December 2026			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
S1-1c: Investigate sustainable methods of effluent management	CVC	DCCEEW	$30,000	CEGP, CVC
Further investigation into the sustainability of the effluent disposal regime at present and over the long-term will be undertaken considering sea level rise, OSSM design and location, lot sizes, effluent management, receiving water quality and uses to identify environmental and health implications and the most suitable wastewater management methods. Key inputs will include the data and outcomes of *Task S1-1a*, *Task S1-1b*, Action S2-1: Monitor coastal hazards (Sandon village), *Action* MER1: Estuary health monitoring program and *Action MER2: Monitoring of recreational water quality*. Areas at risk of flooding during elevated river levels will be reviewed and potential OSSM upgrades will be identified for implementation once funding is obtained.				
Performance target	Investigation into the sustainability of the effluent disposal regime completed by June 2027			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
S1-1d: Implement OSSM upgrades	CVC	DCCEEW	$200,000	CVC, CEGP
The recommended OSSM strategy from *Task S1-1c* will be implemented once funding is obtained.				
Performance target	Investigation into the sustainability of the effluent disposal regime completed by June 2028			

14.2 Strategy S2 – Coastal Hazard Adaptation

Access and power supply to Sandon village are linked to NPWS operations at Sandon River campground and the surrounding Yuraygir National Park. NPWS is considering strategic retreat of the Sandon River campground and associated assets over the long-term (*Action SR1-2: Values, asset and infrastructure management (Sandon River campground)*). Ongoing management of residential areas and infrastructure at the village will be coordinated between CVC, NPWS, DPIRD-Marine Parks, Essential Energy, traditional owners and residents. Impacts on vehicular access roads in extreme events will be managed through *Action EM1-1: Implement emergency response procedures*. Alternative access routes will be required in prolonged

periods of closure. Over the long-term, more permanent measures will be required such as road modifications, alternative access routes or a reduction in service levels (power supply, road access etc.). It is appropriate that planning and investigation of a long-term strategy for management of infrastructure and residential development at Sandon village is commenced as part of the CMP.

Action S2-1: Monitor coastal hazards (Sandon village)

Priority	Medium	**Timeframe**	Ongoing	**Stage 3 option**	SA1
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation, T4 - Entrance instability, T6 - Erosion of foreshores				
Coastal mgt areas	CUA, CEA	**B/C distribution**	100% public		
A coastal hazard monitoring and reporting program will be implemented for Sandon village to assist in identifying changes to the coastal environment to inform decision making, management responses and community education.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
S2-1a: Implement coastal hazard monitoring program	CVC	DCCEEW	$45,000	CEGP, CRIF, CVC

The coastal hazard monitoring program for Sandon may include:

- Monitoring of beach profiles to assess impacts of erosion (volume of sand lost), the rate of shoreline recession, the effectiveness of private coastal protection works, the exposed slope geometry and sand volumes and when triggers for action (*Action EM1-1: Implement emergency response procedures)* are required. The beach profile will be surveyed using land-based, UAV (drone) and hydrographic techniques on a regular basis and following significant storm events, supplemented with publicly available photogrammetry.
- Comparison of beach profiles over time with reference to topographic survey undertaken in 2022 and previous photogrammetry.
- Monitoring and forecasting of dangerous water levels and wave conditions using publicly available tools (e.g. tide/ water level stations, tide prediction tables and wave forecasts).
- Monitoring of water level in Sandon River e.g. a water level gauge for manual reading or a level sensor with data logging capability.
- Community feedback relating to coastal hazard impacts.

Results of the monitoring program will be documented and reported on an annual basis to CVC and published on CVC's website (refer *Task PD1-1c: Coastal hazard webpage*). Reporting will include identification of any required management measures and/or modifications to the monitoring program.

Performance target	Coastal hazard monitoring program implemented by December 2025 and monitoring undertaken annually and following significant storm events.

Action S2-2: Develop Sandon village adaptive management strategy

Priority	Medium	**Timeframe**	Long-term	**Stage 3 option**	SV1
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	

Management of the issues facing Sandon village are complex and challenging and the development of a long-term strategy is required to address coastal hazard risks over the long-term. The strategy will incorporate the outcomes of related CMP actions and align with other management strategies including local disaster adaptation plans developed by the NSW Reconstruction Authority as part of the State Disaster Mitigation Plan.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
S2-2a: Develop adaptive management strategy (Sandon village)	CVC	DCCEEW, DPHI-Crown Land, NPWS	$100,000	CEGP, DRF, CVC

The asset and village adaptive management strategy for Sandon village will address:

- Access to the village and surrounding areas.
- CVC services including waste management.
- The suitability of local water supplies and OSSM systems.
- Other public services including power and telecommunications.
- Predicted impacts on public assets and development on the island due to coastal hazards.
- Triggers/ thresholds for adaptive management, access arrangements and methods.
- Planning and development controls.
- Cultural heritage management.
- Emergency response.

Key inputs to the strategy development will include the data and outcomes of related CMP actions:

- *Action AM1-1: Incorporate coastal hazard risks in CVC asset management planning*
- *Action S2-1: Monitor coastal hazards (Sandon village).*
- *Strategy S1 – Water Quality Management (Sandon River).*
- *Action CH1-1: Protection of cultural heritage.*
- *Action EM1-1: Implement emergency response procedures.*
- *Action PD1-1: Review and implement planning controls to address coastal hazards*
- *Action F1-1: Intertidal marine vegetation strategies.*

Strategy development will include identification of risks, development of management options and consultation with stakeholders including affected property owners, asset and land managers (CVC, DPHI-Crown Lands, NPWS, utilities), Yaegl TOAC and potential approval agencies (DPIRD-Fisheries). A preferred strategy will be identified for further assessment (as required).

Performance target	Sandon village adaptive management strategy completed by June 2035

14.3 Strategy S3 – Coastal Habitat Restoration

Action S3-1: Coastal habitat restoration (Sandon)

Priority	Medium	**Timeframe**	Ongoing	**Stage 3 option**	SA12, SA13, SA14
Threats addressed	T9 - Invasive weeds, T12 – Coastal vegetation damage, T35 - Informal pedestrian access, T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users				
Coastal mgt areas	CUA, CEA	**B/C distribution**	100% public		

Habitat restoration activities within Council-managed Crown reserves at Sandon which may include weed management, revegetation, access control, signage and education will be undertaken when funding is available to assist in stabilising dunes, provide protection from coastal hazards and enhance the biodiversity values and recreational amenity. CVC will continue to support coordination of local environmental/ community groups undertaking dune rehabilitation, revegetation and habitat restoration activities on Council-managed land and community Landcare nurseries to undertake coastal revegetation and habitat restoration activities.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
S3-1a: Coastal habitat restoration (Sandon public reserve)	CVC	DCCEEW, Landcare	$100,000	CEGP, CRIF, CVC, Landcare, ET, IAS, SOS

CVC will prepare and implement a coastal habitat restoration and vegetation management plan for Sandon public reserve (Figure 67) which may but is not limited to include works locations, implementation details such as a weed management regime, species to be used for revegetation, public access management, educational signage and monitoring and maintenance requirements. Key objectives are the maintenance of formalised pedestrian access and the protection of high value coastal vegetation.

Figure 67: Priority coastal habitat restoration area – Sandon village (Lot 31, DP43869)

Performance target	Development of coastal habitat restoration and vegetation management plan to guide restoration works by June 2027. Increased coverage of native vegetation.

Figure 68: CMP actions – Sandon

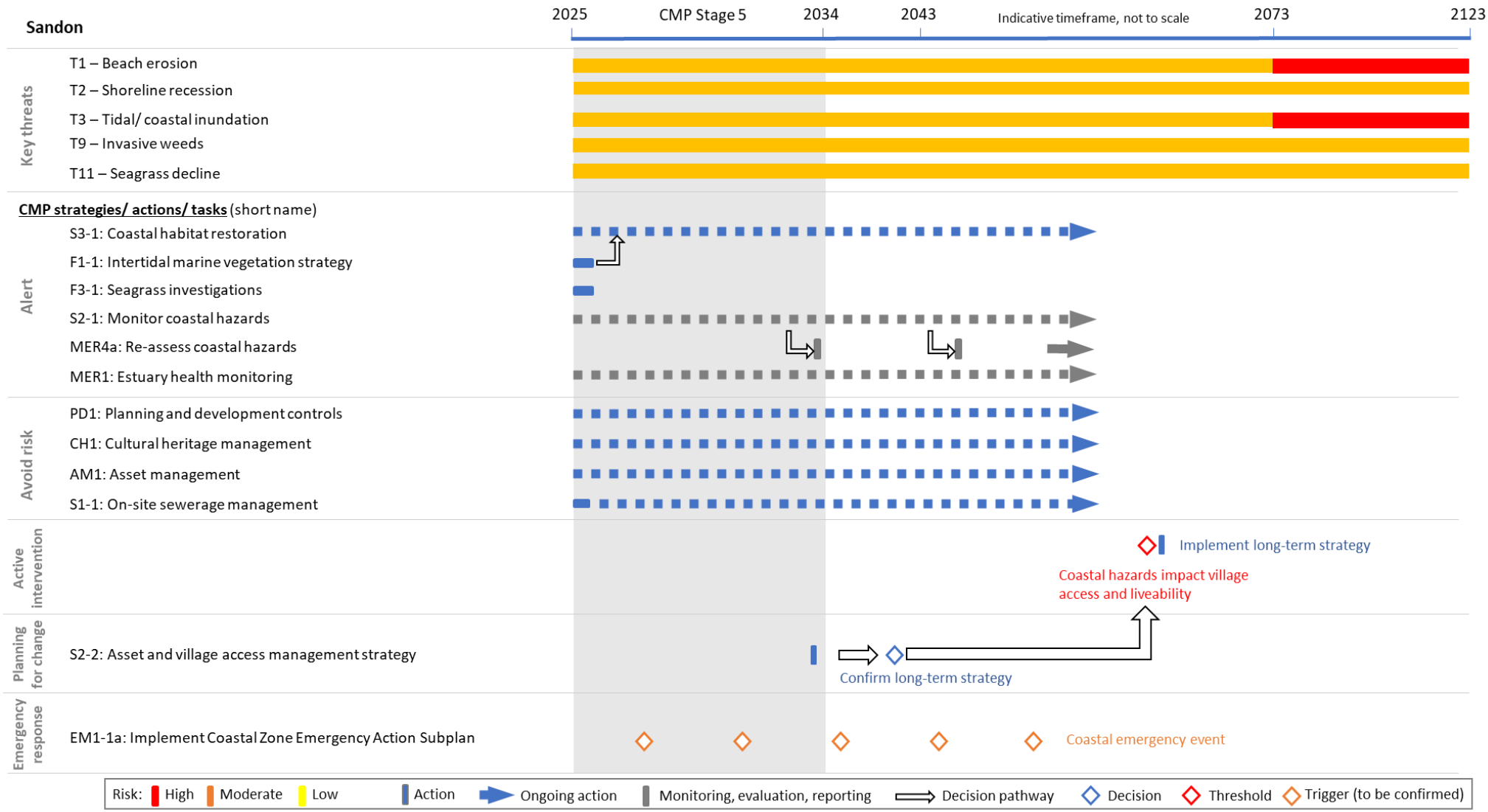

Figure 69: Adaptive management approach - Sandon

15. MANAGEMENT ZONE – MINNIE WATER

The strategies, actions and tasks to be implemented at Minnie Water are discussed in the following sections. CMP actions are listed in Table 18, shown on Figure 71 and the adaptive management approach is provided in Figure 72.

Table 18: CMP actions – Minnie Water

Strategies/ actions	Tasks	Threats addressed	CMP section
Strategy MW1 – Coastal Hazard Adaptation			
Action MW1-1: Monitor coastal hazards (Minnie Water)	MW1-1a: Implement coastal hazard monitoring program MW1-1b: Liaise with Minnie Water-Wooli SLSC regarding operations at Minnie Water beach and management of coastal hazards	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation, T4 - Entrance instability, T6 - Erosion of foreshores	15.1
Strategy MW2 – Coastal Habitat Restoration			
Action MW2-1: Coastal habitat restoration (Minnie Water)	MW2-1a: Weed management and coastal habitat restoration (Minnie Water)	T9 - Invasive weeds, T12 – Coastal vegetation damage, T35 - Informal pedestrian access, T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users	15.2

15.1 Strategy MW1 – Coastal Hazard Adaptation

Action MW1-1: Monitor coastal hazards (Minnie Water)

Priority	Medium	**Timeframe**	Ongoing	**Stage 3 option**	SA1
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation, T4 - Entrance instability, T6 - Erosion of foreshores				
Coastal mgt areas	CUA, CEA	**B/C distribution**	100% public		
A coastal hazard monitoring and reporting program will be implemented for Minnie Water to assist in identifying changes to the coastal environment to inform decision making, management responses and community education.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
MW1-1a: Implement coastal hazard monitoring program	CVC	DCCEEW	$45,000	CEGP, CRIF, CVC
The coastal hazard monitoring program for Minnie Water may include: • Monitoring of beach profiles to assess impacts of erosion (volume of sand lost), the rate of shoreline recession, the exposed slope geometry and sand volumes and when triggers for action (*Action EM1-1: Implement emergency response procedures*) are required. The beach profile will be surveyed using land-based, UAV (drone) and hydrographic techniques on a regular basis and following significant storm events, supplemented with publicly available photogrammetry. • Comparison of beach profiles over time. • Monitoring and forecasting of dangerous water levels and wave conditions using publicly available tools (e.g. tide/ water level stations, tide prediction tables and wave forecasts). • Community feedback relating to coastal hazard impacts. Results of the monitoring program will be documented and reported on an annual basis to CVC and published on CVC's website (refer *Task PD1-1c: Coastal hazard webpage*). Reporting will include identification of any required management measures and/or modifications to the monitoring program.				
Performance target	Coastal hazard monitoring program implemented by December 2027 and monitoring undertaken annually and following significant storm events.			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
MW1-1b: Liaise with Minnie Water-Wooli SLSC regarding operations at Minnie Water beach and management of coastal hazards	CVC	DCCEEW	-	-
CVC will liaise with Minnie Water-Wooli SLSC regarding operations at Minnie Water beach and management of coastal hazards including outcomes from *Task MW1-1a*.				
Performance target	Consultation with Minnie Water-Wooli SLSC as required.			

15.2 Strategy MW2 – Coastal Habitat Restoration

Action MW2-1: Coastal habitat restoration (Minnie Water)

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	SA12, SA13, SA14
Threats addressed	T9 - Invasive weeds, T12 – Coastal vegetation damage, T35 - Informal pedestrian access, T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users				
Coastal mgt areas	CUA, CEA	**B/C distribution**	100% public		

Habitat restoration activities within Council-managed Crown reserves at Minnie Water which may include weed management, revegetation, access control, signage and education will be undertaken when funding is available to assist in stabilising dunes, provide protection from coastal hazards and enhance the biodiversity values and recreational amenity. CVC will continue to support coordination of local environmental/ community groups undertaking dune rehabilitation, revegetation and habitat restoration activities on Council-managed land and community Landcare nurseries to undertake coastal revegetation and habitat restoration activities.

Improved beach access in the Clarence Valley was a consistent theme in community consultation to develop CVC's *Disability Inclusion Action Plan 2023-2026*.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
MW2-1a: Weed management and coastal habitat restoration (Minnie Water)	CVC	DCCEEW, Landcare	$420,000	CEGP, CRIF, CVC, Landcare, ET, IAS, SOS

CVC, as the local control authority responsible for administering the *Biosecurity Act 2015,* will continue to manage weeds at the Minnie Water foreshore (Figure 70), particularly lantana (*Lantana camara*) and bitou bush (*Chrysanthemoides monilifera rotundata*). This will include routine inspections to identify priority weed infestations, weed treatment and supporting the community to prevent the establishment of new weeds. CVC will continue to source funding for weed management from Government funding/ grants to supplement internal resources for weed management.

CVC will prepare and implement a coastal habitat restoration and vegetation management plan for Minnie Water foreshore reserve which may include but is not limited to works locations, implementation details such as a weed management regime, species to be used for revegetation, public access management, dune stabilisation, educational signage and monitoring and maintenance requirements. Key objectives are the management of high visitation areas (including Yuraygir Coastal Walk), preservation of the iconic outlook location, illegal clearing, construction and maintenance of accessible pedestrian access and the protection of high value coastal vegetation.

Figure 70: Priority coastal habitat restoration area – Minnie Water Foreshore Reserve (Lot 7303, DP1153056)

Performance target	Development of coastal habitat restoration and vegetation management plan to guide restoration works by June 2026. Reduction in environmental weeds within targeted areas as determined through formal and informal monitoring.

Figure 71: CMP actions – Minnie Water

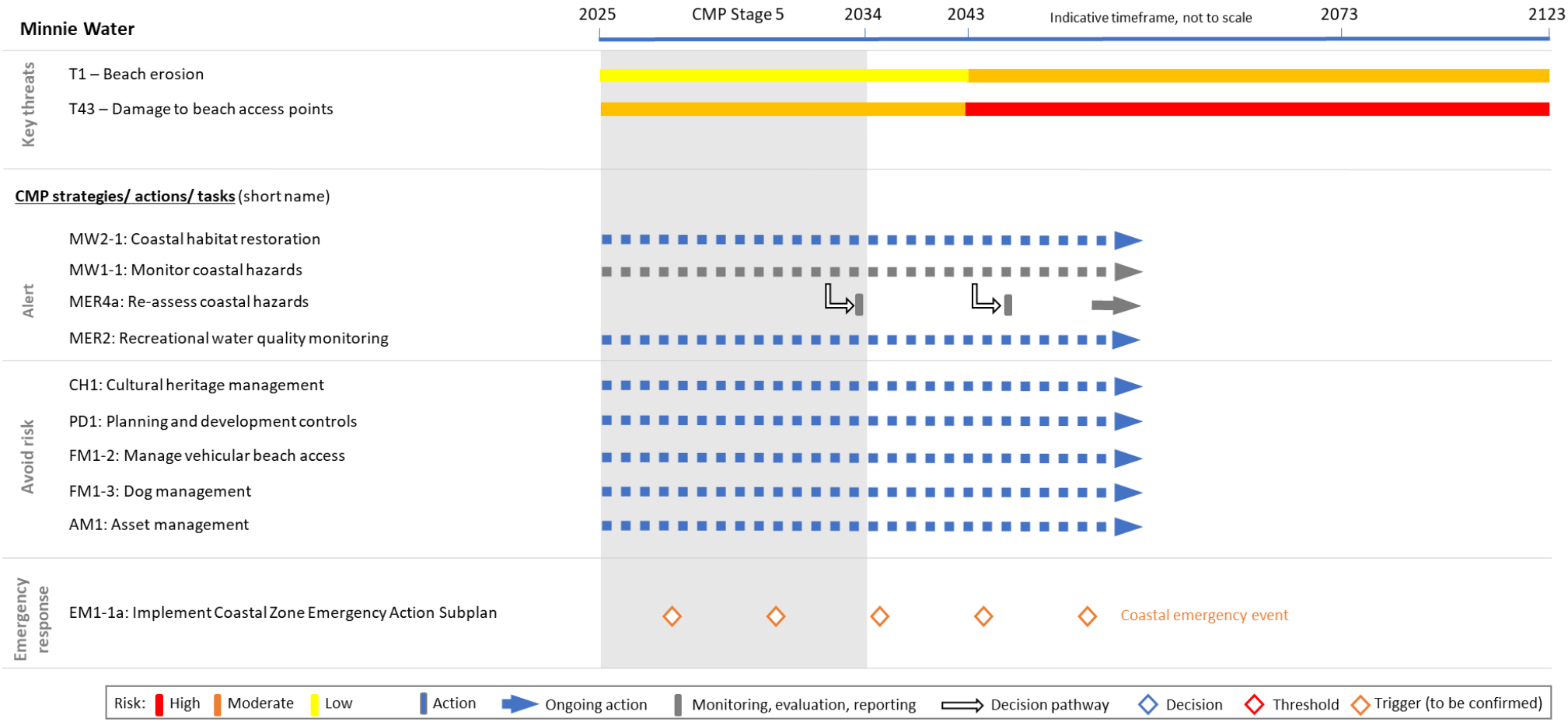

Figure 72: Adaptive management approach - Minnie Water

16. MANAGEMENT ZONE – DIGGERS CAMP

The strategies, actions and tasks to be implemented at Diggers Camp are discussed in the following sections. CMP actions are listed in Table 19, shown on Figure 74 and the adaptive management approach is provided in Figure 75.

Table 19: CMP actions – Diggers Camp

Strategies/ actions	Tasks	Threats addressed	CMP section
Strategy DC1 – Coastal Hazard Adaptation			
Action DC1-1: Monitor coastal hazards (Diggers Camp)	DB1-1a: Implement coastal hazard monitoring program	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation, T4 - Entrance instability, T6 - Erosion of foreshores	16.1
Strategy DC2 – Coastal Habitat Restoration			
Action DC2-1: Coastal habitat restoration (Diggers Camp)	DB2-1a: Coastal habitat restoration (Diggers Headland)	T9 - Invasive weeds, T12 – Coastal vegetation damage, T35 - Informal pedestrian access, T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users	16.2

16.1 Strategy DC1 – Coastal Hazard Adaptation

Action DC1-1: Monitor coastal hazards (Diggers Camp)

Priority	Medium	**Timeframe**	Ongoing	**Stage 3 option**	SA1
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation, T4 - Entrance instability, T6 - Erosion of foreshores				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	
A coastal hazard monitoring and reporting program will be implemented for Diggers Camp to assist in identifying changes to the coastal environment to inform decision making, management responses and community education.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
DC1-1a: Implement coastal hazard monitoring program	CVC	DCCEEW	$45,000	CEGP, CRIF, CVC

The coastal hazard monitoring program for Diggers Camp may include:

- Monitoring of beach profiles to assess impacts of erosion (volume of sand lost), the rate of shoreline recession, the exposed slope geometry and sand volumes and when triggers for action (*Action EM1-1: Implement emergency response procedures*) are required. The beach profile will be surveyed using land-based, UAV (drone) and hydrographic techniques on a regular basis and following significant storm events, supplemented with publicly available photogrammetry.
- Comparison of beach profiles over time.
- Monitoring and forecasting of dangerous water levels and wave conditions using publicly available tools (e.g. tide/ water level stations, tide prediction tables and wave forecasts).
- Community feedback relating to coastal hazard impacts.

Results of the monitoring program will be documented and reported on an annual basis to CVC and published on CVC's website (refer *Task PD1-1c: Coastal hazard webpage*). Reporting will include identification of any required management measures and/or modifications to the monitoring program.

Performance target	Coastal hazard monitoring program implemented by December 2027 and monitoring undertaken annually and following significant storm events.

16.2 Strategy DC2 – Coastal Habitat Restoration

Action DC2-1: Coastal habitat restoration (Diggers Camp)

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	SA12, SA13, SA14
Threats addressed	T9 - Invasive weeds, T12 – Coastal vegetation damage, T35 - Informal pedestrian access, T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users				
Coastal mgt areas	CUA, CEA	**B/C distribution**	100% public		

The Diggers Headland Reserve is a natural landscape, popular with those seeking a basic camping experience and providing a backdrop to a secluded community lifestyle. The reserve also serves as an important link between the village and the national park, with a variety of vegetation types that are representative of coastal plant communities in decline elsewhere in the state. There are also a range of threatened species and threatened ecological communities on the reserve including but not limited to the Coastal Emu, Square-stemmed Olax, Littoral Rainforest, Themeda Grasslands and swamp forest.

CVC has prepared a vegetation management plan for the reserve (CVC, 2022). The plan guides the management of vegetation on the reserve with the maintenance of native vegetation, including weeds, fire and vegetation being the key components of the plan. The primary aim of the Plan is to provide a framework for the management of the Reserve for the protection of native flora and fauna and for public recreation, in line with CVC's *Biodiversity Strategy 2020-2025* objectives.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
DC2-1a: Coastal habitat restoration (Diggers Headland)	CVC	DCCEEW, Landcare	$280,000	CEGP, CRIF, CVC, Landcare, ET, IAS, SOS

CVC will implement actions outlined in the *Vegetation Management Plan Diggers Headland Reserve* (CVC, 2022) as required including but not limited to:

- Weed management through a variety of methods including hand pulling, spraying and cut-scrape-paint.
- Regular inspections and monitoring of weeds and garden escapees.
- Maintenance of foredune vegetation.
- Re-planting and revegetation where required.
- Monitoring and management of Asset Protection Zones and fuel loads in bushland areas including mapping of any fires.

Priority weeds will be targeted across the Reserve (Figure 73) initially.

Figure 73: Priority coastal habitat restoration area – Diggers Headland Reserve (Lot 7035, DP1141643)

Performance target	Implementation of vegetation management plan to guide restoration works from June 2026. Reduction in weeds and increased coverage of native vegetation.

Figure 74: CMP actions – Diggers Camp

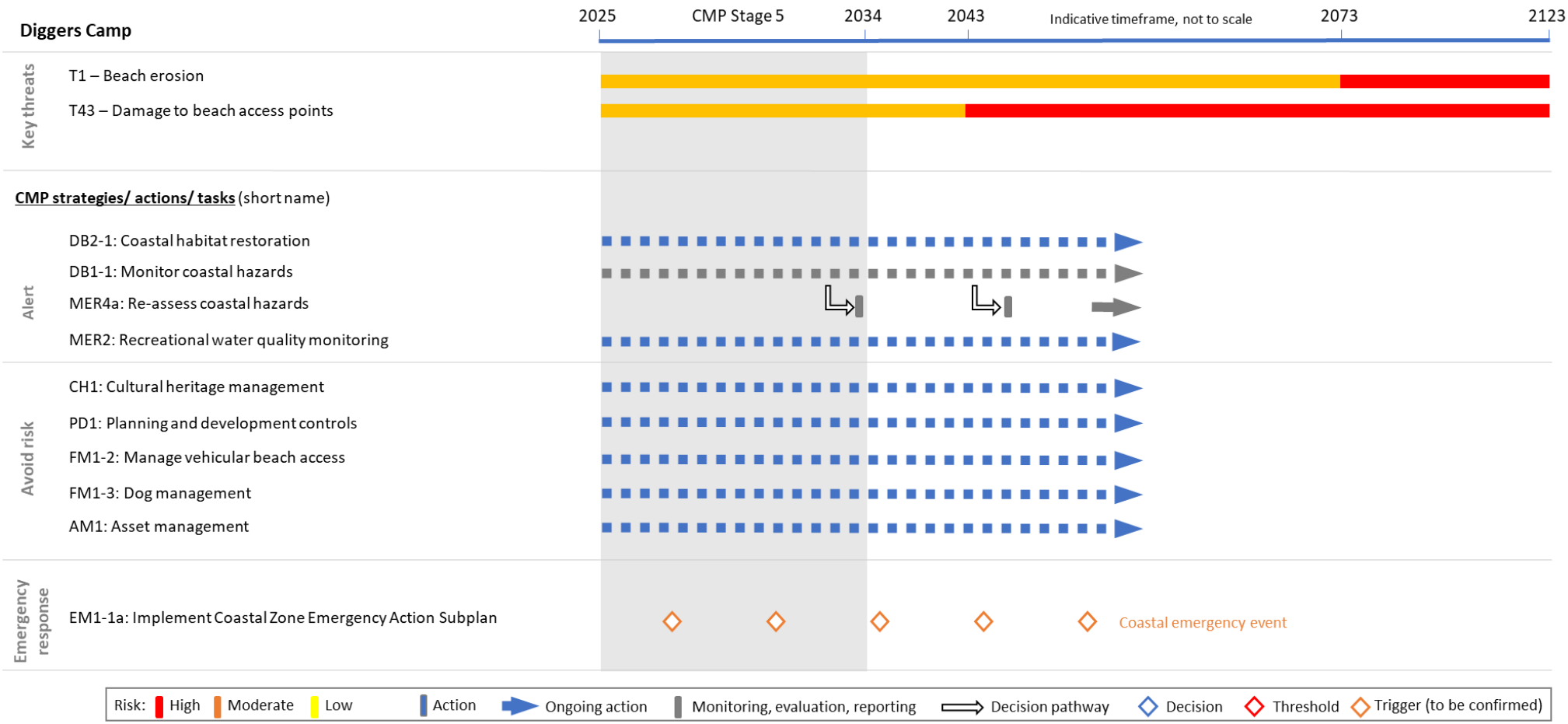

Figure 75: Adaptive management approach - Diggers Camp

17. MANAGEMENT ZONE - WOOLI (W)

The strategies, actions and tasks to be implemented at Wooli are discussed in the following sections. CMP actions are listed in Table 20, shown on Figure 82 and the adaptive management approach is provided in Figure 83 and Figure 84.

Table 20: CMP actions – Wooli

Strategies/ actions	Tasks	Threats addressed	CMP section
Strategy W1 – Mitigate Coastal Erosion/ Shoreline Recession			
Action W1-1: Implement Wooli Beach Management Strategy	W1-1a: Implement Wooli Beach Management Strategy	T1 - Beach erosion, T2 - Shoreline recession	17.1
Strategy W2 – Coastal Hazard Adaptation			
Action W2-1: Monitor coastal hazards (Wooli)	W2-1a: Implement coastal hazard monitoring program W2-1b: Liaise with Minnie Water-Wooli SLSC regarding operations at Minnie Water beach and management of coastal hazards	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation, T4 - Entrance instability, T6 - Erosion of foreshores	17.2
Action W2-2: Alternative sand sources (Wooli)	W2-2a: Liaison with TfNSW-Maritime regarding navigational dredging strategy W2-2b: Investigate alternative sources for sand nourishment	T1 - Beach erosion, T2 - Shoreline recession	
Action W2-3: Develop Wooli adaptive management strategy	W2-3a: Develop adaptive management strategy (Wooli)	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation	
Strategy W3 – Water Quality Management (Wooli Wooli River)			
Action W3-1: On-site sewerage management (Wooli)	W3-1a: OSSM inspection and compliance program W3-1b: Microbial source tracking W3-1c: Investigate sustainable methods of effluent management	T24 - Pollution from on-site wastewater systems, T25 - Poor flushing of ICOLLs	17.3

Strategies/ actions	Tasks	Threats addressed	CMP section
Strategy W4 – Coastal Habitat Restoration			
Action W4-1: Coastal habitat restoration (Wooli)	W4-1a: Weed management and coastal habitat restoration (South Terrace Reserve, Wooli) W4-1b: Weed management (Wooli Sand Drift Reserve) W4-1c: Implement recommendations from Intertidal Marine Vegetation Strategy	T9 - Invasive weeds, T12 – Coastal vegetation damage, T35 - Informal pedestrian access, T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users	17.4
Strategy W5 – Riverbank Management			
Action W5-1: Bank management and waterway access (Wooli Wooli River)	W5-1a: Implement priority bank management measures W5-1b: Enhance waterway access	T6 - Erosion of foreshores, T7 - Historic clearing of riparian vegetation and adjacent habitat, T10 - Uncontrolled stock access to and grazing within the riparian zone	17.5

17.1 Strategy W1 – Mitigate Coastal Erosion/ Shoreline Recession

Coastal erosion and shoreline recession are significant coastal hazards at Wooli. Wooli Beach is vulnerable to erosion with Wooli village at risk from frequent to rare (10% EP) events at present with coastal erosion potentially reaching the Wooli Wooli River within 100 years. The northern section of Wooli is also vulnerable to erosion in frequent to rare (10% EP) events within 100 years.

The Wooli Dune Care group has been active since 2012 in dune rehabilitation and revegetation. A trial beach scraping (two campaigns) was undertaken at Wooli Beach from March - May 2019 (13,500 m^3). Following completion of the scraping, an incipient dune profile was formed along with dune catch fencing and dune revegetation. The purpose of these campaigns was to build sand reserves in front of Wooli village to reduce current erosion and recession risk and inform future sand scraping campaigns and development of a beach management strategy (BMS) to offset future erosion and recession hazards. Beach scraping was also undertaken in November 2023 along approximately 800 m of beach with approximately 8,750 m^3 of sand added to the incipient dune. Dune rehabilitation works were undertaken including installation of sand trap fencing to further enhance dune building and to minimise windblown sand, installation of public access management fencing and revegetation.

A BMS has been developed for Wooli Beach comprising sand back-passing and beach scraping, vegetation management and ongoing monitoring (Royal HaskoningDHV, 2021c). The strategy includes a number of

scenarios, depending on the beach state when the management activities are undertaken. The BMS aims to ensure sufficient sand remains available to reduce risks to public and private assets from storm erosion (designed to maintain an average of 195 m^3/m above MSL in front of the southern 800 m of the original village, which is the estimated 50-year ARI storm demand) and 'hold the line' and offset long-term recession of 2 m^3/m above mean sea level (Royal HaskoningDHV, 2021c). The BMS aims to provide an additional buffer and buy additional time to manage existing land, built assets and infrastructure identified to be at risk. The REF (Australian Wetlands Consulting, 2021) for the BMS concluded that it is unlikely that the proposal would result in any significant adverse environmental impacts if site-specific environmental control measures are implemented.

Action W1-1: Implement Wooli Beach Management Strategy

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	W1
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession				
Coastal mgt areas	CUA, CEA	**B/C distribution**	100% public		
The BMS remains the preferred approach for management of erosion/ recession at Wooli Beach for at least the short-medium term.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
W1-1a: Implement Wooli Beach Management Strategy	CVC	DCCEEW	$1,300,000	CEGP, CRIF, DRF, CVC

CVC will continue to implement the Wooli BMS (Figure 76 and Figure 77) including:

- Beach scraping for initial beach recovery following an extreme storm event as well as dune rebuilding following minor storm erosion.
- Sand back-passing and beach scraping if suitable sand reserves are available for scraping activities following a significant storm erosion event.
- Vegetation management.
- Ongoing monitoring of Wooli Beach to determine when beach nourishment is required and to assess the effectiveness and longevity of beach nourishment campaigns, including vegetation management (*Action W2-1: Monitor coastal hazards (Wooli)*).
- Emergency response measures (*Action EM1-1: Implement emergency response procedures*).

The necessary approvals will be determined and obtained which may include:

- A Crown land licence for works outside of the Council-managed Crown Reserve or for proposals that are not consistent with the reserve purpose (refer *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions*).
- Approval/ concurrence from relevant agencies (DPIRD-Fisheries, DPIRD-Marine Parks).
- Management of native title rights and interests (refer *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions*).

Sources of funding for the implementation of the BMS will be identified (refer *Action FS1-1: Develop a CMP funding strategy*).

Performance target	Beach scraping and sand back-passing are implemented in accordance with the trigger values identified in the BMS

Figure 76: Wooli beach management strategy – beach scraping

Source: Royal HaskoningDHV (2021c)

Figure 77: Wooli beach management strategy – sand back-passing

Source: Royal HaskoningDHV (2021c)

17.2 Strategy W2 – Coastal Hazard Adaptation

The BMS is intended to reduce, but not eliminate risk, initially for the southern part of Wooli village where private land and assets are at greatest threat from coastal erosion at present. While the beach scraping campaigns undertaken to date were considered successful, this action is not a long-term protective measure and will rely on a monitoring program to understand how these works perform.

Wooli is threatened by erosion/recession from the east and inundation from the estuary to the west. While *Strategy W1 – Mitigate Coastal Erosion/ Shoreline Recession* will address the erosion/recession to the east, inundation is predicted to impact the village over time, particularly road access. Lower lying parts of North Street/ Riverside Drive and South Terrace and nearby residential areas may be temporarily impacted by inundation at present with parts of Wooli Road and nearby residential areas also temporarily inundated by 2073. The BMS would be ineffective in protecting the western and northern fringes of the village from inundation.

In the long-term, there will be a need to develop alternative management strategies that may include additional sand nourishment sources, relocation of assets and managed retreat. The need for management approaches would depend on the options available for long-term management of erosion and the longevity of the village in this section of the peninsula.

Action W2-1: Monitor coastal hazards (Wooli)

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	SA1
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation, T4 - Entrance instability, T6 - Erosion of foreshores				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	
A coastal hazard monitoring and reporting program will be implemented for Wooli to assist in identifying changes to the coastal environment to inform decision making, management responses and community education.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
W2-1a: Implement coastal hazard monitoring program	CVC	DCCEEW	$55,000	CEGP, CRIF, CVC

The coastal hazard monitoring program for Wooli may include:

- Monitoring of beach profiles to assess impacts of erosion (volume of sand lost), the rate of shoreline recession, the effectiveness of coastal management actions, the exposed slope geometry and sand volumes and when triggers for action (e.g. *Action W1-1: Implement Wooli Beach Management Strategy, Action EM1-1: Implement emergency response procedures*) are required. The beach profile will be surveyed using land-based, UAV (drone) and hydrographic techniques on a regular basis and following significant storm events, supplemented with publicly available photogrammetry.
- Comparison of beach profiles over time with reference to topographic survey undertaken in 2022 and previous photogrammetry.
- Monitoring and forecasting of dangerous water levels and wave conditions using publicly available tools (e.g. tide/ water level stations, tide prediction tables and wave forecasts).
- Monitoring of water level in Wooli Wooli River e.g. a water level gauge for manual reading or a level sensor with data logging capability.
- Community feedback relating to coastal hazard impacts.

Results of the monitoring program will be documented and reported on an annual basis to CVC and published on CVC's website (refer *Task PD1-1c: Coastal hazard webpage*). Reporting will include identification of any required management measures and/or modifications to the monitoring program.

Performance target	Coastal hazard monitoring program implemented by December 2025 and monitoring undertaken annually and following significant storm events.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
W2-1b: Liaise with Minnie Water-Wooli SLSC regarding operations at Wooli Beach and management of coastal hazards	CVC	DCCEEW	-	-

CVC will liaise with Minnie Water-Wooli SLSC regarding operations at Wooli Beach and management of coastal hazards including outcomes from related CMP actions:

- *Action W1-1: Implement Wooli Beach Management Strategy*
- *Action W2-1: Monitor coastal hazards (Wooli)*
- *Action W2-2: Alternative sand sources (Wooli)*
- *Action W2-3: Develop Wooli adaptive management strategy*

Performance target	Consultation with Minnie Water-Wooli SLSC as required.

Action W2-2: Alternative sand sources (Wooli)

Priority	Medium	**Timeframe**	Medium-term	**Stage 3 option**	W4
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	
While the approach adopted in the CZMP and the resulting BMS developed remains the preferred approach for management of erosion/ recession at Wooli Beach for at least the short-medium term, in the long-term, there will be a need to develop alternative management strategies that may include additional sand nourishment sources.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
W2-2a: Liaison with TfNSW-Maritime regarding navigational dredging strategy	CVC	TfNSW-Maritime	-	CVC
CVC will liaise with TfNSW-Maritime regarding dredging of Wooli Wooli River navigation channels and use of the dredged sand for nourishment of Wooli Beach including development of the navigational dredging strategy (timing, dredging locations, sand characteristics and expected volumes) and the development of a sand placement plan for Wooli Beach.				
Performance target	Stakeholders concur with dredging strategy and sand placement plan			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
W2-2b: Investigate alternative sources for sand nourishment	CVC	DCCEEW, DPHI-Planning	$50,000	CEGP, CRIF, DRF, CVC

CVC will investigate other potential sand sources through review of previous studies (Haskoning Australia, 2015), the proposed NSW government investigations into the feasibility of offshore sand reserves and other opportunities to identify an alternative source of sand to nourish Wooli Beach. Based on the dredging strategy being developed by TfNSW-Maritime (*Action ND1-1: Sand nourishment from navigational dredging*) and data collected from coastal hazard monitoring (*Action W2-1: Monitor coastal hazards (Wooli)*), the efficacy of the BMS sand nourishment activities will be assessed and triggers for introduction of alternative sand sources for beach nourishment will be developed (e.g. erosion of the Wooli Beach dune scarp is within 10 m of public infrastructure). Where a feasible alternative sand source has been identified, design and approval documentation will be prepared to enable implementation once triggers are reached:

- Environmental assessment (REF) and determination under Part 5 of the *Environmental Planning and Assessment Act 1979.*
- A Crown land licence for any works outside of the Council-managed Crown Reserve or for proposals that are not consistent with the reserve purpose (refer *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions*).
- Approval/ concurrence from relevant agencies (DPIRD-Fisheries, DPIRD-Marine Parks) as required.
- Management of native title rights and interests (refer *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions*).

Performance target	Alternative sand sources are identified for implementation as required.

Action W2-3: Develop Wooli adaptive management strategy

Priority	Medium	**Timeframe**	Long-term	**Stage 3 option**	W6
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation				
Coastal mgt areas	CUA, CEA, CWLRA		**B/C distribution**	100% public	

Management of the issues facing Wooli village are complex and challenging and the development of a long-term strategy is required to address coastal hazard risks over the long-term. The strategy will incorporate the outcomes of related CMP actions and align with other management strategies including local disaster adaptation plans developed by the NSW Reconstruction Authority as part of the State Disaster Mitigation Plan.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
W2-3a: Develop adaptive management strategy (Wooli)	CVC	DCCEEW, DPHI-Crown Land	$100,000	CEGP, DRF, CVC

The asset and village adaptive management strategy for Wooli will address:

- Road access to the village and surrounding areas.
- CVC services including water supply and waste management.
- The suitability of local water supplies and OSSM systems.
- Other public services including power and telecommunications.
- Predicted impacts on public assets and development on the island due to coastal hazards.
- Triggers/ thresholds for adaptive management, access arrangements and methods.
- Planning and development controls.
- Cultural heritage management.
- Emergency response.

Key inputs to the strategy development will include the data and outcomes of related CMP actions:

- *Action AM1-1: Incorporate coastal hazard risks in CVC asset management planning*
- *Action W1-1: Implement Wooli Beach Management Strategy*, alternative sand sources identified in *Task W2-1c* and the protection afforded by beach nourishment works.
- *Action W2-1: Monitor coastal hazards (Wooli*).
- *Strategy W3 – Water Quality Management (Wooli Wooli River).*
- *Action CH1-1: Protection of cultural heritage.*
- *Action EM1-1: Implement emergency response procedures.*
- *Action PD1-1: Review and implement planning controls to address coastal hazards*
- *Action F1-1: Intertidal marine vegetation strategies.*

Strategy development will include identification of risks, development of management options and consultation with stakeholders including affected property owners, asset and land managers (CVC, DPHI-Crown Lands, NPWS, utilities), Yaegl TOAC and potential approval agencies (DPIRD-Fisheries). A preferred strategy will be identified for further assessment (as required).

Performance target	Wooli adaptive management strategy completed by June 2035

17.3 Strategy W3 – Water Quality Management (Wooli Wooli River)

The Wooli Wooli River flows through Yuraygir National Park and enters the sea near the Wooli. The entrance to Wooli Wooli River estuary has been trained which ensures the estuary remains open to the sea. Based on previous monitoring in 2006 and 2013, there are indications of poor water quality in the river including elevated nutrient levels, low pH, elevated Chlorophyll *a* and turbidity (Ryder *et al.,* 2014; SEED, 2023). Potential causes of poor water quality have been identified as (Hydrosphere Consulting, 2021):

- Overflow from on-site wastewater management systems. The risk to water quality from on-site wastewater management systems in the Wooli Wooli River estuary is likely to increase into the future due to climate change, further degraded systems and more intensive use.
- Urban stormwater runoff.

The estuary health risk mapping (Dela-Cruz *et al*., 2019) suggests the following:

- Likely slightly elevated total nitrogen in the northern Bookram Creek catchment and southern areas of the catchment.
- Likely high total nitrogen loads from the Wooli township catchment.
- Likely high total phosphorous loads from the far south of the catchment.

Action W3-1: On-site sewerage management (Wooli)

Priority	Medium	**Timeframe**	Ongoing	**Stage 3 option**	WWR4, WWR5, SA5
Threats addressed	T24 - Pollution from on-site wastewater systems, T25 - Poor flushing of ICOLLs				
Coastal mgt areas	CUA, CEA, CWLRA	**B/C distribution**	100% public		
CVC implements an OSSM strategy within the study area which includes regular inspections of on-site systems at Wooli based on risk and issuing of follow up notices and requirements for further actions (e.g. either an 'Approval to Operate' where systems pass inspection or an 'Improvement Notice' where systems fail the inspection). Further investigations of OSSM systems in coastal villages with sensitive waterways such as Wooli will also be undertaken to determine a sustainable level of effluent disposal and the most suitable wastewater management methods for these specific areas.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
W3-1a: OSSM inspection and compliance program	CVC	DCCEEW	-	CVC
The OSSM inspection and compliance program will continue to be implemented in accordance with CVC's OSSM Strategy.				
Performance target	Full implementation of CVC's OSSM Strategy at Wooli.			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
W3-1b: Microbial source tracking	CVC	DCCEEW	$10,000	CVC
Faecal indicator bacteria used in estuary health and recreational monitoring are common to all warm-blooded animals and it is not possible to differentiate between the animal sources of faecal matter (e.g. from humans, cattle, dogs, birds and other wildlife etc.). To conclusively attribute bacteria to any one source, microbial source tracking (e.g. DNA analysis) is required. A short-term microbial source tracking program will be undertaken to identify the extent and sources of faecal pollution and assist in directing management action. This will include sampling and analysis using DNA extraction and Faecal Source Tracking for human-only sources of faecal matter. If sources are of human origin, this may indicate issues with sewerage infrastructure or potentially illegal camping/ parties etc.				
Performance target	Microbial source tracking completed by December 2026			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
W3-1c: Investigate sustainable methods of effluent management	CVC	DCCEEW	$50,000	CEGP, CVC
Further investigation into the sustainability of the effluent disposal regime at present and over the long-term will be undertaken considering sea level rise, OSSM design and location, lot sizes, effluent management, receiving water quality and uses to identify environmental and health implications and the most suitable wastewater management methods. Key inputs will include the data and outcomes of *Task W3-1a*, *Task W3-1b*, *Action W2-1: Monitor coastal hazards (Wooli), Action* MER1: Estuary health monitoring program and *Action MER2: Monitoring of recreational water quality.* Areas at risk of flooding during elevated river levels will be reviewed and potential OSSM upgrades will be identified for implementation once funding is obtained.				
Performance target	Investigation into the sustainability of the effluent disposal regime completed by June 2027			

17.4 Strategy W4 – Coastal Habitat Restoration

Action W4-1: Coastal habitat restoration (Wooli)

Priority	Medium	**Timeframe**	Ongoing	**Stage 3 option**	SA12, SA13, SA14
Threats addressed	T9 - Invasive weeds, T12 – Coastal vegetation damage, T35 - Informal pedestrian access, T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users				
Coastal mgt areas	CUA, CEA, CWLRA	**B/C distribution**	100% public		

Habitat restoration activities within Council-managed Crown reserves at Wooli which may include weed management, revegetation, access control, signage and education will be undertaken when funding is available to assist in stabilising dunes, provide protection from coastal hazards and enhance the biodiversity values and recreational amenity. CVC will continue to support coordination of local environmental/ community groups undertaking dune rehabilitation, revegetation and habitat restoration activities on Council-managed land and community Landcare nurseries to undertake coastal revegetation and habitat restoration activities.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
W4-1a: Weed management and coastal habitat restoration (South Terrace Reserve, Wooli)	CVC	DCCEEW, Landcare	$320,000	CEGP, CRIF, CVC, Landcare, ET, IAS, SOS

CVC, as the local control authority responsible for administering the *Biosecurity Act 2015,* will continue to manage weeds at the South Terrace Reserve (Figure 78), particularly lantana (*Lantana camara*) and bitou bush (*Chrysanthemoides monilifera rotundata*). This will include routine inspections to identify priority weed infestations, weed treatment and supporting the community to prevent the establishment of new weeds. CVC will continue to source funding for weed management from Government funding/ grants to supplement internal resources for weed management. The weed management works may include environmental protection works (works associated with the rehabilitation of land towards its natural state or any work to protect land from environmental degradation, and includes bush regeneration works, wetland protection works, erosion protection works, dune restoration works and the like, but does not include coastal protection works) in areas that are also mapped as CWLRA shown on Figure 79.

CVC will prepare and implement a coastal habitat restoration and vegetation management plan for South Terrace Reserve and adjoining reserves which may include but is not limited to works locations, implementation details such as a weed management regime, species to be used for revegetation, public access management, dune stabilisation and monitoring and maintenance requirements. Key objectives are the management of high visitation areas, access controls, maintenance of formalised pedestrian access, educational signage and the protection of high value coastal vegetation and shorebird habitat. Coastal habitat restoration works may include environmental protection works in areas that are also mapped as CWLRA shown on Figure 79.

Figure 78: Priority weed management – South Terrace Reserve, Wooli

Figure 79: Potential weed management and coastal habitat restoration and weed management on Council-managed land in areas mapped as CWLRA – Wooli

Performance target	Development of coastal habitat restoration and vegetation management plan to guide restoration works by June 2028. Reduction in environmental weeds within targeted areas as determined through formal and informal monitoring.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
W4-1b: Weed management (Wooli Sand Drift Reserve)	CVC	DCCEEW, Landcare	$80,000	CEGP, CRIF, CVC, Landcare, ET, IAS, SOS

CVC, as the local control authority responsible for administering the *Biosecurity Act 2015,* will continue to manage weeds at the Wooli Sand Drift Reserve (Figure 80), particularly lantana (*Lantana camara*) and bitou bush (*Chrysanthemoides monilifera rotundata*). This will include routine inspections to identify priority weed infestations, weed treatment and supporting the community to prevent the establishment of new weeds. CVC will continue to source funding for weed management from Government funding/ grants to supplement internal resources for weed management.

Figure 80: Priority weed management – Wooli Sand Drift Reserve

Performance target	Reduction in environmental weeds within targeted areas as determined through formal and informal monitoring.

17.5 Strategy W5 – Riverbank Management

Bank erosion in Wooli Wooli River has been attributed to a variety of causes including the removal of riparian vegetation combined with tidal and flood flows, boat wake and wind waves. Historic clearing of riparian vegetation and adjacent habitat was also identified in the CMP risk assessment as a key threat around the urban areas of the Wooli Wooli River, primarily due to exacerbation of bank erosion. The most recent erosion assessment was undertaken in 2006.

Action W5-1: Bank management and waterway access (Wooli Wooli River)

Priority	High	**Timeframe**	Short – medium-term	**Stage 3 option**	WWR3, WWR9
Threats addressed	T6 - Erosion of foreshores, T7 - Historic clearing of riparian vegetation and adjacent habitat, T10 - Uncontrolled stock access to and grazing within the riparian zone				
Coastal mgt areas	CUA, CEA, CWLRA	**B/C distribution**	100% public		
Actions relevant to CVC responsibilities identified through *Action F2-1: Wooli Wooli riverbank and riparian* condition assessment to be undertaken by DPIRD-Fisheries will be implemented. CVC will also investigate opportunities to formalise and upgrade waterway access (e.g. swimming, canoes) to enhance recreational opportunities and minimise bank erosion.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
W5-1a: Implement priority bank management measures	CVC	DCCEEW, NPWS, DPIRD-Marine Parks, DPIRD-Fisheries	$300,000	CEGP, CVC

CVC will consider and implement the recommendations of *Action F2-1: Wooli Wooli riverbank and riparian* condition assessment for priority bank remediation sites on Council-managed land. Bank management works may include environmental protection works (works associated with the rehabilitation of land towards its natural state or any work to protect land from environmental degradation, and includes bush regeneration works, wetland protection works, erosion protection works, dune restoration works and the like, but does not include coastal protection works) in areas that are also mapped as CWLRA shown on Figure 81. The necessary approvals for the bank management works will be obtained including:

- Environmental assessment (REF) and determination under Part 5 of the *Environmental Planning and Assessment Act 1979.*
- Approval/ concurrence from relevant agencies (DPIRD-Fisheries, DPIRD-Marine Parks, NPWS) as required.
- Management of native title rights and interests (refer *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions*).

The bank management works will be constructed in accordance with the design and approvals and sources of funding identified (refer *Action FS1-1: Develop a CMP funding strategy*).

Figure 81: Potential bank management measures on Council-managed land in areas mapped as CWLRA – Wooli Wooli River

Performance target	Priority bank management works are implemented by June 2027.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
W5-1b: Enhance waterway access	CVC	DCCEEW, NPWS, DPIRD-Marine Parks, DPIRD-Fisheries	$70,000	CEGP, CBP, CRIF, CVC

CVC will investigate opportunities to enhance recreational access and activities in and adjacent to the Solitary Islands Marine Park within the vicinity of Wooli village. This will include:

- Review of outcomes of *Action F2-1: Wooli Wooli riverbank and riparian condition assessment* and priority bank restoration sites.
- Consultation with DPIRD-Marine Parks, DPIRD-Fisheries and the community.
- Analysis of needs and potential opportunities.
- Identification and design for priority locations for waterway and beach access enhancement.
- Environmental assessment (REF) and determination under Part 5 of the *Environmental Planning and Assessment Act 1979.*
- Approval/ concurrence from relevant agencies (DPIRD-Fisheries, DPIRD-Marine Parks, NPWS) as required.
- Management of native title rights and interests (refer *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions*).

The works will be constructed in accordance with the design and approvals and sources of funding identified (refer *Action FS1-1: Develop a CMP funding strategy*).

Performance target	Priority works to enhance waterway access are implemented by June 2029.

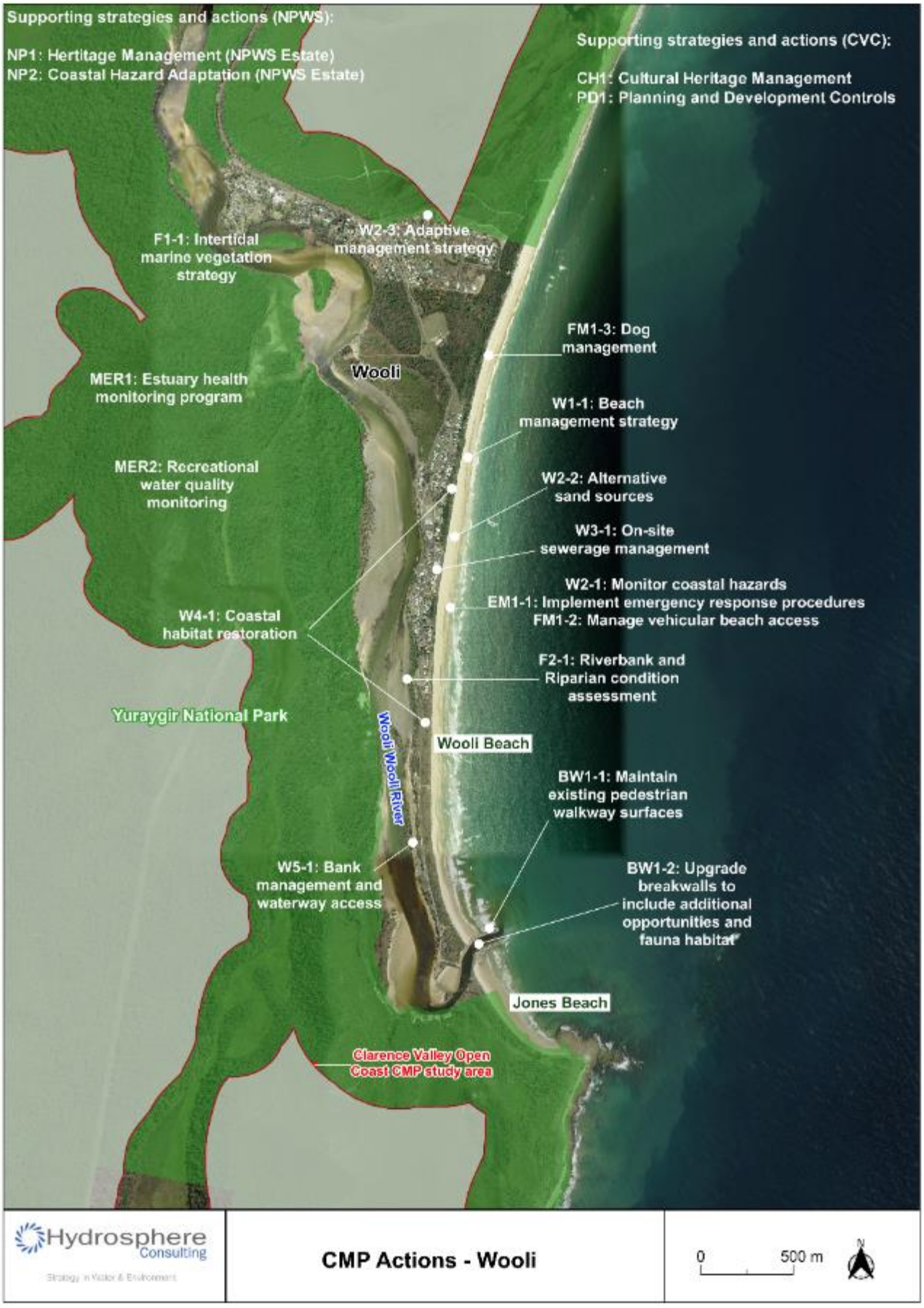

Figure 82: CMP actions – Wooli

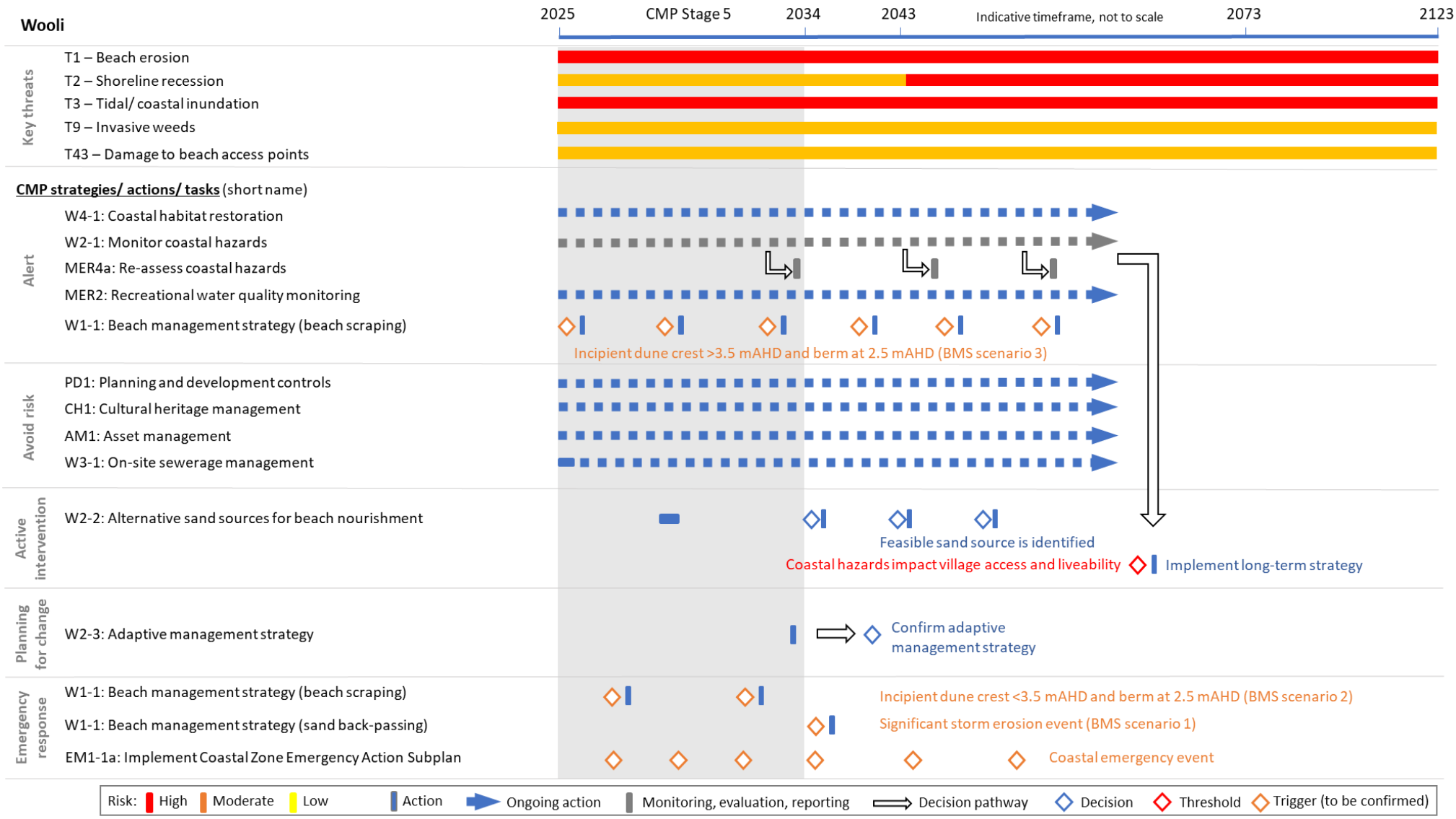

Figure 83: Adaptive management approach – Wooli

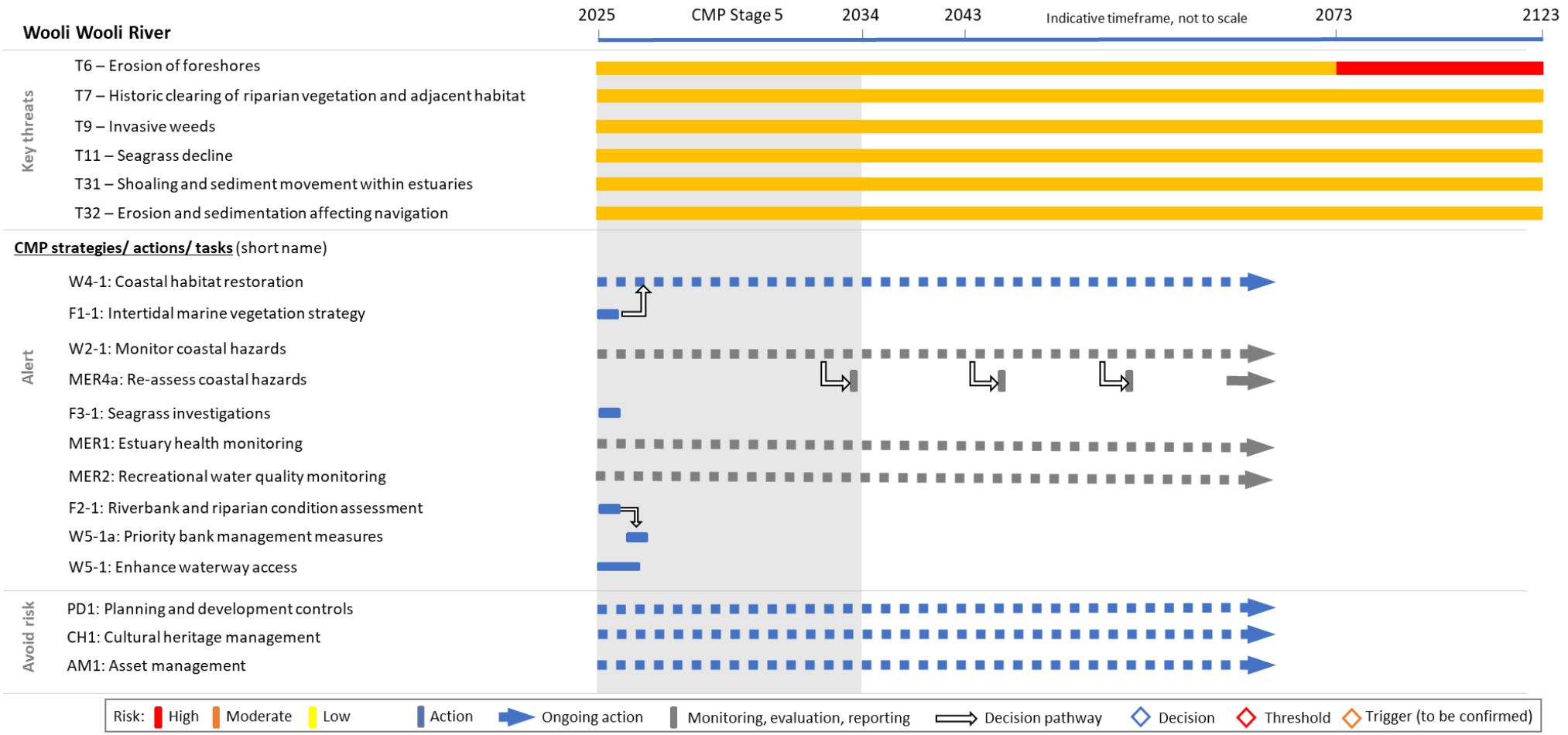

Figure 84: Adaptive management approach – Wooli Wooli River

18. MONITORING, EVALUATION AND REPORTING PROGRAM

The coastal hazard adaptation strategies in this CMP include coastal hazard monitoring actions to assist in identifying changes to the coastal environment to inform decision making, management responses and community education. The adaptive management strategies will be informed by the coastal hazard monitoring actions and will establish trigger and thresholds which will be informed by the monitoring actions. These coastal hazard monitoring and reporting actions and associated CMP actions are listed in Table 21 and include (as relevant to each location):

- Monitoring of beach profiles to assess impacts of erosion (volume of sand lost), the rate of shoreline recession, the effectiveness of coastal management actions, the exposed slope geometry and sand volumes and when triggers for action are required.
- Comparison of beach profiles over time with reference to previous topographic survey and photogrammetry.
- Monitoring and forecasting of dangerous water levels and wave conditions using publicly available tools.
- Monitoring of water level in estuaries, potential triggers for artificial intervention and to assist with community education.
- Stability of the Lake Cakora entrance including position and status (open/closed).
- Condition of the Lake Cakora banks including mapping of bank condition and erosion sites.
- Photography and survey to map the slope geometry of coastal cliffs.
- Community feedback relating to coastal hazard impacts.

Results of the monitoring programs will be documented and reported on an annual basis to CVC and published on CVC's website (refer *Task PD1-1c: Coastal hazard webpage*). Reporting will include identification of any required management measures and/or modifications to the monitoring program.

Table 21: Coastal hazard monitoring and reporting actions

Coastal hazard monitoring action	CMP Section	Related CMP actions/ tasks
Action IL1-1: Monitor coastal hazards (Iluka)	8.1	Action EM1-1: Implement emergency response procedures Action IL1-2: Develop Iluka adaptive management strategy Action MER4: Re-assessment of coastal hazards
Action HW2-1: Monitor coastal hazards (Hickey Island and Whiting Beach)	9.2	Action HW1-1: Sand nourishment – Whiting Beach Action HW2-2: Develop Hickey Island adaptive management strategy Action MER4: Re-assessment of coastal hazards

Coastal hazard monitoring action	CMP Section	Related CMP actions/ tasks
Action Y4-1: Monitor coastal hazards (Yamba Main Beach)	10.4	Action Y1-1: Sand nourishment (Yamba Main Beach) Task Y4-1b: Liaise with Yamba SLSC regarding operations at Yamba Main Beach and Turners Beach and management of coastal hazards Action Y2-2: Additional geotechnical investigations and review of slope stability at Pilot Hill Action MER4: Re-assessment of coastal hazards
Action CB2-1: Monitor coastal hazards (Convent Beach)	11.2	Action CB1-1: Additional geotechnical investigations and review of slope stability at Convent Beach Action MER4: Re-assessment of coastal hazards
Action AN3-1: Monitor coastal hazards (Spooky Beach)	12.3	Action MER4: Re-assessment of coastal hazards
Action BH2-1: Monitor coastal hazards (Brooms Head)	13.2	Action EM1-1: Implement emergency response procedures Action BH1-2: Beach scraping (Brooms Head reserve) Action BH1-3: Coastal protection works (stage 1, temporary) Action BH1-4: Extension of Brooms Head Reserve revetment Action BH1-5: Develop a preferred strategy for the management of public infrastructure and private land fronting Ocean Road, Brooms Head Action BH2-2: Develop Brooms Head adaptive management strategy Action BH4-1: On-site sewerage management (Brooms Head) Action BH4-2: ICOLL management strategy (Lake Cakora) Action MER4: Re-assessment of coastal hazards
Action S2-1: Monitor coastal hazards (Sandon village)	14.2	Action S1-1: On-site sewerage management (Sandon village) Action S2-2: Develop Sandon village adaptive management strategy Action MER4: Re-assessment of coastal hazards
Action MW1-1: Monitor coastal hazards (Minnie Water)	15.1	Action EM1-1: Implement emergency response procedures Action MER4: Re-assessment of coastal hazards
Action DC1-1: Monitor coastal hazards (Diggers Camp)	16.1	Action EM1-1: Implement emergency response procedures Action MER4: Re-assessment of coastal hazards

Coastal hazard monitoring action	CMP Section	Related CMP actions/ tasks
Action W2-1: Monitor coastal hazards (Wooli)	17.2	Action EM1-1: Implement emergency response procedures Action W1-1: Implement Wooli Beach Management Strategy Task W2-1b: Liaise with Minnie Water-Wooli SLSC regarding operations at Minnie Water beach and management of coastal hazards Action W2-2: Alternative sand sources (Wooli) Action W2-3: Develop Wooli adaptive management strategy Action W3-1: On-site sewerage management (Wooli) Action MER4: Re-assessment of coastal hazards
Action WH1-1: Monitor coastal hazards (Woody Head campground)	20.1	Action EM1-1: Implement emergency response procedures Action WH1-2: Values, asset and infrastructure management (Woody Head campground) Action WH1-3: Review effectiveness of adaptation planning (Woody Head campground) Action MER4: Re-assessment of coastal hazards
Action SR1-1: Monitor coastal hazards (Sandon River campground)	21.1	Action EM1-1: Implement emergency response procedures Action SR1-2: Values, asset and infrastructure management (Sandon River campground) Action SR1-3: Review effectiveness of adaptation planning (Sandon River campground) Action MER4: Re-assessment of coastal hazards

An important purpose of preparing and implementing a CMP is to strengthen the resilience of natural coastal systems and create sustainable opportunities for coastal communities. To maintain focus, highlight successes and provide early warning of problems, it is important to monitor and review progress towards these outcomes at regular intervals. This approach will also assist in developing and applying an approach of continuous improvement in coastal management across NSW. The IP&R reporting system (including annual operational reporting and longer interval strategic reporting) provides the opportunity to formally report on monitoring of coastal management and its outcomes (OEH, 2018c).

The CM Act (section 18(1)) requires CVC to ensure that its CMP is reviewed at least once every 10 years. CVC may review or update the CMP sooner, for any reason, including if there are significant new circumstances which need to be considered.

The monitoring, evaluation and reporting (MER) actions are listed in Table 22 and discussed in the following sections. The estuary health monitoring program will continue to be implemented by DCCEEW.

Table 22: CMP actions – monitoring, evaluation and reporting

MER actions
Action MER1: Estuary health monitoring program
Action MER2: Recreational water quality monitoring
Action MER3: Review of CMP progress and monitoring of performance targets
Action MER4: Re-assessment of coastal hazards
Action MER5: Ten-year review of CMP

Action MER1: Estuary health monitoring program

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
MER1a: Review estuary health monitoring approaches	CVC	DCCEEW	-	CVC
The *Clarence Catchment Ecohealth Project: Assessment of River and Estuarine Condition 2014* (Ryder *et al.*, 2014) assessed the ecological condition at sites in Lake Arragan, Lake Cakora, Sandon River and Wooli Wooli River over a 12-month period (August 2012 to August 2013). This project has not been repeated. The NSW government's estuary health monitoring program included raw water quality datasets and online estuary report cards prepared at various intervals for Wooli Wooli River, Lake Cakora, Lake Arragan and Sandon River. The most recent sampling undertaken for the four estuaries in 2021-22 resulted in ecosystem health grade of B-Good for each estuary (NSW Government, 2024). The NSW government's estuary health monitoring program has been a long running program which is currently under review and is unlikely to continue in its current form. Other CMP actions will also investigate estuary health relating to the performance of on-site sewerage systems at Brooms Head, Sandon and Wooli as well as recreational water quality monitoring (MER2). CVC and DCCEEW will review previous estuary health monitoring programs including sampling locations and monitoring and reporting frequency and develop potential estuary health monitoring approaches for Wooli Wooli River, Lake Cakora, Lake Arragan and Sandon River with the aim of including these estuaries in any future monitoring program. Potential approaches may include a NSW Government funded program, community partnerships or University research programs.				
Performance target	Wooli Wooli River, Lake Cakora, Lake Arragan and Sandon River estuaries are included in an estuary health monitoring program by June 2030.			

Action MER2: Recreational water quality monitoring

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
MER2a: Implement Beachwatch monitoring program at key swimming locations	CVC	DCCEWW	$100,000	DCCEWW, CVC

The Beachwatch program involves monitoring of water quality at swim sites to provide information on the cleanliness of the water to help inform people about their risks and protect their health and wellbeing.

Regular assessment plays an important role in detecting emerging pollution problems. High-quality data enables effective stormwater and wastewater management and assessment, and highlights areas where further work is needed. Beachwatch water quality monitoring provides transparency and ensures that guidelines are followed, so CVC and the community can feel confident that human health risks at swim sites are fully assessed.

CVC participated in the Beachwatch Partnership Program between 2003 and 2009 with many locations monitored within the LGA and a portion of these within the CMP study area. The Beachwatch program will be reinstated based on the state-wide program where required to assess the suitability of water quality at key swimming locations/ areas of high primary contact with coastal waters, subject to the allocation of resources by Beachwatch to implement any monitoring program. Monitoring locations may include:

- Iluka Beach
- Whiting Beach
- Turners Beach
- Yamba Main Beach
- Pippi Beach
- Spooky Beach
- Angourie Blue and Green Pools
- Lake Cakora
- Brooms Head Beach
- Sandon River
- Minnie Water Beach
- Wooli Beach
- Wooli Wooli River

CVC will publish links to the weekly ‘star ratings’ on its website to enable the community to make informed decisions about where and when to swim. The NSW Government will also report results in the State of the Beaches reports.

Performance target	Beachwatch program is reinstated by summer 2025/26.

Action MER3: Review of CMP progress and monitoring of performance targets

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
MER3a: Review of CMP progress and monitoring of performance targets	CVC	DCCEEW, NPWS, DPIRD-Fisheries, TfNSW-Maritime	-	CVC
This CMP and the progress of the management actions will be reviewed to ensure the actions remain relevant and to assess the performance of the CMP in achieving its intended outcomes. CVC will maintain sufficient information and records about its management of the relevant parts of the coastal zone that will enable it to demonstrate how the CMP has been implemented and what has been achieved in connection with the CMP, including whether coastal management actions have been carried out within the timeframes identified in the CMP. CVC will report progress in implementing the CMP, including progress towards the performance targets included for each action, as part of the IP&R framework. This will cumulatively provide valuable information for the strategic review of the CMP.				
Performance target	IP&R reporting on an annual, four-year and ten-year basis			

Action MER4: Re-assessment of coastal hazards

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
MER4a: Re-assessment of coastal hazards	CVC	DCCEEW, NPWS	$200,000	CEGP, CVC
The Stage 2 detailed studies included the first detailed probabilistic assessment of erosion/ recession for the Clarence Valley coastline. The coastal hazard assessments undertaken for Stage 2 of the CMP development (JBP, 2022; JBP, 2023) were undertaken using contemporary methods and data available at the time. Uncertainty exists within all datasets, numerical modelling outputs and mapping approaches used to develop the CMP. The assessment will be revisited and refined in future with a shoreline response model that ideally addresses some of the limitations identified. Ongoing assessment would improve coastal knowledge and understanding of potential future threats, vulnerabilities and risks resulting from changing processes and climate change. CVC will reassess coastal hazards using available data, tools and guidelines and management strategy as part of *Action MER5: Ten-year review of CMP*. The coastal hazards in high-risk areas may need to be assessed more frequently as triggers for intervention are approached, as thresholds for adaptation become more imminent or where large-scale storm events have occurred. Localised re-assessment may be required following major coastal erosion and coastal inundation events.				
Performance target	Re-assessment of study area coastal hazards as part of CMP review process. Localised re-assessment of coastal hazards following major coastal erosion and coastal inundation events where considered necessary.			

Action MER5: Ten-year review of CMP

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
MER5a: Ten-year review of CMP	CVC	DCCEEW, NPWS	$100,000	CEGP, CVC

The CMP will be reviewed at the end of the CMP implementation timeframe (or earlier if warranted by legislative or management changes or improved scientific understanding). The review of the CMP will consider:

- The extent to which CMP actions have been implemented and the outcomes achieved (results of the IP&R reporting from *Action MER3: Review of CMP progress and monitoring of performance targets)*.
- Progress in the implementation of responses, actions and commitments which continue beyond the ten-year timeframe.
- Whether coastal change (either related to the implementation of the CMP, or for reasons outside of the CMP) has reached a threshold where the strategic management approach needs to be reviewed.
- Any new or updated scientific knowledge including outcomes of *Action MER4: Re-assessment of coastal hazards*.
- Data available from the coastal hazard monitoring programs for each management zone, *Action* MER1: Estuary health monitoring program and *Action MER2: Recreational water quality monitoring.*
- Prevailing community attitudes, government policy and strategic planning status.

Performance target	Review and reporting undertaken by June 2035. Adoption and gazettal of the amended CMP as required.

ACTIONS TO BE IMPLEMENTED BY NPWS

NPWS will report on the implementation of coastal management actions in their routine program-based reporting or in reporting linked to relevant plans of management.

Implementation of NPWS CMP actions is subject to funding availability and ability to access other potential funding mechanisms.

19. MANAGEMENT ZONE – NPWS ESTATE

The strategies, actions and tasks to be implemented by NPWS are listed in Table 23 and discussed in the following sections. These apply to all management zones which include NPWS Estate.

Table 23: CMP actions – NPWS Estate

Strategies/ actions	Tasks	Threats addressed	CMP section
Strategy NP1 – Heritage, Asset and Values Management (NPWS Estate)			
Action NP1-1: Conservation and protection of NPWS estate values, assets and heritage items	NP1-1a: Monitor and assess emerging coastal risks and identify response options	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation, T5 - Slope instability/ landslip, T56 - Damage to cultural heritage items/ sites	19.1
Strategy NP2 – Coastal Hazard Adaptation (NPWS Estate)			
Action NP2-1: Incorporate coastal hazard risks into Reserve Plans of Management	NP2-1a: Incorporate coastal hazard risks into reserve Plans of Management	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation, T5 - Slope instability/ landslip, T56 - Damage to cultural heritage items/ sites	19.2
Strategy NP3 – Coastal Habitat Restoration (NPWS Estate)			
Action NP3-1: Coastal habitat restoration and management (NPWS Estate)	NP3-1a: Undertake habitat restoration and weed management works	T9 - Invasive weeds, T12 – Coastal vegetation damage, T35 - Informal pedestrian access, T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users	19.3

Strategies/ actions	Tasks	Threats addressed	CMP section
Strategy NP4 - Emergency Management			
Action NP4-1: Implement emergency response procedures	NP4-1a: Implement CZEAS NP4-1b: Reassess emergency management strategy	T1 - Beach erosion, T5 - Slope instability/ landslip	19.4

19.1 Strategy NP1 – Heritage, Asset and Values Management (NPWS Estate)

Action NP1-1: Conservation and protection of NPWS estate values, assets and heritage items

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	SA17, SA18, SA19
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation, T5 - Slope instability/ landslip, T56 - Damage to cultural heritage items/ sites				
Coastal mgt areas	CUA, CEA	**B/C distribution**	100% public		
Reserve assets including natural and cultural heritage (e.g. middens, burial sites, artefacts) and historic heritage items, visitor facilities and infrastructure including structures, roads, trails and key beach access points may become vulnerable to coastal hazards including significant erosion during the life of the CMP. NPWS is required to conserve, protect, and manage these values and assets under the *National Parks and Wildlife Act 1974*. NPWS will assess the risks and identify appropriate response actions.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
NP1-1a: Monitor and assess emerging coastal risks and identify response options	NPWS	DCCEEW	Not costed	NPWS, IAS

In consultation with Yaegl TOAC, NPWS will develop options to address emerging risks to visitors, reserve values and assets including implementation of the following measures as required:

- Site assessments (e.g. heritage, access/safety, structures) to identify issues and develop response actions.
- Preparation of site remediation plans including review of safety risks and environmental values.
- Dune stabilisation and rehabilitation.
- Sand trapping, beach scraping or re-profiling.
- Battering of access points and unsafe erosion scarps in visitor use areas.
- Maintenance of safe and viable beach access and beach use areas through:
  - Vegetation management (e.g. pruning and lopping) of trees that are vulnerable to erosion.
  - Relocation of lopped and fallen trees to the beach and dune.
  - Maintenance of access ways and associated infrastructure.
- Assess and implement sediment and erosion control, stability measures and exclusion zones if required for heritage listed items at Red Cliff and Lake Arragan.
- Strategic withdrawal, relocation, or redesign of infrastructure or assets such as the Yuraygir Coastal Walk, if sections become under threat to coastal hazards.

Performance target	Regular site assessments following significant storm events or extreme high-water events such as king tides or flooding.

19.2 Strategy NP2 – Coastal Hazard Adaptation (NPWS Estate)

Action NP2-1: Incorporate coastal hazard risks into Reserve Plans of Management

Priority	High	**Timeframe**	Long-term	**Stage 3 option**	SA20
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation, T5 - Slope instability/ landslip, T56 - Damage to cultural heritage items/ sites				
Coastal mgt areas	CUA, CEA, CWLRA		**B/C distribution**	100% public	

The *Broadwater National Park, Bundjalung National Park, and Iluka Nature Reserve Plan of Management* (NPWS, 1997) and *Yuraygir National Park and Yuraygir State Conservation Area Plan of Management* (NPWS, 2003) guide the management of NPWS estate within the CMP study area. The plans were prepared over twenty years ago, and do not adequately reflect the increasing risk posed by coastal hazards within the NPWS estate and the Woody Head, Sandon River, Lake Arragan and Red Cliff campgrounds. Future updates of the plans of management will consider coastal vulnerability and respond to significant coastal hazards, risks and threats to reserve values and assets.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
NP2-1a: Incorporate coastal hazard risks into reserve Plans of Management	NPWS	DCCEEW	$50,000	NPWS
Future updates of NPWS reserve Plans of Management will: • Consider the objects of the CM Act including integrated coastal management and response and adaptation to coastal hazards. • Support implementation of the Clarence Valley Open Coast CMP and incorporate relevant strategies (*Strategy WH1 – Coastal Hazard Adaptation (Woody Head Campground), Strategy SR1 – Coastal Hazard Adaptation (Sandon River Campground)* and *Strategy LR1 – Manage Slope Instability (Lake Arragan and Red Cliff).* • Review arrangements for bicycle access, vehicle beach access and interactions between national parks and adjoining lands for recreation and tourism.				
Performance target	Update NPWS reserve plans of management by 2035.			

19.3 Strategy NP3 – Coastal Habitat Restoration (NPWS Estate)

Action NP3-1: Coastal habitat restoration and management (NPWS Estate)

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	SA7, SA12
Threats addressed	T9 - Invasive weeds, T12 – Coastal vegetation damage, T35 - Informal pedestrian access, T36 - Population increase and visitor pressure increasing demand on services and environment and conflict between users				
Coastal mgt areas	CUA, CEA, CWLRA	**B/C distribution**	100% public		
Coastal dune, river margins and headland habitats in the NPWS estate are subject to weed invasion from a range of species including bitou bush, groundsel bush, ochna, lantana and glory lily. NPWS has identified control of these species as a priority for restoration at Iluka Bluff to Shark Bay, Angourie Point, Grey Cliffs (Lake Arragan) to Mara Creek and Sandon Beach. Other coastal areas, including beaches and rocky shores, provide habitats that support roosting, foraging, and breeding for a range of species. These habitats are threatened by both coastal hazards and increased visitation. Inundation poses a risk to turtle nests for species including the green turtle and the hawksbill turtle. Disturbance from beach users poses a risk to shore and beach nesting birds such as little terns, pied and sooty oystercatchers and the beach stone-curlew.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
NP3-1a: Undertake habitat restoration and weed management works	NPWS	Yaegl TOAC, Landcare	$600,000	NPWS, SOS, IAS, Landcare

NPWS will continue the habitat restoration and weed management regime in accordance with reserve plans of management and the North Coast Regional Weed Management Strategy (2023) including:
• Weed control and bush regeneration undertaken at identified locations.
• Monitoring of turtles and nest locations.
• Monitoring of shore and beach nesting birds.
• Implementing protection measures to support breeding and nesting.
• Monitor and manage threats to wildlife including:
  ○ Establishing exclusion areas.
  ○ Pest management such as cane toads.
  ○ Relocation of vulnerable turtle nests.
Coastal habitat restoration and weed management works may include environmental protection works (works associated with the rehabilitation of land towards its natural state or any work to protect land from environmental degradation, and includes bush regeneration works, wetland protection works, erosion protection works, dune restoration works and the like, but does not include coastal protection works) in areas that are also mapped as CWLRA shown on Figure 4, Section 2.2				

Performance target	Weed control program commenced by December 2025.			

19.4 Strategy NP4 - Emergency Management

Emergency response includes actions to address residual risk in emergency situations. Emergency response procedures have been developed for NPWS estate areas that are at risk from coastal hazards (where coastal protection works have not been implemented or are not always effective) to limit the consequences of large and/or unpredicted coastal events.

NPWS will undertake emergency coastal protection works identified in the Coastal Zone Emergency Action Subplan (CZEAS) included in Appendix 3. This may include the placement of sand, or the placing of sandbags for a period of not more than 90 days, on a beach, or land adjacent to a beach, to mitigate the effects of coastal hazards on land. Other emergency actions may include the installation of temporary fencing and signage, closure of NPWS-managed roads and accessways affected by beach erosion or cliff/ slope instability/ landslip hazards. These works are exempt development as they would be carried out by or on behalf of NPWS in accordance with this CMP and the CZEAS.

Action NP4-1: Implement emergency response procedures

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	SA30, SA31, SA32
Threats addressed	T1 - Beach erosion, T3 – Coastal inundation, T5 - Slope instability/ landslip				
Coastal mgt areas	CUA, CEA			**B/C distribution**	100% public
The CZEAS (Appendix 3) outlines the roles and responsibilities of all public authorities in response to emergencies immediately preceding or during periods of beach erosion, coastal inundation or cliff instability, where the beach erosion, coastal inundation or cliff instability occurs through storm activity or an extreme or irregular event. The roles and responsibilities defined in the CZEAS include the carrying out of coastal protection works and emergency coastal protection works for the protection of property and assets affected or likely to be affected by coastal emergency events within the NPWS estate. The CZEAS details actions to be implemented in the four emergency phases of emergency management (prevention, preparation, response and recovery, Figure 25) to manage coastal emergency events relating to coastal erosion, coastal inundation and coastal cliff/ slope instability.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
NP4-1a: Implement CZEAS	NPWS	CVC, SES	$50,000	NPWS
The CZEAS will be implemented in areas where beach erosion, coastal inundation or cliff instability occurs through storm activity or an extreme or irregular event within NPWS estate areas.				
Performance target	Emergency response procedures implemented in accordance with the CZEAS			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
NP4-1b: Reassess CZEAS and triggers for implementation of emergency coastal protection works	NPWS	CVC, SES	-	NPWS
NPWS will reassess the coastal hazards and the emergency management strategy documented in the CZEAS following major coastal erosion events.				
Performance target	Review of emergency management strategy within 6 months of a coastal erosion event			

20. MANAGEMENT ZONE – WOODY HEAD CAMPGROUND

The strategies, actions and tasks to be implemented at Woody Head campground are listed in Table 24 and discussed in the following sections. CMP actions are shown on Figure 91.

Table 24: CMP actions – Woody Head campground

Strategies/ actions	Tasks	Threats addressed	CMP section
Strategy WH1 – Coastal Hazard Adaptation (Woody Head Campground)			
Action WH1-1: Monitor coastal hazards (Woody Head campground)	WH1-1a: Implement coastal hazard monitoring program	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation	20.1
Action WH1-2: Values, asset and infrastructure management (Woody Head campground)	WH1-2a: Implement CHRP for Woody Head campground WH1-2b: Ongoing maintenance and/or upgrade of coastal protection works	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation	
Action WH1-3: Review effectiveness of adaptation planning (Woody Head campground)	WH1-3a: Review effectiveness of adaptation planning	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation	

20.1 Strategy WH1 – Coastal Hazard Adaptation (Woody Head Campground)

The beach at Woody Bay adjoins the Woody Head campground and is used by campground and day visitors for recreation activities. Shoreline recession has been ongoing at Woody Bay with significant natural, cultural and built assets vulnerable to coastal hazards. NPWS has made significant investment in facilities and coastal protection works at Woody Head. A seawall was constructed along the shoreline of the Woody Head campground (Figure 85 and Plate 13) to protect the campground amenities while a phased retreat program from the eroding section of the campground was formulated and carried out. An artificial dune was also constructed at Woody Bay in 2004 (Figure 85). The purpose of this dune was to limit wave overtopping and coastal inundation of low-lying areas of the campground.

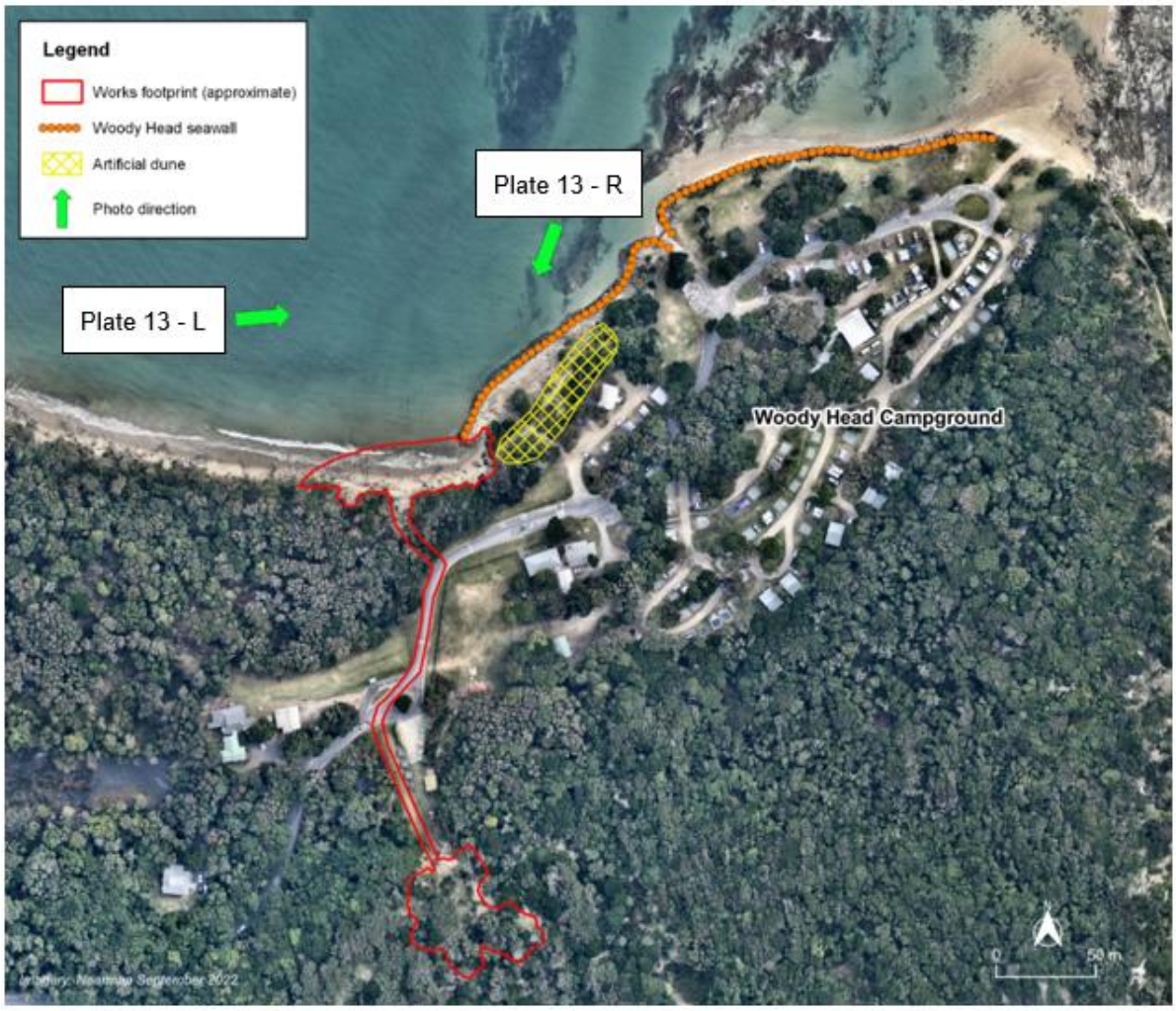

Figure 85: Location of seawall, artificial dune and June 2024 sand nourishment footprint – Woody Head

Plate 13: Woody Head campground seawall (Plate 13-L, Plate 13-R)

NPWS has developed a Coastal Hazard Response Plan (CHRP) for Woody Head (NPWS, 2024a). The CHRP assessed the current and future risk of the Woody Head campground to coastal hazards including erosion, inundation and coastline recession. The CHRP has assessed options to manage the risk and presents a recommended option including coastal protection works (extending the existing seawall by approximately 80 m with sand nourishment and dune rehabilitation of a pocket beach) and adaptive management, including developing a retreat plan that establishes triggers and thresholds for decommissioning, retreat and relocation of vulnerable assets.

Acknowledging the significant time required to progress these components and the increasing threat to the campground access road due to coastal recession, NPWS implemented a sand nourishment campaign in June 2024 (Figure 85, Figure 86 and Figure 87). This is the adopted interim approach to restore the beach while the permanent coastal protection works are progressed. The sand nourishment is consistent with the longer-term strategy and includes many components of that strategy (sand extraction from the borrow site, new access path and beach nourishment).

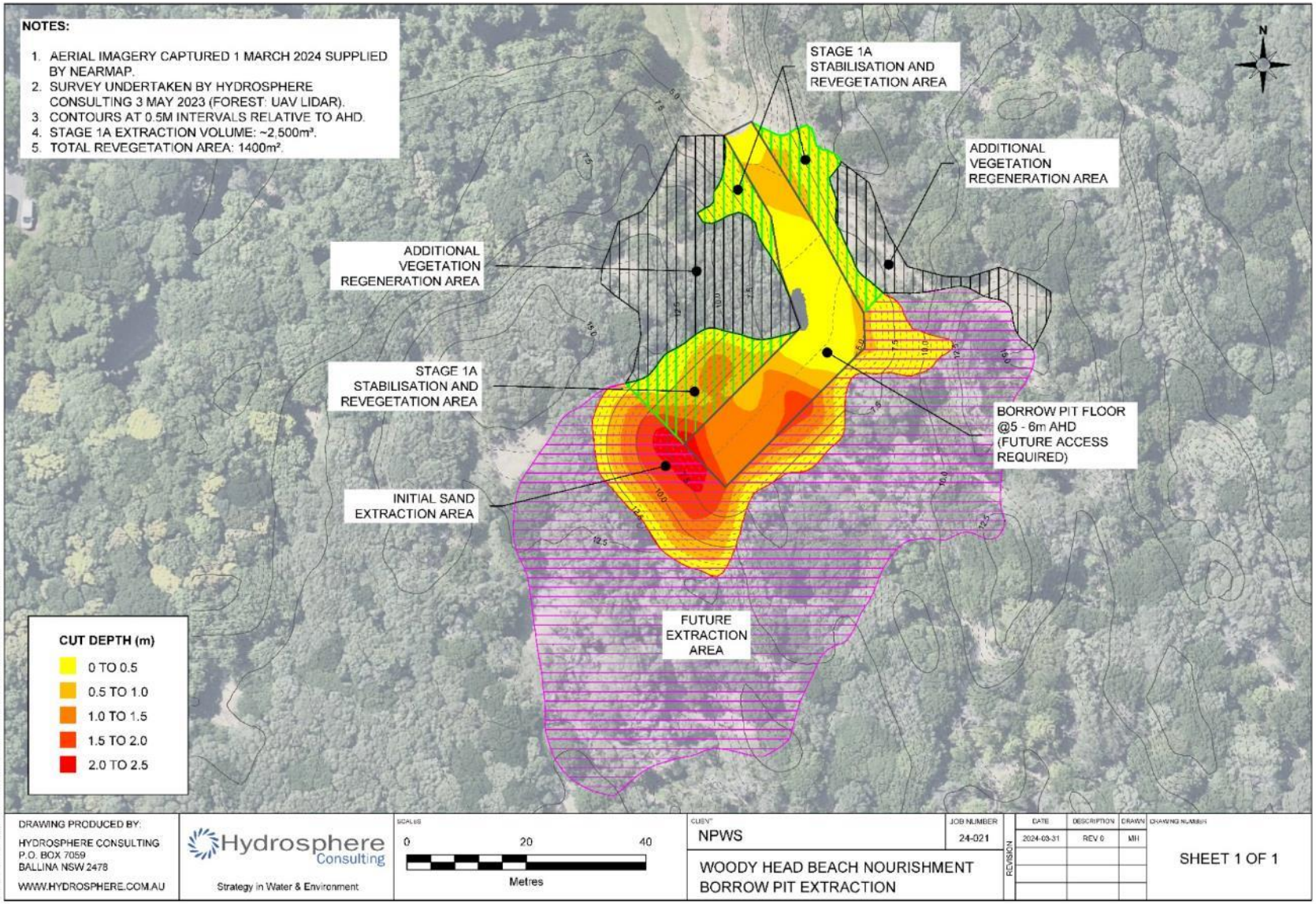

Figure 86: Sand nourishment borrow pit – Woody Head

Source: Hydrosphere Consulting (2024b)

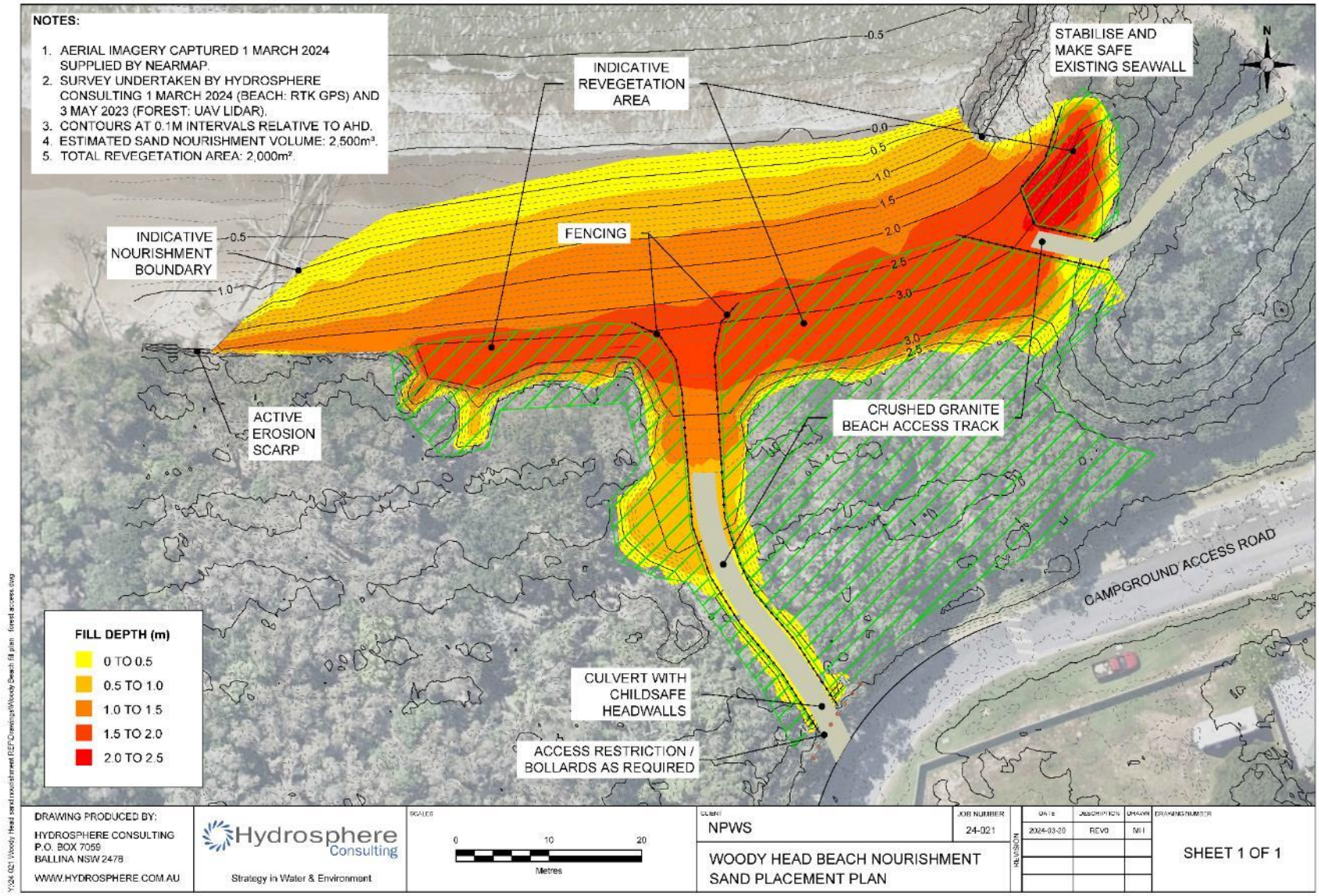

Figure 87: Sand placement plan – Woody Head

Source: Hydrosphere Consulting (2024b)

Action WH1-1: Monitor coastal hazards (Woody Head campground)

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	SA1
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation				
Coastal mgt areas	CUA, CEA			**B/C distribution**	100% public
Monitoring of erosion and beach recession at Woody Bay and Shark Bay Beach will alert NPWS of significant changes to the shoreline and provide information for future decision making and management responses.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
WH1-1a: Implement coastal hazard monitoring program	NPWS	DCCEEW	$50,000	NPWS
The coastal hazard monitoring program may include: • Monitoring of beach erosion and recession using periodic updates to beach profiles in the NSW Beach Profile Database and updates to DEA Coastlines for Woody Bay Beach. • Establishing photo points to monitor and record changes to the shoreline. • Establishing a reference point to monitor and record changes in position of the erosion scarp at Woody Bay Beach following storm events.				
Performance target	Coastal hazard monitoring program implemented by December 2026 and monitoring undertaken annually and following significant storm events.			

Action WH1-2: Values, asset and infrastructure management (Woody Head campground)

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	NPC1
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation				
Coastal mgt areas	CUA, CEA			**B/C distribution**	100% public
Based on the recommendations of the Woody Head CHRP, NPWS will undertake coastal protection works to protect the campground and associated recreational, environmental and cultural values. Subject to actual recession rates observed, detailed design and environmental assessments, the recommended coastal protection works include extending the existing seawall by approximately 80 m with sand nourishment and dune rehabilitation of a pocket beach. Concept designs (Figure 88 to Figure 90) show approximate location of the coastal protection works. The exact works location may be refined and located further southwards as necessary if ongoing shoreline recession and the impact of storm events results in significant recession of the shoreline prior to completion of the works design, approvals and construction. The final works location will be determined through the design process as guided by an appropriately qualified coastal and/or geotechnical engineer. An assessment of feasibility (Hydrosphere, 2023b) was completed and contains further detail on the concept design and constructability of the preferred option. To maintain functionality and adapt to sea level rise, existing coastal protection works within the Woody Head campground precinct may also require maintenance and/or upgrade. In the long-term, parts of the campground are likely to become vulnerable to coastal hazards and decommissioning and/or relocation will be required.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
WH1-2a: Implement CHRP for Woody Head campground	NPWS	DCCEEW	$2,422,000	NPWS

NPWS will implement the recommendations of the CHRP including:

- Environmental and cultural assessments, detailed design and approvals based on the recommendations in Hydrosphere (2023b).
- Relocating the campground access road and associated services if required, particularly if construction of the recommended final option is not feasible in the short term.
- Developing a small beach through an initial sand nourishment campaign to provide safe access for beach recreation opportunities.
- Ongoing sand nourishment campaigns will be conducted over the life of the CMP to maintain the pocket beach and mitigate seawall end-effects.
- Sand will be sourced based on the recommendations in Hydrosphere (2023b), with the hind-dune at Woody Head as the primary source and potential opportunistic use of navigational dredging sand.
- Extending the existing seawall approximately 80 m, with the exact location to be determined through detailed investigation and design. Depending on the severity of erosion/recession experienced, the position of the wall may be landward of concept designs.
- Dune rehabilitation and revegetation.
- Adaptive management, including developing a retreat plan that establishes triggers and thresholds for decommissioning, retreat and relocation of vulnerable assets.

The concept design is provided in Figure 88 to Figure 90.

Performance target	Construction of coastal protection works commenced by 2028 and retreat plan developed by 2035.

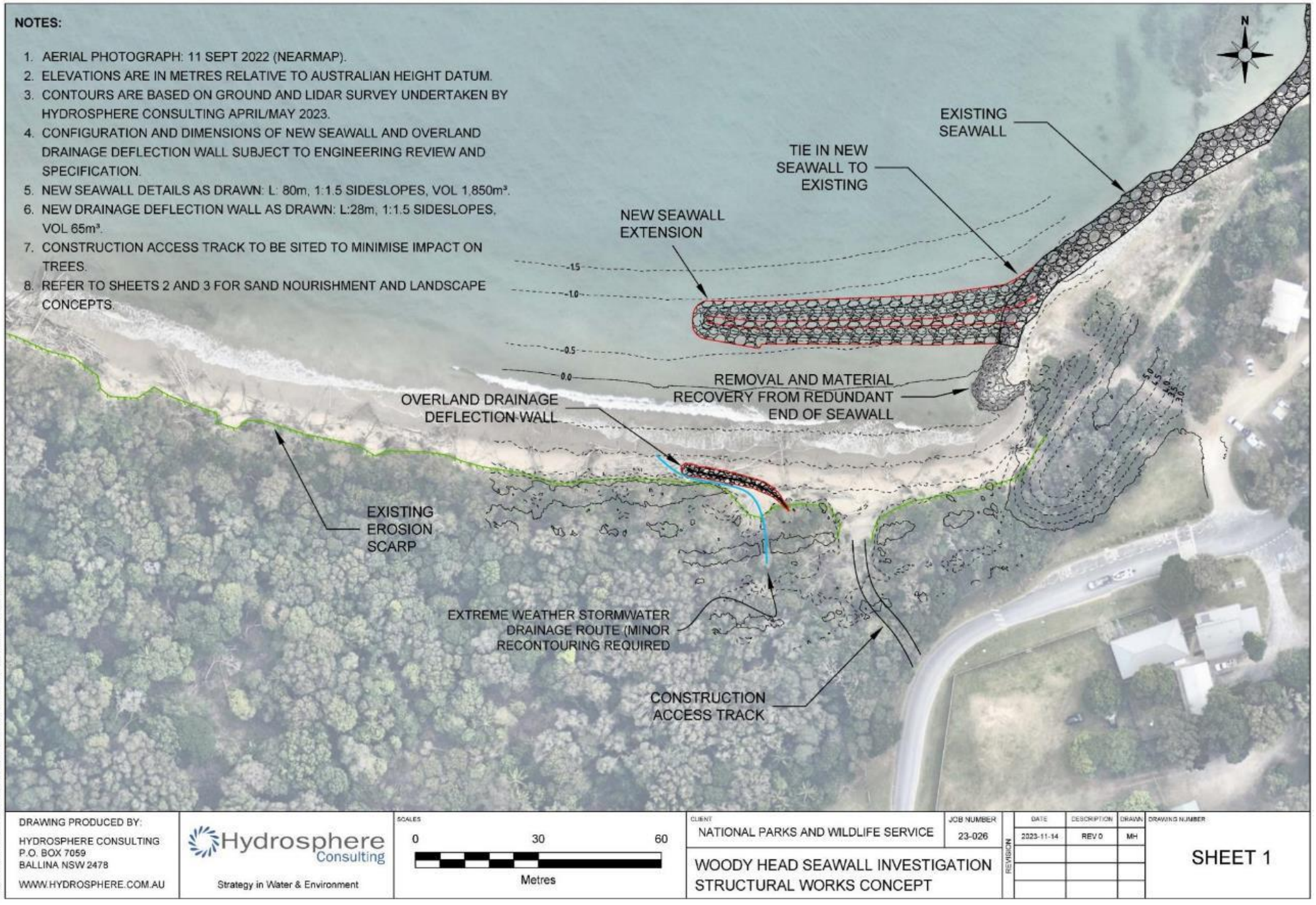

Figure 88: Woody Head seawall extension structural works concept

Source: Hydrosphere Consulting (2023b)

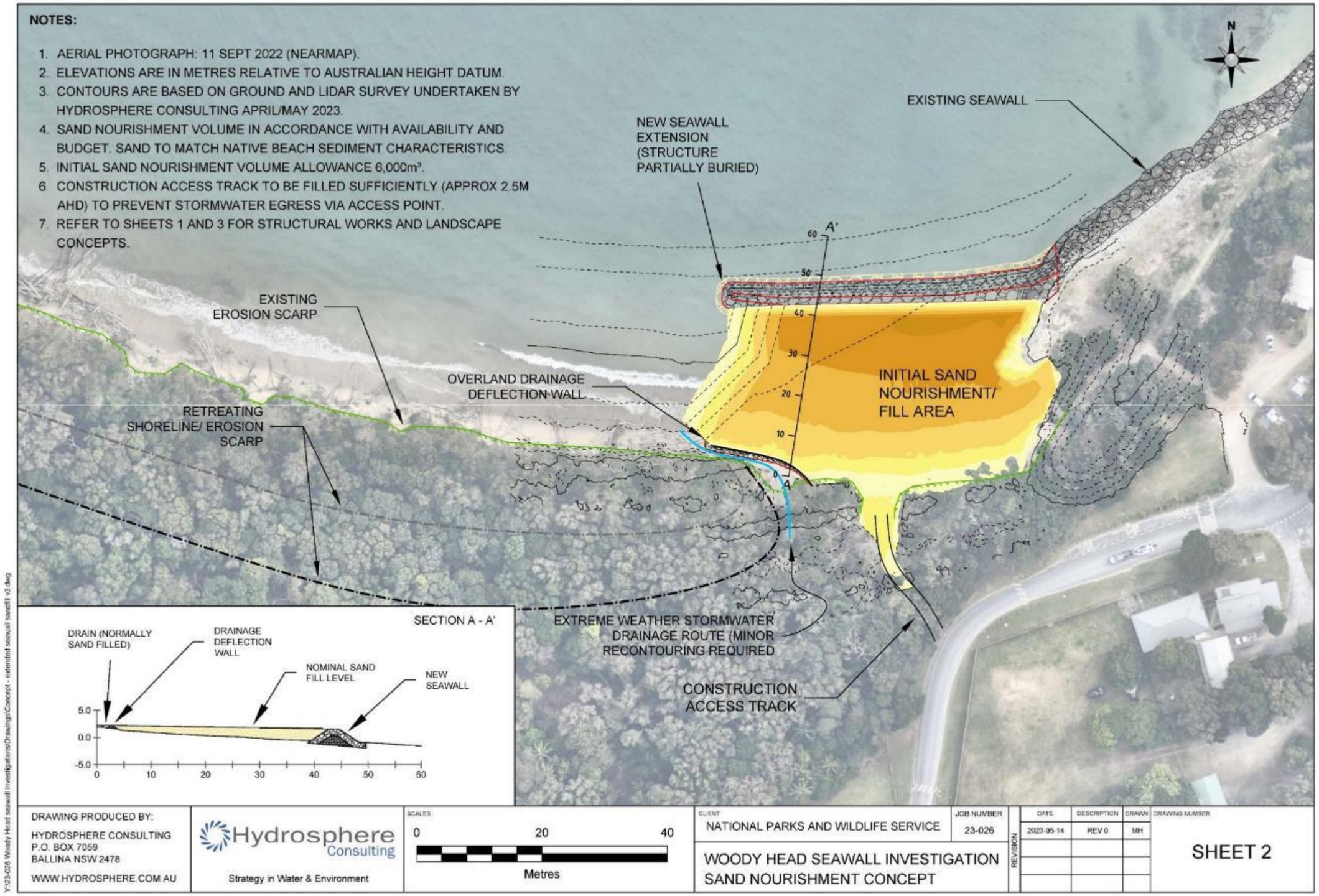

Figure 89: Woody Head sand nourishment concept

Source: Hydrosphere Consulting (2023b)

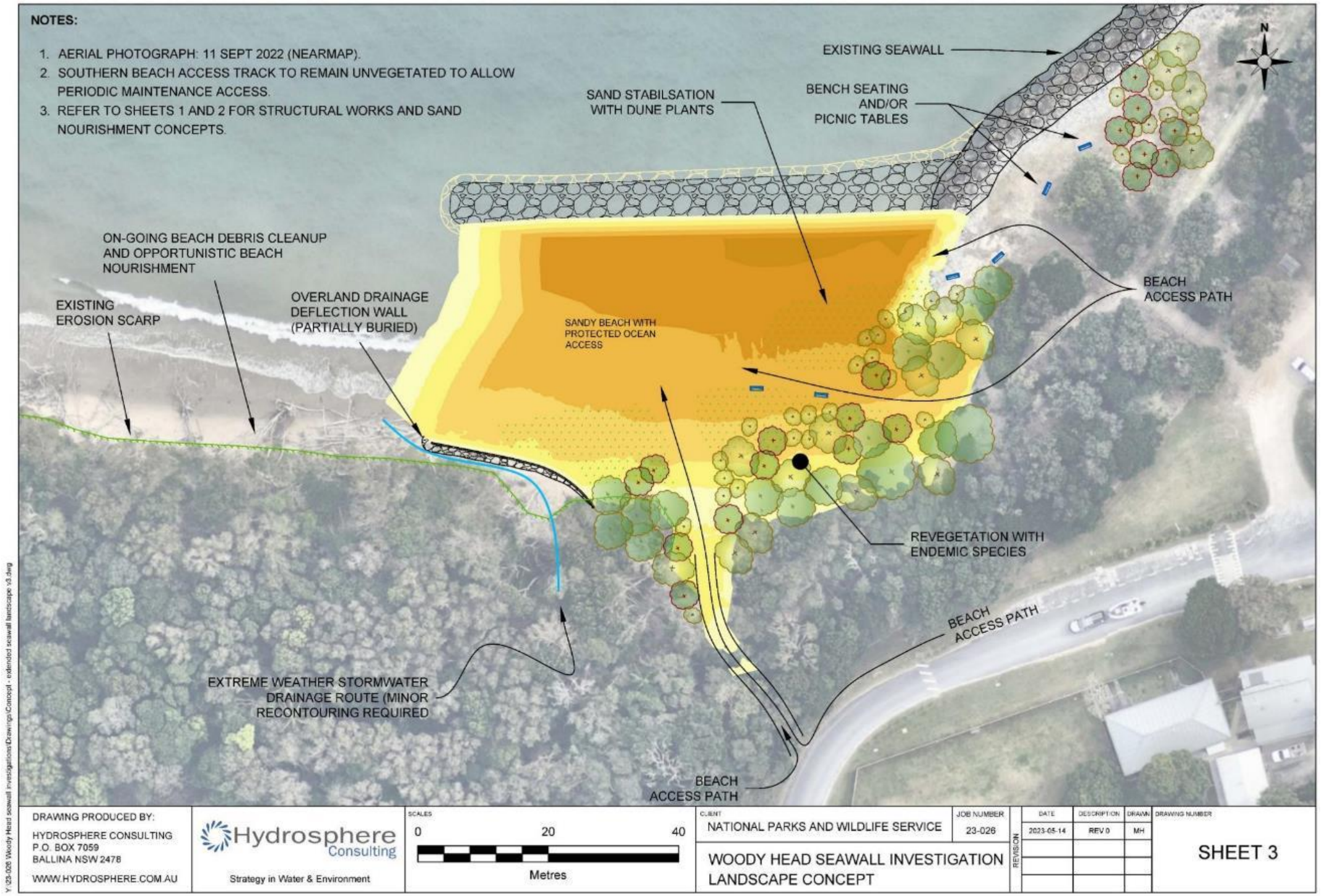

Figure 90: Woody Head landscaping concept

Source: Hydrosphere Consulting (2023b)

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
WH1-2b: Ongoing maintenance and/or upgrade of coastal protection works	NPWS	DCCEEW	$500,000	NPWS

The existing seawall at Woody Head is comprised of two sections, the eastern section constructed in the 1980s and 1990s, while the western section was progressively constructed in sections from 2006. The existing seawall requires regular maintenance works to maintain its functionality, particularly to protect against undermining. Maintenance of and/or upgrade of coastal protection works within the Woody Head precinct may include:

- Regular visual checks of the condition of the seawall.
- Undertaking required environmental and cultural assessments, design and approvals.
- If visual checks indicate degradation, structural assessment or repair of the existing seawall may be undertaken. This may include replacing sections with new rocks, armouring or extension of the eastern wall to connect with the bedrock headland.
- Maintenance of the drainage structures connected to the existing seawall for stormwater management.
- Weeding and vegetation management of dune vegetation and littoral rainforest at Woody Bay.
- Consultation with the Clarence River Fisherman Association regarding boat ramp maintenance to allow safe access.
- Improving pedestrian access ways in the vicinity of the existing seawall.
- Improving signage and information available.

Performance Target	Existing seawall is visually assessed annually and following storm events.

Action WH1-3: Review effectiveness of adaptation planning (Woody Head campground)

Priority	High	**Timeframe**	Long-term	**Stage 3 option**	SA2
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation				
Coastal mgt areas	CUA, CEA			**B/C distribution**	100% public

The CHRP is the first stage of adaptation planning for Woody Head campground under the CMP. In the medium to long-term implementation of the CMP, NPWS will develop an adaptation plan for the Woody Head campground precinct and surrounding national park estate such as the Iluka Nature Reserve, to recognise the long-term risk of coastal hazards. A review of the CHRP and adaptation planning will be undertaken using available information from *Task WH1-1a*.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
WH1-3a: Review effectiveness of adaptation planning	NPWS	DCCEEW	$100,000	NPWS
The review will assess coastline changes over the timeframe of the CMP. Additional information or hazard reassessment may be captured should it be required. This will be used to evaluate the effectiveness of implementing the CHRP and other adaptation plans to ensure NPWS is managing the risks to Woody Head campground precinct from coastal hazards.				
Performance target	Undertake a review of the Woody Head CHRP and any other adaptation plans in year 10 of the CMP.			

Figure 91: CMP actions – Bundjalung National Park

21. MANAGEMENT ZONE – SANDON RIVER CAMPGROUND

The strategies, actions and tasks to be implemented at Sandon River campground are listed in Table 25 and discussed in the following sections. CMP actions are shown on Figure 68.

Table 25: CMP actions – Sandon River campground

Strategies/ actions	Tasks	Threats addressed	CMP section
Strategy SR1 – Coastal Hazard Adaptation (Sandon River Campground)			
Action SR1-1: Monitor coastal hazards (Sandon River campground)	SR1-1a: Implement coastal hazard monitoring program	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation	21.1
Action SR1-2: Values, asset and infrastructure management (Sandon River campground)	SR1-2a: Implement CHRP for Sandon River campground SR1-2b: Ongoing maintenance and/or upgrade of coastal protection works	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation	
Action SR1-3: Review effectiveness of adaptation planning (Sandon River campground)	SR1-3a: Review effectiveness of adaptation planning	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation	

21.1 Strategy SR1 – Coastal Hazard Adaptation (Sandon River Campground)

NPWS developed a CHRP for Sandon River (NPWS, 2024b) as part of the CMP development. The CHRP assessed the current and future risk of the Sandon River campground to coastal hazards including erosion, inundation, and coastal recession. Sandon River campground area is at high risk of inundation impacting the campground access road in the present day. The CHRP has assessed options to manage the risk and presents a recommended option.

Action SR1-1: Monitor coastal hazards (Sandon River campground)

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	SA1
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	
Monitoring of riverbank erosion and beach recession at Sandon River and Sandon Beach will alert NPWS of significant changes to the shoreline and provide information for future decision making and management responses.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
SR1-1a: Implement coastal hazard monitoring program	NPWS	DCCEEW	$50,000	NPWS

Coastal hazard monitoring may include:

- Monitoring of beach erosion and recession using periodic updates to beach profiles in the NSW Beach Profile Database and updates to Digital Earth Australia Coastlines for Sandon Beach.
- Establishing photo points to monitor and record changes to the shoreline and dune building associated with sand trapping and dune stabilisation.
- Establishing a reference point to monitor and record changes in position of the erosion scarp at Sandon Beach following storm events.
- Monitoring and recording changes in the stability and condition of Sandon River Road including bank erosion and protection measures.

Performance target	Coastal hazard monitoring program implemented by 2026 and monitoring undertaken annually and following significant storm and flood events.

Action SR1-2: Values, asset and infrastructure management (Sandon River campground)

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	NPC2
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation				
Coastal mgt areas	CUA, CEA		**B/C distribution**		

Based on the recommendations of the CHRP, NPWS will apply an adaptive management approach at Sandon River campground to provide short-term mitigation against coastal hazards whilst developing a plan to retreat from the campground. The dune stabilisation will provide a buffer to erosion in the short term. Retreat planning will identify thresholds and trigger points for when the site is no longer viable and when infrastructure should be removed. Maintenance, upgrade and extension to existing riverbank protection measures may be undertaken as needed, while access to and use of the Sandon River campground is viable. Beach stabilisation and riverbank protection work will be maintained during this period.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
SR1-2a: Implement CHRP for Sandon River campground	NPWS	DCCEEW	$560,000	NPWS
Implementing the CHRP may include: • Undertaking environmental and cultural assessments, design and approvals. • Infill planting to the north of campground between the campsites and existing dune restoration area with suitable low growing species. • Infill planting along the eastern perimeter of the campground to restore the eroded riverbank. • Reconfiguration of the sand trap fencing and dune rehabilitation measures. • Maintenance of existing and new coastal protection works including riverbank protection, sand trapping and dune stabilisation. • Adaptive management, including establishing triggers and thresholds for decommissioning, retreat, and relocation of vulnerable assets in consultation with stakeholders. • Improving signage and information available.				
Performance target	Implementation of Sandon River campground CHRP commenced by 2025.			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
SR1-2b: Ongoing maintenance and/or upgrade of coastal protection works	NPWS	DCCEEW, DPIRD – Marine Parks	$250,000	NPWS
Rock armouring of the riverbank protects a vulnerable section of Sandon River Road. Sand traps, exclusion fencing, and dune stabilisation measures have been established on Sandon beach in response to coastal erosion. Maintenance of and/or upgrade of these beach stabilisation measures and protection works within the Sandon River precinct may include: • Undertaking required environmental and cultural assessments, design and approvals. • Regular visual checks of rock armouring and undertaking structural assessments as necessary. • Replacing sections of the rock revetment to maintain safe access in the short term. • Maintenance, repair, raising and relocating of dune fencing including adjustment to access points. • Weeding and vegetation management of dunes. • Maintenance of the boat ramp to allow safe access. • Improving pedestrian access ways in the campground precinct.				
Performance Target	The rock revetment and other coastal protection works are visually assessed annually and following significant storm events.			

Action SR1-3: Review effectiveness of adaptation planning (Sandon River campground)

Priority	High	**Timeframe**	Long-term	**Stage 3 option**	SA2
Threats addressed	T1 - Beach erosion, T2 - Shoreline recession, T3 - Tidal/ coastal Inundation				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	
The CHRP is the first stage of adaptation planning for Sandon River campground under the CMP. NPWS will develop an adaptation plan for the Sandon River campground precinct, to recognise the long-term risk of coastal hazards. A review of the CHRP and adaptation planning will be undertaken.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
SR1-3a: Review effectiveness of adaptation planning	NPWS	DCCEEW	$100,000	NPWS
The review will involve: • Assessing coastline changes over the term of the CMP. • Evaluating the effectiveness of adaptation measures. • Updating the adaptation plan including measures and timelines.				
Performance target	Undertake a review of the Sandon River CHRP and any other adaptation plans in year 10 of the CMP.			

22. MANAGEMENT ZONE – LAKE ARRAGAN AND REDCLIFF (LR)

The strategies, actions and tasks to be implemented at Lake Arragan and Red Cliff campground are listed in Table 26 and discussed in the following sections. CMP actions are shown on Figure 92.

Table 26: CMP actions – Lake Arragan and Redcliff campground

Strategies/ actions	Tasks	Threats addressed	CMP section
Strategy LR1 – Manage Slope Instability (Lake Arragan and Red Cliff)			
Action LR1-1: Implement measures to mitigate risks from slope instability (Lake Arragan and Red Cliff)	LR1-1a: Install signage and implement remedial works	T5 - Slope instability/ landslip	22.1

22.1 Strategy LR1 – Manage Slope Instability (Lake Arragan and Red Cliff)

NPWS has identified recent and/or active landslides at five sections of the coastal escarpment at Lake Arragan and Red Cliff campground. An appraisal of geotechnical conditions was undertaken to assist NPWS to develop and implement management strategies at these sites (Regional Geotechnical Solutions, 2023a; 2023b).

Action LR1-1: Implement measures to mitigate risks from slope instability (Lake Arragan and Red Cliff)

Priority	High	**Timeframe**	Short-term	**Stage 3 option**	NPC4
Threats addressed	T5 - Slope instability/ landslip				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	
Landslide events have resulted in damage to the existing open space at Lake Arragan and Red Cliff campground. A geotechnical management strategy will be developed and implemented to respond to cliff slope instability risk.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
LR1-1a: Install signage and implement remedial works	NPWS	-	$325,000	NPWS
Measures to mitigate risks from slope instability will be implemented based on the recommendations of Regional Geotechnical Solutions (2023a; 2023b) and any future advice. NPWS will assess the recommendations of the report and implement the preferred remedial actions which may include: • Signage and exclusion fencing installed to raise awareness of instability issues and manage risk to visitors. • Soil erosion control measures including vegetation cover. • Maintenance and/or upgrade of the elevated timber walkway on the southern bank of Lake Arragan including deeper footings and additional steps/ ladder. • The open swale drain located on the eastern side of Red Cliff Road will be redirected to discharge away from the rear of the landslide. • Diversion of stormwater from behind/upslope of Grey Cliff steps footings. • Reconstruct Grey Cliff step foundations to ensure that the footings are founded at a depth of at least 0.4 m into the weathered rock. • Strategic management of access tracks, open space and parking areas along the banks of Lake Arragan, Red Cliff and Grey Cliff. • Periodic reassessment by a geotechnical engineer every 2-5 years or as required. • NPWS ground staff will be trained on the identification of potential geotechnical hazards and actively encourage regular assessment of areas of concern. NPWS will further investigate the report recommendations and will consider strategic withdrawal, relocation, or redesign of infrastructure or assets if sections become under threat to coastal hazards.				
Performance target	Remedial measures are completed by June 2028.				

Figure 92: CMP actions – Lake Arragan and Red Cliff

ACTIONS TO BE IMPLEMENTED BY DPIRD-FISHERIES

The strategies, actions and tasks to be implemented by DPIRD-Fisheries are discussed in the following sections and included on the figures showing the CMP actions for relevant management zones.

DPIRD-Fisheries will report on the implementation of coastal management actions in their routine program-based reporting or in reporting linked to relevant plans of management.

23. FISH HABITAT MANAGEMENT

The strategies, actions and tasks relating to management of fish habitat are discussed in the following sections and included on the figures showing the CMP actions for relevant management zones.

Table 27: CMP actions – fish habitat management

Strategies/ actions	Tasks	Threats addressed	CMP section
Strategy F1 - Marine Vegetation Management			
Action F1-1: Intertidal marine vegetation strategies	F2-1a: Develop IMVS for Clarence River estuary F2-1b: Develop IMVS for Solitary Islands Marine Park estuaries	T22 – Modification of coastal wetland habitat due to coastal hazards	23.1
Strategy F2 – Mitigate Bank Erosion			
Action F2-1: Wooli Wooli riverbank and riparian condition assessment	F2-1a: Bank and riparian condition assessment (Wooli Wooli River)	T6 - Erosion of foreshores, T7 - Historic clearing of riparian vegetation and adjacent habitat, T10 - Uncontrolled stock access to and grazing within the riparian zone	23.2
Strategy F3 – Seagrass Management			
Action F3-1: Seagrass investigations	F3-1a: Assess extent of seagrass decline in Sandon River F3-1b: Assess extent of seagrass decline in Wooli Wooli River	T11 - Seagrass decline	23.3

23.1 Strategy F1 - Marine Vegetation Management

Threats to coastal wetland and littoral rainforest areas in the study area have been identified including coastal hazards (e.g. erosion and increasing tidal inundation), damage to estuarine vegetation, invasive weeds and unauthorised clearing. In addition, with future sea level rise, the frequency, extent, depth and duration of tidal inundation are expected to increase. This is expected to cause changes to species composition and/or the potential die-off of some species (e.g. due to exposure of intolerant freshwater species to saltwater, or where barriers to upslope movement exist or anthropogenic impacts such as mowing

limit the extent of colonisation). If no barriers to migration exist, over time estuarine vegetation is likely to expand and migrate upslope with increasing tidal inundation. In some areas this may cause displacement of adjacent habitats. It is important to identify viable migration pathways for both marine vegetation and adjacent habitats, particularly where endangered ecological communities (EECs) may be impacted (e.g. Coastal Saltmarsh, Freshwater Wetlands, Littoral Rainforest, Lowland Rainforest, Subtropical Coastal Floodplain Forest, Swamp Oak Floodplain Forest and Swamp Sclerophyll Forest). To ensure that marine vegetation continues to provide essential ecosystem services, threats to estuarine vegetation need to be managed and viable migration pathways need to be identified.

Action F1-1: Intertidal marine vegetation strategies

Priority	Medium	**Timeframe**	Short-term	**Stage 3 option**	SA25
Threats addressed	T22 – Modification of coastal wetland habitat due to coastal hazards				
Coastal mgt areas	CUA, CEA, CWLRA	**B/C distribution**	100% public		

Intertidal Marine Vegetation Strategies (IMVS) are being developed as part of the Marine Estate Management Strategy (MEMS). The development of an IMVS includes actions to address threats and risks to estuarine vegetation including identified potential migration pathways. Strategy development is likely to include the identification of actions that:

- Support key ecosystem drivers.
- Build resilience of existing mangrove and saltmarsh habitats.
- Change behaviours or planning approaches to enhance appropriate management of coastal wetland habitats.

Development of the IMVS will allow for evaluation of potential management options for coastal wetlands including:

- Potential offsets and compensatory measures for coastal wetland loss.
- Establishing habitat migration pathways.
- Monitoring options to track gradual changes in vegetation composition including migration of estuarine vegetation upslope into terrestrial/ freshwater wetland areas.
- Removal or modification of infrastructure that impact natural hydrology or sediment regimes.
- Planning controls to facilitate appropriate development in known hazard areas and reduce the risk of impacts on coastal wetlands from inappropriate development.
- Providing appropriate access to coastal wetland areas to enhance recreational, educational and cultural use and minimise disturbance (e.g. raised boardwalk and signage over coastal wetland areas).
- Installation of new infrastructure e.g. hybrid living shorelines to protect coastal habitats from erosion.
- Measures to protect and enhance existing estuarine vegetation such as fencing, buffers and feral or invasive pest control.

Once available, the actions recommended in the IMVS will be considered for implementation in the CMP by relevant land managers.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
F1-1a: Develop IMVS for Clarence River estuary	DPIRD-Fisheries	CVC, NPWS	-	MEMS
An IMVS will be developed for the Clarence River estuary catchment (including Hickey Island). This will include Lake Cakora and Lake Arragan catchments.				
Performance target	IMVS for Clarence River estuary completed by December 2025			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
F1-1b: Develop IMVS for Solitary Islands Marine Park estuaries	DPIRD-Fisheries	CVC, NPWS	-	MEMS
An IMVS will be developed for the Solitary Islands Marine Park estuary catchments (including Wooli Wooli River and Sandon River).				
Performance target	IMVS for Solitary Islands Marine Park estuaries completed by December 2025			

23.2 Strategy F2 – Mitigate Bank Erosion

The NSW Estuary Asset Protection (NEAP) program aims to improve riverine and estuarine habitat condition, resilience and connectivity in coastal waterways of NSW in LGAs affected by the 2022 catastrophic flood events. The NEAP program is focused on 'estuarine environmental assets', improving their condition post-flood and their resilience to future impacts. DPIRD-Fisheries will undertake the NEAP Riverbank Resilience' action for Wooli Wooli River by undertaking desktop and field assessment of bank and riparian areas.

Action F2-1: Wooli Wooli riverbank and riparian condition assessment

Priority	High	**Timeframe**	Short-term	**Stage 3 option**	WWR3
Threats addressed	T6 - Erosion of foreshores, T7 - Historic clearing of riparian vegetation and adjacent habitat, T10 - Uncontrolled stock access to and grazing within the riparian zone				
Coastal mgt areas	CUA, CEA, CWLRA		**B/C distribution**	100% public	
A bank and riparian condition assessment for the Wooli Wooli River estuary will be undertaken.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
F2-1a: Bank and riparian condition assessment (Wooli Wooli River)	DPIRD-Fisheries	CVC, NPWS	-	NEAP

The bank and riparian condition assessment will include:

- Desktop and field assessments of bank and riparian land condition of foreshores from the mouth of the Wooli Wooli River estuary to the upper tidal limit, including all navigable tributaries.
- Identification of threats to bank and riparian condition.
- Assessment and prioritisation of impacts and bank stability risks.
- Review of effectiveness of existing bank treatment measures.
- Assessment and prioritisation of the severity of issues and risk to both natural and built assets.
- Application of the DPIRD-Fisheries Decision Support Tool developed under Initiative 2 of the MEMS.
- Identification of appropriate riverbank rehabilitation and protection treatments.
- Prioritisation of sites for bank remediation works based on risk to natural and built assets.
- Reporting on the findings of the field survey and desktop assessment.
- Provision of project data for viewing and interrogation via an online geographical information system (GIS) platform.

Performance target	Bank and riparian condition assessment for Wooli Wooli River completed by June 2025

23.3 Strategy F3 – Seagrass Management

DPIRD-Fisheries has management responsibility for fish and marine vegetation, including seagrasses, under the *Fisheries Management Act 1994* and the *Marine Estate Management Act 2014* and associated regulations. DPIRD-Fisheries will undertake seagrass investigations within the SIMP.

Action F3-1: Seagrass investigations

Priority	Medium	**Timeframe**	Short-term	**Stage 3 option**	SR2, WWR2
Threats addressed	T11 - Seagrass decline				
Coastal mgt areas	CUA, CEA, CWLRA		**B/C distribution**	100% public	

There has been anecdotal evidence of seagrass decline over the last 10-15 years at Sandon River, particularly Toumbaal Creek and Wooli Wooli River (Hydrosphere Consulting, 2021). Factors commonly contributing to seagrass decline include sedimentation/ siltation, dredging, turbidity, nutrients, major flood events, water depth, water temperature and direct damage. Further investigation is recommended to evaluate seagrass distribution and temporal changes over the last 20 years and assess the broadscale drivers of seagrass decline.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
F3-1a: Assess extent of seagrass decline in Sandon River	DPIRD-Fisheries	CVC, NPWS	-	NEAP
DPIRD-Fisheries completed mapping of estuarine vegetation at Sandon River in 2005 and 2024. DPIRD-Fisheries will undertake a desktop review of historical aerial photographs and seagrass mapping data to compare seagrass extents within Sandon River, trends over time and provide advice on the broadscale drivers of seagrass health and distribution.				
Performance target	Assessment of extent and causes of seagrass decline in Sandon River completed by December 2025			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
F3-1b: Assess extent of seagrass decline in Wooli Wooli River	DPIRD-Fisheries	CVC, NPWS	-	NEAP
DPIRD-Fisheries completed mapping of estuarine vegetation at Wooli Wooli River in 2005. DPIRD-Fisheries will undertake a field survey to confirm current extents of seagrass and to document condition. A desktop review of historical aerial photographs and seagrass mapping data will also be undertaken to compare seagrass extents within Wooli Wooli River, trends over time and provide advice on the broadscale drivers of seagrass health and distribution.				
Performance target	Assessment of extent and causes of seagrass decline in Wooli Wooli River completed by December 2025			

ACTIONS TO BE IMPLEMENTED BY TFNSW-MARITIME

The strategies, actions and tasks to be implemented by TfNSW-Maritime are discussed in the following sections and included on the figures showing the CMP actions for relevant management zones.

TfNSW-Maritime will report on the implementation of coastal management actions in their routine program-based reporting or in reporting linked to relevant plans of management.

24. MARITIME INFRASTRUCTURE AND SAFETY

The strategies, actions and tasks relating to maritime infrastructure and safety are listed in Table 28 and discussed in the following sections.

Table 28: CMP actions – maritime infrastructure and safety

Strategies/ actions	Tasks	Threats addressed	CMP section
Strategy BW1 – Breakwall Management			
Action BW1-1: Maintain existing pedestrian walkway surfaces	BW1-1a: Maintain existing pedestrian walkway surfaces (Clarence River breakwalls) BW1-1b: Maintain existing pedestrian walkway surfaces (Wooli Wooli River breakwall)	T33 - Estuary entrance modifications	24.1
Action BW1-2: Upgrade breakwalls to include additional recreational opportunities and fauna habitat	BW1-2a: Investigate options to enhance recreational opportunities and fauna habitat (Clarence River breakwalls) BW1-2b: Investigate options to enhance recreational opportunities and fauna habitat (Wooli Wooli River breakwalls)	T33 - Estuary entrance modifications	
Strategy ND1 – Beneficial Use of Sand from Navigational Dredging for Beach Nourishment on Priority Beaches			
Action ND1-1: Sand nourishment from navigational dredging	ND1-1a: Placement of dredged sand on priority beaches	T1 – Beach erosion, T2 – Shoreline recession	24.2

24.1 Strategy BW1 – Breakwall Management

The Clarence River entrance is stabilised with a southern breakwater from Yamba headland and another breakwater on the northern side at Iluka. The lower estuary is further stabilised with a number of other training and protection walls including along the foreshore at Yamba and Iluka, Middle Wall, Moriarty's Wall, Iluka, Freeburn and Goodwood Island training walls. The entrance management works have resulted in a stable entrance, providing safe access from offshore for shallow draft vessels. An estuarine wave trap beach has formed adjacent to the northern breakwall providing recreational and fishing opportunities. Turners Beach is stabilised by construction of the southern river breakwater. A walkway has been constructed along

the length of the breakwaters apart from the easternmost section of the northern breakwater which is a refuge for avifauna.

The entrance to Wooli Wooli River estuary has been trained with a breakwater on the northern side at Wooli and another breakwater on the southern side stabilising Jones Beach. The estuary inlet and breakwall rubble surfaces support areas of oyster reef. A walkway has been constructed along the length of the northern breakwall and the southern breakwall is not accessible. An estuarine wave-trap beach is stabilised by construction of the southern breakwall.

The breakwater audit undertaken by DPIRD-Fisheries as part of the MEMS (Dwyer and Dengate, 2021a; 2021b) recommended future maintenance and upgrade works for the Clarence River and Wooli River breakwaters.

Action BW1-1: Maintain existing pedestrian walkway surfaces

Priority	Medium	**Timeframe**	Ongoing	**Stage 3 option**	CR1, WWR7
Threats addressed	T33 - Estuary entrance modifications				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	
Maintaining recreational values and access to the coastline is a key aim of the CMP. Maintenance of the existing walkways along the breakwalls is an ongoing operational objective of TfNSW-Maritime. Existing pedestrian walkway surfaces along the Clarence River and Wooli River breakwalls will be maintained to ensure continued safe pedestrian access.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BW1-1a: Maintain existing pedestrian walkway surfaces (Clarence River breakwalls)	TfNSW-Maritime	-	-	TfNSW-Maritime
TfNSW- Maritime will continue to implement a maintenance program for the Clarence River north and south breakwall walkways.				
Performance target	Pedestrian access continues to be available along the breakwaters.			

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BW1-1b: Maintain existing pedestrian walkway surfaces (Wooli Wooli River breakwall)	TfNSW-Maritime	-	-	TfNSW-Maritime
TfNSW- Maritime will continue to implement a maintenance program for the northern Wooli Wooli River breakwall walkway.				
Performance target	Pedestrian access continues to be available along the northern breakwater.			

Action BW1-2: Upgrade breakwalls to include additional recreational opportunities and fauna habitat

Priority	Medium	**Timeframe**	Medium-term	**Stage 3 option**	CR2, WWR8
Threats addressed	T33 - Estuary entrance modifications				
Coastal mgt areas	CUA, CEA		**B/C distribution**	100% public	
Maintaining access to the coastline and enhancing safety, recreational and fishing opportunities and marine habitats are key aims of the CMP. Options to enhance recreational opportunities and fauna habitat along the Clarence River and Wooli Wooli River breakwalls will be investigated by TfNSW-Maritime.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BW1-2a: Investigate options to enhance recreational opportunities and fauna habitat (Clarence River breakwalls)	TfNSW-Maritime	CVC, DPIRD-Fisheries	-	TfNSW-Maritime

TfNSW- Maritime will develop and assess options to enhance recreational opportunities and fauna habitat along the Clarence River breakwalls based on the recommendations of the breakwater audit (Dwyer and Dengate, 2021a; 2021b). Examples identified in that study were:

- Rock placement for emergency safety stairs, seating and fishing opportunities.
- Maintain fauna refuge area along northern breakwater.
- Include an osprey tower adjacent to the walls.
- Increase the complexity of the submerged habitat.
- Enhance key fish habitat.

Options will be developed with consideration of available guidelines including *Breakwater maintenance and upgrades: muti-use and eco-features: guidance for asset owners, designers and project managers* (Dwyer and Dengate, 2021c), as well as environmental, social and economic factors. Consultation with stakeholders including CVC, Yaegl TOAC, DPIRD-Fisheries, OzFish, recreational fishing groups and the wider community will be undertaken to identify needs and opportunities. Feasible options will be developed for implementation when funding is available.

Performance target	Feasible options to enhance recreational opportunities and fauna habitat (Clarence River breakwalls) identified by June 2028.

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
BW1-2b: Investigate options to enhance recreational opportunities and fauna habitat (Wooli Wooli River breakwalls)	TfNSW-Maritime	CVC, DPIRD-Fisheries	-	TfNSW-Maritime
TfNSW- Maritime will develop and assess options to enhance recreational opportunities and fauna habitat along the Wooli Wooli River breakwalls based on the recommendations of the breakwater audit (Dwyer and Dengate, 2021a; 2021b). Examples identified in that study were: • Install CoastSnap photo point on the northern breakwall. • Rock placement for emergency safety stairs on the northern breakwall. • Enhance key fish habitat along both breakwalls. Options will be developed with consideration of available guidelines including *Breakwater maintenance and upgrades: muti-use and eco-features: guidance for asset owners, designers and project managers* (Dwyer and Dengate, 2021c), as well as environmental, social and economic factors. Consultation with stakeholders including CVC, Yaegl TOAC, DPIRD-Fisheries, DPIRD-Marine Parks, OzFish, recreational fishing groups and the wider community will be undertaken to identify needs and opportunities. Feasible options will be developed for implementation when funding is available.				
Performance target	Feasible options to enhance recreational opportunities and fauna habitat (Wooli Wooli River breakwalls) identified by June 2028.			

24.2 Strategy ND1 – Beneficial Use of Sand from Navigational Dredging for Beach Nourishment on Priority Beaches

Historically, dredging has occurred in the Clarence River entrance to improve navigation. The *NSW Coastal Dredging Strategy 2019 – 2024* (NSW Government, 2019) outlined waterway user benefits and other expected favourable outcomes, statewide priority dredging preferences, adopted management principles and identified funding needs to maintain healthy and accessible waterways in NSW. TfNSW-Maritime is currently reviewing priorities for dredging with an updated strategy and priorities expected to be released in 2024.

Action ND1-1: Sand nourishment from navigational dredging

Priority	High	**Timeframe**	Ongoing	**Stage 3 option**	HIWB1, Y1
Threats addressed	T1 – Beach erosion, T2 – Shoreline recession				
Coastal mgt areas	CUA, CEA			**B/C distribution**	100% public
Suitable material dredged from the Clarence River and Wooli Wooli River navigational channels will be beneficially used for beach nourishment.					

Task	Lead agency	Support agencies	Ten-year cost estimate	Potential funding
ND1-1a: Placement of dredged sand on priority beaches	TfNSW-Maritime	CVC	-	TfNSW-Maritime
Suitable dredged material will be placed on priority beaches in consultation with CVC, Yaegl traditional owners and approval agencies (DPHI-Crown Lands and DPIRD-Fisheries) in accordance with an agreed placement plan.				
Performance target	Beneficial use of dredged sand on priority beaches			

25. WHETHER THE CMP IDENTIFIES RECOMMENDED CHANGES TO THE RELEVANT PLANNING CONTROLS, INCLUDING ANY PROPOSED MAPS

The mapping of the CEA, CUA and CEA in the CMP study area is shown in Figure 4 (Section 2.2). This CMP does not include any proposed changes to existing mapping. However, mapping amendments may be pursued as part of future versions of the Open Coast CMP or the Clarence River Estuary CMP.

Stage 2 of this CMP identified the need for review of the SEPP mapping of CWLRA within the study area to afford the ecological communities the required level of protection from future land use pressures, development and coastal hazards. Several areas have been identified where estuarine vegetation mapping is not included in the current CWLRA mapping, and other areas of the CWLRA mapping exist over CVC assets such as stormwater drains, which presents barriers to carrying out asset maintenance. A review of SEPP mapping is also required to incorporate outcomes of the coastal hazard assessments (inundation and erosion/ recession) from JBP (2022), JBP (2023) and the regional scale mapping in Stage 2. This will ensure adequate protection is provided to coastal wetlands and littoral rainforest areas. CVC will undertake a review of CLWRA mapping for the entire LGA coastal zone and any mapped CWLRA overlapping neighbouring council areas as part of the Clarence River Estuary CMP.

As sea level rises, the tidal extent will expand, eventually extending beyond the mapped CEA and CUA within the CMP study area. Similar considerations would apply to the CEA and CUA within the Clarence River Estuary CMP study area. Eventually the CEA and CUA mapping will be amended to ensure all tidal areas are included.

Although the CVA is not mapped in the Resilience and Hazards SEPP, the CMP study area is subject to coastal hazards. The outcome of *Action PD1-1: Review and implement planning controls to address coastal hazards* will be the development and implementation of a preferred LGA-wide planning control approach to address coastal hazard risks considering available local or state-based mechanisms and integration with the Clarence River Estuary CMP. This may result in development of CVA mapping as part of the Resilience and Hazards SEPP or LEP updates as well as DCP amendments based on the CMP Stage 2 assessments.

CVC's planning certificates will continue to identify the land that is exposed or has potential future exposure to coastal hazards. Access to educational materials will be provided to private landholders, lessees of public land, land managers and developers regarding the implications of coastal hazards on land use and future development and appropriate emergency responses (refer *Task PD1-1c: Coastal hazard webpage*).

26. BUSINESS PLAN

The business plan outlines the key components of the funding strategy for the CMP, including the cost of the proposed actions, proposed cost-sharing arrangements and potential funding sources. The actions detailed in the Business Plan will be implemented by CVC, or by other relevant public authorities where indicated in Table 29 to Table 32, in accordance with the *Local Government Act 1993*, environmental planning instruments, development control plans under the *Environmental Planning and Assessment Act* 1979; and/or other relevant legislation

26.1 Funding

CMP actions are expected to be funded through CVC and state government contributions, monetary grants and volunteer works by community members and organisations. Some actions will be funded under CVC and government agency operating budgets or through existing programs and grants, particularly within CVC's current Delivery Program.

CVC operates an annual budget primarily through rates and charges as well as fees, investment revenues, loans, property management and operating grants. CVC's current coastal budget is insufficient to successfully fund and implement all CMP actions. It will not be possible for CVC to implement all actions without additional sources of funding. As such, identification of additional funding mechanisms, grants and the submission of successful funding applications will be an important component of the CMP and the development stages. CVC will investigate other potential revenue sources for funding coastal works as part of *Action FS1-1: Develop a CMP funding strategy*. Implementation of the CMP for the Clarence River estuary will also require financial contributions and the development of waterway and coastline management funding opportunities will be undertaken for the whole LGA.

The NSW Government's Coastal and Estuary Grants Program provides technical and financial support to local government to help manage the coastal zone. The program supports coastal and estuary planning projects and the implementation of works identified in certified CMPs. Coast and Estuary Grants Program (CEGP) grant offers are subject to state-wide priorities and availability of funds each financial year. Funding is available under planning and implementation streams:

- Planning stream: funding is available for planning projects that aim to undertake investigations and designs or cost-benefit analyses for infrastructure works recommended in a certified CMP.
- Implementation streams: funding is available for:
    - Implementation of actions in the CEA, CUA, CVA and CWLRA identified in a certified CMP.
    - Exempt activities (activities that are eligible for funding without being included in a certified CMP) which include:
        - beach scraping to mitigate immediate coastal erosion risk
        - management and stabilisation of dune systems
        - formalising or reducing the number of beach access points to reduce environmental damage/impact
        - restoring or enhancing natural defence to coastal or estuarine hazards by managing coastal dunes and riparian vegetation
        - littoral rainforest regeneration
        - coastal wetland rehabilitation where an approved management plan for the site exists.

The proportion of NSW Government funding available for open coast protection structures depends on the beneficiaries (private landholders or public assets).

Other external funding opportunities are listed in Section 6.2 and included in CMP action descriptions (Sections 7 to 17) where relevant.

26.2 Business Plan

The Business Plan outlines the key components of the funding strategy for the CMP, including the cost of proposed tasks, potential funding sources and timing and alignment with CVC's Delivery Program under the IP&R Framework. The Business Plan (Table 29 to Table 32) specifies:

- Strategy, action and task identifiers and names.
- Cost estimate - an estimate of total costs for implementation over the ten-year life of the plan is provided (2026 $'000). A breakdown of costs in accordance with CVC's Delivery Program (DP) periods including an estimate of total capital, operational/ maintenance costs is also provided. Where actions require CVC staff resources, actual costs have only been applied where it is expected that implementation will exceed current resourcing levels and additional funding is required. Cost estimates cover the tasks listed in the actions (including preliminary investigations, environmental assessment, approvals and implementation) unless otherwise stated.

  Cost estimates are preliminary only and are based on the best available information. Where a study/ review is required to determine the appropriate level of expenditure, the implementation costs will be confirmed through the study/ review.
- Potential funding sources – refer Section 26.1.
- Cost benefit distribution – A key driver in meeting these objectives is the protection and improvement of the coastal zone bringing about subsequent public benefits (e.g. through improved recreational potential and amenity). Some actions may benefit private interests directly or indirectly as a consequence of other actions (e.g. to commercial businesses in the nearby area including tourism operators and food and beverage outlets). Cost-sharing arrangements with private parties will be based on NSW government Coast and Estuary Grant Program (CEGP) funding guidelines.
- Economic analysis and funding category – three categories are provided as follows:
  - Category 1 – economic analysis complete, action funded under normal operating budget or existing programs and grants and not expected to impact on current resourcing levels.
  - Category 2 – economic analysis complete, action subject to funding.
  - Category 3 – no economic analysis, action subject to detailed costing, economic analysis and funding.

Table 29: Business Plan – CVC responsibilities

CMP Strategies	CMP Actions and Tasks	Action priority	Total 10-year cost (2026 $'000)	Total capital cost (2026 $'000)	Total operational/ maintenance cost (2026 $'000)	[1]DP2026-2029 (2026 $'000)	[1]DP2030-2032 (2026 $'000)	[1]DP2033-2035 (2026 $'000)	[1]DP2036-2038 (2026 $'000)	Cost-benefit distribution	[2]Potential funding sources	[3]Business plan category
SUPPORTING ACTIONS												
Strategy CH1 - Cultural Heritage Management	***Action CH1-1: Protection of cultural heritage***	High										
	CH1-1a: Establish a working group with traditional owners		CVC staff time	-	CVC staff time	CVC staff time				100% public	CVC	1
	CH1-1b: Assess impacts of coastal hazards on cultural heritage values		50	50	-	50	-	-	-		CEGP, IAS, ET, CVC	2
	CH1-1c: Develop opportunities to enhance cultural heritage values		150	150	-	100	50	-	-		CEGP, IAS, ET, CVC	2
	CH1-1d: Support the development of opportunities for education, employment, and training for Yaegl people		CVC staff time	-	CVC staff time	CVC staff time					CEGP, IAS	2
	CH1-1e: Review and update controls to protect cultural heritage		30	30	-	30	-	-	-		CEGP, ET, CVC	2
Strategy PD1 - Planning and Development Controls	***Action PD1-1: Review and implement planning controls to address coastal hazards***	High										
	PD1-1a: Review and evaluate potential approaches to address coastal hazard risks in planning and development controls		50	50	-	50	-	-	-	100% public	CEGP, CVC, DRF	2
	PD1-1b: Implement preferred approach to planning controls		50	50	-	50	-	-	-		CEGP, CVC, DRF	2
	PD1-1c: Educational materials		5	5	-	5	-	-	-		CVC, CEGP	2
Strategy FM1 - Foreshore Management	***Action FM1-1: Kelp management***	Medium										
	FM1-1a: Develop a policy and procedure for management of kelp on beaches		CVC staff time	-	CVC staff time	-	CVC staff time	-	-	100% public	CVC	1
	Action FM1-2: Manage vehicular beach access	Medium										
	FM1-2a: Review vehicular beach access policy		15	15	-	5	5	5	-	100% public	CVC	1
	Action FM1-3: Dog management	Medium										
	FM1-3a: Incorporate management of dogs into Animal Management Strategy		15	15	-	5	5	5	-	100% public	CVC	1
	Action FM1-4: Reduce litter and marine debris	Medium										
	FM1-4a: Promote/ implement initiatives to reduce illegal dumping and littering		10	10	-	2	4	2	2	100% public	EPA, CVC	2
	Action FM1-5: Accessible beach access	High										
	FM1-5a: Implement outcomes of accessible beach audit		50	50	-		50		-	100% public	CEGP, CVC	2
Strategy AM1 - Asset Management	***Action AM1-1: Incorporate coastal hazard risks in CVC asset management planning***	High										
	AM1-1a: Incorporate coastal hazard risks into CVC asset management strategies and plans		90	90	-	90	-	-	-	100% public	CVC, CEGP	2
	Action AM1-2: Provide coastal hazard information to non-Council asset managers	Medium										
	AM1-2a: Provide coastal hazard information to non-Council asset managers to enable them to incorporate coastal hazard risks in asset management strategies		CVC staff time	-	CVC staff time	CVC staff time				100% public	CVC	1

CMP Strategies	CMP Actions and Tasks	Action priority	Total 10-year cost (2026 $'000)	Total capital cost (2026 $'000)	Total operational/ maintenance cost (2026 $'000)	[1]DP2026-2029 (2026 $'000)	[1]DP2030-2032 (2026 $'000)	[1]DP2033-2035 (2026 $'000)	[1]DP2036-2038 (2026 $'000)	Cost-benefit distribution	[2]Potential funding sources	[3]Business plan category
Strategy LA1 - Licensing and Approvals	***Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions***	High										
	LA1-1a: Review reserve boundaries for Council-managed Crown reserve areas that are affected by coastal hazards		2	2	-	2	-	-	-	100% public	CVC	1
	LA1-1b: Develop mechanisms to ensure native title rights and interests are considered as part of the CMP actions		60	60	-	60	-	-	-		CEGP, CVC	2
	LA1-1c: Develop mechanisms to facilitate landowner approvals for CMP actions		20	20	-	20	-	-	-		CEGP, CVC	2
Strategy FS1 – Funding	***Action FS1-1: Develop a CMP funding strategy***	High										
	FS1-1a: Develop strategy to secure funding sources		10	10	-	10	-	-	-	100% public	CVC	1
	FS1-1b: Implement CMP funding strategy		CVC staff time		CVC staff time	CVC staff time					CVC	1
Strategy EM1 - Emergency Management	***Action EM1-1: Implement emergency response procedures***	High										
	EM1-1a: Implement CZEAS		200	200	-	60	60	60	20	100% public	CVC	1
	EM1-1b: Reassess CZEAS		CVC staff time	-	CVC staff time	CVC staff time					CVC	1
MANAGEMENT ZONE – ILUKA AREA (IL)												
Strategy IL1 – Coastal Hazard Adaptation	***Action IL1-1: Monitor coastal hazards (Iluka)***	High								100% public		
	IL1-1a: Implement coastal hazard monitoring program		55	55	-	20	15	15	5		CEGP, CRIF, CVC	2
	Action IL1-2: Develop Iluka adaptive management strategy	High										
	IL1-2a: Develop adaptive management strategy (Iluka)		100	100	-	100	-	-	-	100% public	CEGP, DRF, CVC	2
Strategy IL2 – Coastal Habitat Restoration	***Action IL2-1: Coastal habitat restoration (Iluka)***	Medium										
	IL2-1a: Weed management (Iluka Beach Foreshore Reserve)		100	100	-	30	30	30	10	100% public	CEGP, CRIF, CVC, Landcare, ET, IAS, SOS	2
	IL2-1b: Coastal habitat restoration (Iluka foreshore)		170	170	-	110	20	30	10		CEGP, CRIF, CVC, Landcare, ET, IAS, SOS	2
MANAGEMENT ZONE – HICKEY ISLAND AND WHITING BEACH												
Strategy HW1 – Mitigate Coastal Erosion	***Action HW1-1: Sand nourishment – Whiting Beach***	High										
	HW1-1a: Liaison with TfNSW-Maritime regarding navigational dredging strategy		CVC staff time	-	CVC staff time	CVC staff time				100% public	CVC	1
	HW1-1b: Investigate alternative sources for sand nourishment		80	80	-	-	80	-	-		CEGP, DRF, CVC	2
	HW1-1c: Implement sand nourishment		600	600	-	-	200	400	-		CEGP, DRF, CVC	2

CMP Strategies	CMP Actions and Tasks	Action priority	Total 10-year cost (2026 $'000)	Total capital cost (2026 $'000)	Total operational/ maintenance cost (2026 $'000)	[1]DP2026-2029 (2026 $'000)	[1]DP2030-2032 (2026 $'000)	[1]DP2033-2035 (2026 $'000)	[1]DP2036-2038 (2026 $'000)	Cost-benefit distribution	[2]Potential funding sources	[3]Business plan category
Strategy HW2 – Coastal Hazard Adaptation	***Action HW2-1: Monitor coastal hazards (Hickey Island and Whiting Beach)***	High										
	HW2-1a: Implement coastal hazard monitoring program		55	55	-	20	15	15	5	100% public	CEGP, CRIF, CVC	2
	Action HW2-2: Develop Hickey Island adaptive management strategy	Medium										
	HW2-2a: Develop adaptive management strategy (Hickey Island)		100	100	-	-	-	-	100	100% public	CEGP, DRF, CVC	2
Strategy HW3 – Coastal Habitat Restoration	***Action HW3-1: Coastal habitat restoration (Hickey Island)***	Medium										
	HW3-1a: Coastal habitat restoration (Hickey Island)		370	370	-	310	20	30	10	100% public	CEGP, CRIF, CVC, Landcare, ET, IAS, SOS	2
MANAGEMENT ZONE – YAMBA MAIN BEACH AND PILOT HILL												
Strategy Y1 – Mitigate Coastal Erosion	***Action Y1-1: Sand nourishment (Yamba Main Beach)***	Medium										
	Y1-1a: Liaison with TfNSW-Maritime regarding navigational dredging strategy		CVC staff time	-	CVC staff time	CVC staff time				100% public	CVC	2
	Y1-1b: Investigate alternative sources for sand nourishment		80	80	-	-	80	-	-		CEGP, CRIF, DRF, CVC	2
	Y1-1c: Implement sand nourishment		600	600	-	-	200	200	200		CEGP, CRIF, DRF, CVC	2
	Action Y1-2: Replace/upgrade Yamba Main Beach seawall	High										
	Y1-2a: Review and update design and environmental assessment for replacement of Yamba Main Beach seawall		300	300	-	300	-	-	-	100% public	CVC, CEGP, CRIF	3
	Y1-2b: Construct Yamba Main Beach seawall		2,400	2,400	-	-	2,400	-	-		CVC, CEGP, CRIF	3
Strategy Y2 - Manage Slope Instability	***Action Y2-1: Yamba Coastline Interim Emergency Management Strategy***	High										
	Y2-1a: Continue to implement the Yamba Coastline Interim Emergency Management Strategy		CVC staff time	-	CVC staff time	CVC staff time				100% public	CVC	2
	Action Y2-2: Additional geotechnical investigations and review of slope stability at Pilot Hill	High										
	Y2-2a: Implement instrumentation and monitoring improvements		100	100	-	100	-	-	-	100% public	CEGP, CRIF, DRF, CVC	2
	Y2-2b: Undertake geotechnical investigations		30	30	-	30	-	-	-		CEGP, CRIF, DRF, CVC	2
	Action Y2-3: Slope stability improvements at Pilot Hill	High										
	Y2-3a: Implement slope stability measures at Pilot Hill		200	200	-	-	200	-	-	100% public	CEGP, CRIF, DRF, CVC	3

CMP Strategies	CMP Actions and Tasks	Action priority	Total 10-year cost (2026 $'000)	Total capital cost (2026 $'000)	Total operational/ maintenance cost (2026 $'000)	[1]DP2026-2029 (2026 $'000)	[1]DP2030-2032 (2026 $'000)	[1]DP2033-2035 (2026 $'000)	[1]DP2036-2038 (2026 $'000)	Cost-benefit distribution	[2]Potential funding sources	[3]Business plan category
Strategy Y3 – Recreational Improvements	***Action Y3-1: Raising of Yamba ocean pool***	Medium										
	Y3-1a: Design and approvals for raising of Yamba ocean pool		100	100	-	-	100	-	-	100% public	CEGP, CBP, CRIF, CVC	3
	Y3-1b: Construct raised eastern wall of Yamba ocean pool		500	500	-	-	500	-	-		CEGP, CBP, CRIF, CVC	3
	Action Y3-2: Extension of the existing pathway from Yamba Main Beach to Pilot Hill	Medium										
	Y3-2a: Develop the "missing link" pathway design and prepare environmental assessment and approval documentation		50	50	-	-	-	50	-	100% public	CEGP, CBP, CRIF, CVC	3
	Y3-2b: Construct the "missing link" pathway		500	500	-	-	-	500	-		CEGP, CBP, CRIF, CVC	3
Strategy Y4 – Coastal Hazard Adaptation	***Action Y4-1: Monitor coastal hazards (Yamba Main Beach)***	Medium										
	Y4-1a: Implement coastal hazard monitoring program		55	55	-	20	15	15	5	100% public	CEGP, CRIF, CVC	2
	Y4-1b: Liaise with Yamba SLSC regarding operations at Yamba Main Beach and Turners Beach and management of coastal hazards		CVC staff time	-	CVC staff time	CVC staff time					CVC	2
	Action Y4-2: Ongoing upgrade of Yamba Main Beach seawall	Medium										
	Y4-2a: Maintain upgraded seawall		200	-	200	50	50	100	-	100% public	CEGP, CRIF, CVC	2
Strategy Y5 – Coastal Habitat Restoration	***Action Y5-1: Coastal habitat restoration (Yamba)***	High										
	Y5-1a: Weed management and coastal habitat restoration (Pilot Hill)		440	440	-	370	30	30	10	100% public	CEGP, CRIF, CVC, Landcare, ET, IAS, SOS	2
MANAGEMENT ZONE – CONVENT BEACH (CB)												
Strategy CB1 - Manage Slope Instability	***Action CB1-1: Additional geotechnical investigations and review of slope stability at Convent Beach***	Medium								100% public		
	CB1-1a: Undertake geotechnical investigations		30	30	-	30	-	-	-		CEGP, CRIF, CVC	2
Strategy CB2 – Coastal Hazard Adaptation	***Action CB2-1: Monitor coastal hazards (Convent Beach)***	Medium										
	CB2-1a: Implement coastal hazard monitoring program		45	45	-	10	15	15	5	100% public	CEGP, CRIF, CVC	2
Strategy CB3 – Coastal Habitat Restoration	***Action CB3-1: Coastal habitat restoration (Lovers Point and Pippi Beach)***	Medium										
	CB3-1a: Coastal habitat restoration (Lovers Point and Pippi Beach)		470	470	-	400	30	30	10	100% public	CEGP, CRIF, CVC, Landcare, ET, IAS, SOS	2
MANAGEMENT ZONE – ANGOURIE (AN)												
Strategy AN1 – Water Quality Management (Blue and Green Pools)	***Action AN1-1: Algal monitoring (Angourie pools)***	High										
	AN1-1a: Algae monitoring (Angourie pools)		90	90	-	90	-	-	-	100% public	CVC, CEGP, CRIF	2
	AN1-1b: Review and update water quality signage (Angourie pools)		6	6	-	6	-	-	-		CVC, CEGP, CRIF	2
	AN1-1c: Investigate potential measures to manage algal blooms (Angourie pools)		30	30	-	-	30	-	-		CVC, CEGP, CRIF	2

CMP Strategies	CMP Actions and Tasks	Action priority	Total 10-year cost (2026 $'000)	Total capital cost (2026 $'000)	Total operational/ maintenance cost (2026 $'000)	[1]DP2026-2029 (2026 $'000)	[1]DP2030-2032 (2026 $'000)	[1]DP2033-2035 (2026 $'000)	[1]DP2036-2038 (2026 $'000)	Cost-benefit distribution	[2]Potential funding sources	[3]Business plan category
Strategy AN2 – Coastal Habitat Restoration	***Action AN2-1: Coastal habitat restoration (Angourie)***	High										
	AN2-1b: Coastal habitat restoration (Angourie)		310	310	-	240	30	30	10	100% public	CEGP, CRIF, CVC, Landcare, ET, IAS, SOS	2
Strategy AN3 – Coastal Hazard Adaptation	***Action AN31-1: Monitor coastal hazards (Spooky Beach)***	Medium										
	AN3-1a: Implement coastal hazard monitoring program		45	45	-	10	15	15	5	100% public	CEGP, CRIF, CVC	2
	MANAGEMENT ZONE - BROOMS HEAD AND LAKE CAKORA (BH)											
Strategy BH1 – Mitigate Coastal Erosion/ Shoreline Recession	***Action BH1-1: Formalise Brooms Head reserve dune rehabilitation works***	High										
	BH1-1a: Dune fencing and revegetation		60	60	-	25	15	15	5	100% public	CEGP, CRIF, CVC	2
	Action BH1-2: Beach scraping (Brooms Head reserve)	High										
	BH1-2a: Investigate the feasibility of beach scraping and obtain the necessary approvals		50	50	-	50	-	-	-	100% public	CEGP, CRIF, DRF, CVC	2
	BH1-2b: Beach scraping and rehabilitation		200	200	-	40	80	40	40		CEGP, CRIF, DRF, CVC	2
	Action BH1-3: Coastal protection works (stage 1, temporary)	High										
	BH1-3a: Stage 1 coastal protection works (temporary) - design and approvals		40	40	-	40	-	-	-		CEGP, CRIF, DRF, CVC	2
	BH1-3b: Acquisition of stage 1 coastal protection works (temporary) materials and equipment		75	75	-	75	-	-	-	100% public	CEGP, CRIF, DRF, CVC	2
	BH1-3c: Install stage 1 coastal protection works		60	60	-	55	5	-	-		CEGP, CRIF, DRF, CVC	2
	BH1-3d: Decommission stage 1 coastal protection works		15	15	-	-	15	-	-		CEGP, CRIF, DRF, CVC	2
	Action BH1-4: Extension of Brooms Head Reserve revetment	High										
	BH1-4a: Review and update design and environmental assessment for Brooms Head reserve revetment extension		200	200	-	200	-	-	-	100% public	CEGP, CRIF, DRF, CVC	2
	BH1-4b: Construct extension of Brooms Head reserve revetment		3,000	3,000	-	3,000	-	-	-		CEGP, CRIF, DRF, CVC	2
	Action BH1-5: Develop a preferred strategy for the management of public infrastructure and private land fronting Ocean Road, Brooms Head	High										
	BH1-5a: Investigate existing coastal protection works fronting Ocean Road private properties		100	100	-	100	-	-	-	80% private, 20% public	Private landowners, CEGP, DRF, CVC	2
	BH1-5b: Stakeholder consultation to identify the preferred strategy		20	20	-	20	-	-	-		CEGP, DRF, CVC	2
	BH1-5c: Development and assessment of the preferred strategy		200	200	-	200	-	-	-		Private landowners, CEGP, DRF, CVC	2

CMP Strategies	CMP Actions and Tasks	Action priority	Total 10-year cost (2026 $'000)	Total capital cost (2026 $'000)	Total operational/ maintenance cost (2026 $'000)	[1]DP2026-2029 (2026 $'000)	[1]DP2030-2032 (2026 $'000)	[1]DP2033-2035 (2026 $'000)	[1]DP2036-2038 (2026 $'000)	Cost-benefit distribution	[2]Potential funding sources	[3]Business plan category
Strategy BH2 – Coastal Hazard Adaptation	***Action BH2-1: Monitor coastal hazards (Brooms Head)***	High										
	BH2-1a: Implement coastal hazard monitoring program		55	55	-	20	15	15	5	100% public	CVC, CEGP, CRIF	2
	Action BH2-2: Develop Brooms Head adaptive management strategy	Medium										
	BH2-2a: Develop adaptive management strategy (Brooms Head)		100	100	-	-	-	-	100	100% public	CEGP, DRF, CVC	2
	Action BH2-3: Ongoing upgrade of existing Brooms Head foreshore revetment	High										
	BH2-3a: Investigate existing revetment		30	30	-	30	-	-	-	100% public	CEGP, CRIF, CVC	2
	BH2-3b: Maintain/ upgrade existing revetment		300	-	300	100	100	100	-		CEGP, CRIF, CVC	2
Strategy BH3 – Manage Slope Instability	***Action BH3-1: Additional geotechnical investigations and review of slope stability at Cakora Point***	Medium										
	BH3-1a: Geotechnical investigations		50	50	-	-	50	-	-	100% public	CEGP, CRIF, DRF CVC	2
Strategy BH4 – ICOLL Management (Lake Cakora)	***Action BH4-1: On-site sewerage management (Brooms Head)***	High										
	BH4-1a: OSSM inspection and compliance program		CVC staff time	-	CVC staff time	CVC staff time				100% public	CVC	1
	BH4-1b: Investigate sustainable methods of effluent management		30	30	-	30	-	-	-		CEGP, CVC	2
	Action BH4-2: ICOLL management strategy (Lake Cakora)	High										
	BH4-2a: Microbial source tracking		10	10	-	10	-	-	-	100% public	CVC	1
	BH4-2b: Investigate feasibility of artificial entrance management and develop an interim management regime		60	60	-	60	-	-	-		CEGP, CVC	2
	BH4-2c: ICOLL management strategy		70	70		-	70	-	-			2
Strategy BH5 – Coastal Habitat Restoration	***Action BH5-1: Coastal habitat restoration (Brooms Head)***	High										
	BH5-1a: Weed management (Lake Cakora)		100	100	-	30	30	30	10	100% public	CEGP, CRIF, CVC, Landcare, ET, IAS, SOS	2
	BH5-1b: Coastal habitat restoration (Brooms Head)		540	540	-	470	30	30	10		CEGP, CRIF, CVC, Landcare, ET, IAS, SOS	2
	BH5-1c: Coastal habitat restoration (Brooms Head Back Beach)		310	310	-	240	30	30	10		CEGP, CRIF, CVC, Landcare, ET, IAS, SOS	2
Strategy BH6 – Recreational Improvements	***Action BH6-1 – Enhance waterway access (Lake Cakora)***	Medium										
	W5-1b: Enhance waterway access		70	70	-	-	70		-	100% public	CEGP, CBP, CRIF, CVC	3

CMP Strategies	CMP Actions and Tasks	Action priority	Total 10-year cost (2026 $'000)	Total capital cost (2026 $'000)	Total operational/ maintenance cost (2026 $'000)	[1]DP2026-2029 (2026 $'000)	[1]DP2030-2032 (2026 $'000)	[1]DP2033-2035 (2026 $'000)	[1]DP2036-2038 (2026 $'000)	Cost-benefit distribution	[2]Potential funding sources	[3]Business plan category
MANAGEMENT ZONE – SANDON												
Strategy S1 – Water Quality Management (Sandon River)	***Action S1-1: On-site sewerage management (Sandon village)***	Medium										
	S1-1a: OSSM inspection and compliance program		CVC staff time	-	CVC staff time	CVC staff time				100% public	CVC	1
	S1-1b: Microbial source tracking		10	10	-	10	-	-	-		CVC	1
	S1-1c: Investigate sustainable methods of effluent management		30	30	-	30	-	-	-		CEGP, CVC	2
	S1-1d: Implement OSSM upgrades		200	200	-	200	-	-	-		CEGP, CVC	2
Strategy S2 – Coastal Hazard Adaptation	***Action S2-1: Monitor coastal hazards (Sandon Village)***	Medium								100% public		
	S2-1a: Implement coastal hazard monitoring program		45	45	-	10	15	15	5		CEGP, CRIF, CVC	2
	Action S2-2: Develop Sandon village adaptive management strategy	Medium								100% public		
	S2-2a: Develop adaptive management strategy (Sandon village)		100	100	-	-	-	-	100		CEGP, CRIF, CVC	2
Strategy S3 – Coastal Habitat Restoration	***Action S3-1: Coastal habitat restoration (Sandon)***	Medium										
	S3-1a: Coastal habitat restoration (Sandon public reserve)		100	100	-	30	30	30	10	100% public	CEGP, CRIF, CVC, Landcare, ET, IAS, SOS	2
MANAGEMENT ZONE – MINNIE WATER												
Strategy MW1 – Coastal Hazard Adaptation	***Action MW1-1: Monitor coastal hazards (Minnie Water)***	Medium										
	MW1-1a: Implement coastal hazard monitoring program		45	45	-	10	15	15	5	100% public	CVC, CEGP, CRIF	2
	MW1-1b: Liaise with Minnie Water-Wooli SLSC regarding operations at Minnie Water beach and management of coastal hazards		CVC staff time	-	CVC staff time	CVC staff time					CVC	1
Strategy MW2 – Coastal Habitat Restoration	***Action MW2-1: Coastal habitat restoration (Minnie Water)***	High										
	MW2-1a: Weed management and coastal habitat restoration (Minnie Water)		420	420	-	350	30	30	10	100% public	CEGP, CRIF, CVC, Landcare, ET, IAS, SOS	2
MANAGEMENT ZONE – DIGGERS CAMP												
Strategy DC1 – Coastal Hazard Adaptation	***Action DC1-1: Monitor coastal hazards (Diggers Camp)***	Medium										
	DB1-1a: Implement coastal hazard monitoring program		45	45	-	10	15	15	5	100% public	CEGP, CRIF, CVC	2
Strategy DC2 – Coastal Habitat Restoration	***Action DC2-1: Coastal habitat restoration (Diggers Camp)***	High										
	DB2-1a: Coastal habitat restoration (Diggers Headland)		280	280	-	210	30	30	10	100% public	CEGP, CRIF, CVC, Landcare, ET, IAS, SOS	2
MANAGEMENT ZONE - WOOLI (W)												
Strategy W1 – Mitigate Coastal Erosion/ Shoreline Recession	***Action W1-1: Implement Wooli Beach Management Strategy***	High										
	W1-1a: Implement Wooli Beach Management Strategy		1,300	1,300	-	300	450	450	100	100% public	CEGP, CRIF, DRF, CVC	2

CMP Strategies	CMP Actions and Tasks	Action priority	Total 10-year cost (2026 $'000)	Total capital cost (2026 $'000)	Total operational/ maintenance cost (2026 $'000)	[1]DP2026-2029 (2026 $'000)	[1]DP2030-2032 (2026 $'000)	[1]DP2033-2035 (2026 $'000)	[1]DP2036-2038 (2026 $'000)	Cost-benefit distribution	[2]Potential funding sources	[3]Business plan category
Strategy W2 – Coastal Hazard Adaptation	***Action W2-1: Monitor coastal hazards (Wooli)***	High										
	W2-1a: Implement coastal hazard monitoring program		55	55	-	20	15	15	5	100% public	CEGP, CRIF, CVC	2
	W2-1b: Liaise with Minnie Water-Wooli SLSC regarding operations at Minnie Water beach and management of coastal hazards		CVC staff time	-	CVC staff time	CVC staff time					CVC	1
	Action W2-2: Alternative sand sources (Wooli)	Medium										
	W2-2a: Liaison with TfNSW-Maritime regarding navigational dredging strategy		CVC staff time	-	CVC staff time	CVC staff time				100% public	CVC	1
	W2-2b: Investigate alternative sources for sand nourishment		50	50	-	-	50	-	-		CEGP, CRIF, DRF, CVC	2
	Action W2-3: Develop Wooli adaptive management strategy	Medium										
	W2-3a: Develop adaptive management strategy (Wooli)		100	100	-	-	-	-	100	100% public	CEGP, DRF, CVC	2
Strategy W3 – Water Quality Management (Wooli Wooli River)	***Action W3-1: On-site sewerage management (Wooli)***	Medium										
	W3-1a: OSSM inspection and compliance program		CVC staff time		CVC staff time	CVC staff time				100% public	CVC	1
	W3-1b: Microbial source tracking		10	10	-	10	-	-	-		CVC	1
	W3-1c: Investigate sustainable methods of effluent management		50	50	-	50	-	-	-		CEGP, CVC	2
Strategy W4 – Coastal Habitat Restoration	***Action W4-1: Coastal habitat restoration (Wooli)***	Medium										
	W4-1a: Weed management and coastal habitat restoration (South Terrace Reserve, Wooli)		320	320	-	260	20	30	10	100% public	CEGP, CRIF, CVC, Landcare, ET, IAS, SOS	2
	W4-1b: Weed management (Wooli Sand Drift Reserve)		80	80	-	10	30	30	10		CEGP, CRIF, CVC, Landcare, ET, IAS, SOS	2
Strategy W5 – Riverbank Management	***Action W5-1: Bank management and waterway access (Wooli Wooli River)***	High										
	W5-1a: Implement priority bank management measures		300	300	-	300	-	-	-	100% public	CEGP, CVC	3
	W5-1b: Enhance waterway access		70	70	-	-	70	-	-		CEGP, CBP, CRIF, CVC	3
MONITORING, EVALUATION AND REPORTING PROGRAM												
Monitoring, evaluation and reporting program	***Action MER1: Estuary health monitoring program***	MER										
	MER1a: Review estuary health monitoring approaches		CVC staff time	-	CVC staff time	CVC staff time				100% public	CVC	1
	Action Mer2: Recreational water quality monitoring	MER										
	MER2-1: Implement Beachwatch monitoring program at key swimming locations		100	100	-	30	30	30	10	100% public	CVC	1
	Action MER3: Review of CMP progress and monitoring of performance targets	MER										
	MER3a: Review of CMP progress and monitoring of performance targets		CVC staff time	-	CVC staff time	CVC staff time				100% public	CVC	1
	Action MER4: Re-assessment of coastal hazards	MER										
	MER4a: Re-assessment of coastal hazards		200	200	-	-	-	-	200	100% public	CEGP, CVC	2
	Action MER5: Ten-year review of CMP	MER										
	MER5a: Ten-year review of CMP		100	100	-	-	-	-	100	100% public	CEGP, CVC	2

CMP Strategies	CMP Actions and Tasks	Action priority	Total 10-year cost (2026 $'000)	Total capital cost (2026 $'000)	Total operational/ maintenance cost (2026 $'000)	[1]DP2026-2029 (2026 $'000)	[1]DP2030-2032 (2026 $'000)	[1]DP2033-2035 (2026 $'000)	[1]DP2036-2038 (2026 $'000)	Cost-benefit distribution	[2]Potential funding sources	[3]Business plan category
	Total CVC actions		**18,773**	**18,273**	**500**	**9,420**	**5,559**	**2,527**	**1,267**			

1. DP - Delivery Program within CVC's IP&R framework. Years correspond to end of financial year (i.e. DP 2026 - 2029 is the first four-year Delivery Program (start 1st July 2025, end 30th June 2029) etc.). Timing may be dependent on certification of CMP and approval of funding where applicable.
2. Potential funding sources: CVC general income from ordinary rates and fees/ charges (CVC), NSW Government's Coastal and Estuary Grants Program (CEGP) administered by DCCEEW, the Disaster Ready Fund (DRF) administer by the Australian Government, Community Building Partnership (CBP) program administered by the NSW Department of Communities and Justice, Department of Regional NSW Riparian Stabilisation Package (including the NSW Estuarine Asset Protection Program - NEAPP) administered by DPIRD-Fisheries, Crown Reserves Improvement Fund (CRIF) administered by DPHI-Crown Lands, NSW Environment Trust (ET) grants, Indigenous Advancement Strategy (IAS) administered by the National Indigenous Australians Agency, Litter prevention grants (EPA), Recreational Fishing Trust (RFT) administered by DPIRD-Fisheries, Saving our Species (SOS) program administered by DCCEEW. Marine Estate Management Strategy (MEMS).
3. Business Plan Categories: Category 1 – economic analysis complete, action funded under normal operating budget or existing programs and grants and not expected to impact on current resourcing levels. Category 2 – economic analysis complete, action subject to funding. Category 3 – no economic analysis, action subject to detailed costing, economic analysis and funding.

Table 30: Business Plan – NPWS responsibilities

CMP Strategies	CMP Actions and Tasks	Action priority	Total 10-year cost (2026 $'000)	Total capital cost (2026 $'000)	Total operational/ maintenance cost (2026 $'000)	[1]DP2026-2029 (2026 $'000)	[1]DP2030-2032 (2026 $'000)	[1]DP2033-2035 (2026 $'000)	[1]DP2036-2038 (2026 $'000)	Cost-benefit distribution	Potential funding sources	[2]Business plan category
MANAGEMENT ZONE - NPWS ESTATE												
Strategy NP1 - Heritage Management (NPWS Estate)	***Action NP1-1: Conservation and protection of NPWS estate values, assets and heritage items***	High								100% public		
	NP1-1a: Monitor and assess emerging coastal risks and identify response options		-	NPWS staff time	NPWS staff time	NPWS staff time					NPWS	1
Strategy NP2 – Coastal Hazard Adaptation (NPWS Estate)	***Action NP2-1: Incorporate coastal hazard risks into Reserve Plans of Management***	High								100% public		
	NP2-1a: Incorporate coastal hazard risks into reserve Plans of Management		50	50	-	-	-	-	50		NPWS	1
Strategy NP3 – Coastal Habitat Restoration (NPWS Estate)	***Action NP3-1: Coastal habitat restoration and management (NPWS Estate)***	High								100% public		
	NP3-1a: Undertake habitat restoration and weed management works		600	600	-	180	180	180	60		NPWS	1
Strategy NP4 - Emergency Management	***Action NP4-1: Implement emergency response procedures***	High								100% public		
	NP4-1a: Implement CZEAS		50	50	-	20	10	20	-		NPWS	1
	NP4-1b: Reassess emergency management strategy		NPWS staff time	-	NPWS staff time	NPWS staff time					NPWS	1
MANAGEMENT ZONE - WOODY HEAD CAMPGROUND												
Strategy WH1 – Coastal Hazard Adaptation (Woody Head Campground)	***Action WH1-1: Monitor coastal hazards (Woody Head campground)***	High								100% public		
	WH1-1a: Implement coastal hazard monitoring program		50	50	-	15	15	15	5		NPWS	1
	Action WH1-2: Values, asset and infrastructure management (Woody Head campground)	High								100% public		
	WH1-2a: Implement CHRP for Woody Head campground		2,422	2,327	95	1,787	95	340	200		NPWS	2
	WH1-2b: Ongoing maintenance and/or upgrade of coastal protection works		500	-	500	150	150	150	50		NPWS	2
	Action WH1-3: Review effectiveness of adaptation planning (Woody Head campground)	High								100% public		
	WH1-3a: Review effectiveness of adaptation planning		100	100	-	-	-	-	100		NPWS	2
MANAGEMENT ZONE - SANDON RIVER CAMPGROUND												
Strategy SR1 – Coastal Hazard Adaptation (Sandon River Campground)	***Action SR1-1: Monitor coastal hazards (Sandon River campground)***	High								100% public		
	SR1-1a: Implement coastal hazard monitoring program		50	50	-	15	15	15	5		NPWS	1
	Action SR1-2: Values, asset and infrastructure management (Sandon River campground)	High								100% public		
	SR1-2a: Implement CHRP for Sandon River campground		560	560	-	135	65	155	205		NPWS	2
	SR1-2b: Ongoing maintenance and/or upgrade of coastal protection works		250	-	250	75	75	75	25		NPWS	2
	Action SR1-3: Review effectiveness of adaptation planning (Sandon River campground)	High								100% public		
	SR1-3a: Review effectiveness of adaptation planning		100	100	-	-	-	-	100		NPWS	2

CMP Strategies	CMP Actions and Tasks	Action priority	Total 10-year cost (2026 $'000)	Total capital cost (2026 $'000)	Total operational/ maintenance cost (2026 $'000)	[1]DP2026-2029 (2026 $'000)	[1]DP2030-2032 (2026 $'000)	[1]DP2033-2035 (2026 $'000)	[1]DP2036-2038 (2026 $'000)	Cost-benefit distribution	Potential funding sources	[2]Business plan category
MANAGEMENT ZONE - LAKE ARRAGAN AND RED CLIFF												
Strategy LR1 – Manage Slope Instability (Lake Arragan and Red Cliff)	***Action LR1-1: Implement measures to mitigate risks from slope instability (Lake Arragan and Red Cliff)***											
	LR1-1a: Install signage and implement remedial works	High	325	325	-	325	-	-	-	100% public	NPWS	2
	Total NPWS actions		**5,057**	**4,212**	**845**	**2,702**	**605**	**950**	**800**			

1. DP - Delivery Program within CVC's IP&R framework. Years correspond to end of financial year (i.e. DP 2026 - 2029 is the first four-year Delivery Program (start 1st July 2025, end 30th June 2029) etc.). Timing may be dependent on certification of CMP and approval of funding where applicable.
2. Business Plan Categories: Category 1 – economic analysis complete, action funded under normal operating budget or existing programs and grants and not expected to impact on current resourcing levels. Category 2 – economic analysis complete, action subject to funding. Category 3 – no economic analysis, action subject to detailed costing, economic analysis and funding.

Table 31: Business Plan – DPIRD-Fisheries responsibilities

CMP Strategies	CMP Actions and Tasks	Action priority	Total 10-year cost (2026 $'000)	Total capital cost (2026 $'000)	Total operational/ maintenance cost (2026 $'000)	[1]DP2026-2029 (2026 $'000)	[1]DP2030-2032 (2026 $'000)	[1]DP2033-2035 (2026 $'000)	[1]DP2036-2038 (2026 $'000)	Cost-benefit distribution	[2]Potential funding sources	[2]Business plan category
FISH HABITAT MANAGEMENT												
Strategy F1 - Marine Vegetation Management	***Action F1-1: Intertidal marine vegetation strategies***	Medium										
	F1-1a: Develop IMVS for Clarence River estuary		DPIRD-Fisheries staff time	-	DPIRD-Fisheries staff time	DPIRD-Fisheries staff time				100% public	MEMS	1
	F1-1b: Develop IMVS for Solitary Islands Marine Park estuaries		DPIRD-Fisheries staff time	-	DPIRD-Fisheries staff time	DPIRD-Fisheries staff time					MEMS	1
Strategy F2 – Mitigate Bank Erosion	***Action F2-1: Wooli Wooli riverbank and riparian condition assessment***	High										
	F2-1a: Bank and riparian condition assessment (Wooli Wooli River)		Costs to be developed by DPIRD	Costs to be developed by DPIRD	-	Implementation cost included within DPIRD operating budget				100% public	NEAPP	1
Strategy F3 – Seagrass Management	***Action F3-1: Seagrass investigations***	Medium										
	F3-1a: Assess extent of seagrass decline in Sandon River		DPIRD-Fisheries staff time	-	DPIRD-Fisheries staff time	DPIRD-Fisheries staff time				100% public	DPIRD-Fisheries	1
	F3-1b: Assess extent of seagrass decline in Wooli Wooli River		DPIRD-Fisheries staff time	-	DPIRD-Fisheries staff time	DPIRD-Fisheries staff time					DPIRD-Fisheries	1

1. DP - Delivery Program within CVC's IP&R framework. Years correspond to end of financial year (i.e. DP 2026 - 2029 is the first four-year Delivery Program (start 1st July 2025, end 30th June 2029) etc.). Timing may be dependent on certification of CMP and approval of funding where applicable.
2. Potential funding sources: Department of Regional NSW Riparian Stabilisation Package (including the NSW Estuarine Asset Protection Program - NEAPP) administered by DPIRD-Fisheries.
3. Business Plan Categories: Category 1 – economic analysis complete, action funded under normal operating budget or existing programs and grants and not expected to impact on current resourcing levels. Category 2 – economic analysis complete, action subject to funding. Category 3 – no economic analysis, action subject to detailed costing, economic analysis and funding.

Table 32: Business Plan – TfNSW-Maritime responsibilities

CMP Strategies	CMP Actions and Tasks	Action priority	Total 10-year cost (2026 $'000)	Total capital cost (2026 $'000)	Total operational/ maintenance cost (2026 $'000)	[1]DP2026-2029 (2026 $'000)	[1]DP2030-2032 (2026 $'000)	[1]DP2033-2035 (2026 $'000)	[1]DP2036-2038 (2026 $'000)	Cost-benefit distribution	Potential funding sources	[2]Business plan category
MARITIME INFRASTRUCTURE AND SAFETY												
Strategy BW1 – Breakwall Management	***Action BW1-1: Maintain existing pedestrian walkway surfaces***	Medium										
	BW1-1a: Maintain existing pedestrian walkway surfaces (Clarence River breakwalls)		-	-	-	To be funded from TfNSW operating budget subject to Maritime's assessed infrastructure and dredging priorities across NSW				100% public	TfNSW-Maritime	3
	BW1-1b: Maintain existing pedestrian walkway surfaces (Wooli Wooli River breakwall)		-	-	-	To be funded from TfNSW operating budget subject to Maritime's assessed infrastructure and dredging priorities across NSW					TfNSW-Maritime	3
	Action BW1-2: Upgrade breakwalls to include additional recreational opportunities and fauna habitat	Medium										
	BW1-2a: Investigate options to enhance recreational opportunities and fauna habitat (Clarence River breakwalls)		-	-	-	To be funded from TfNSW operating budget subject to Maritime's assessed infrastructure and dredging priorities across NSW				100% public	TfNSW-Maritime	3
	BW1-2b: Investigate options to enhance recreational opportunities and fauna habitat (Wooli Wooli River breakwalls)		-	-	-	To be funded from TfNSW operating budget subject to Maritime's assessed infrastructure and dredging priorities across NSW					TfNSW-Maritime	3
Strategy ND1 – Beneficial Use of Sand from Navigational Dredging for Beach Nourishment on Priority Beaches	***Action ND1-1: Sand nourishment from navigational dredging***	High										
	ND1-1a: Placement of dredged sand on priority beaches		-	-	-	To be funded from TfNSW operating budget subject to Maritime's assessed infrastructure and dredging priorities across NSW				100% public	TfNSW-Maritime	3

1. DP - Delivery Program within CVC's IP&R framework. Years correspond to end of financial year (i.e. DP 2026 - 2029 is the first four-year Delivery Program (start 1st July 2025, end 30th June 2029) etc.). Timing may be dependent on certification of CMP and approval of funding where applicable.
2. Business Plan Categories: Category 1 – economic analysis complete, action funded under normal operating budget or existing programs and grants and not expected to impact on current resourcing levels. Category 2 – economic analysis complete, action subject to funding. Category 3 – no economic analysis, action subject to detailed costing, economic analysis and funding.

27. COASTAL ZONE EMERGENCY ACTION SUBPLAN

The Coastal Zone Emergency Action Subplan (CZEAS) for the Clarence coastline forms part of this CMP and is provided in Appendix 3. The CZEAS applies to the beaches and coastal communities within the CMP study area and details arrangements to manage coastal emergency events relating to coastal erosion, coastal inundation and coastal cliff/ slope instability.

28. MAPS

Table 33: Index of maps in the CMP

Content	Reference	Section in the CMP
CMP study area	Figure 3: The Clarence Valley Open Coast CMP study area	Section 2.2 - Areas Covered by this CMP
Coastal management areas	Figure 4: Coastal management areas for the Clarence Valley open coast	Section 2.2 - Areas Covered by this CMP
Secondary coastal sediment compartments	Figure 5: Secondary coastal sediment compartments within the CMP study area	Section 2.2 - Areas Covered by this CMP
Land tenure and native title areas	Figure 7: Land tenure and native title within the CMP area	Section 2.4 - Existing Management Arrangements
Urban growth areas	Figure 11: Urban growth area map for Clarence Valley LGA	Section 2.5.1 - North Coast Regional Plan 2041
CMP actions for each management zone		
Iluka Area	Figure 28: CMP actions – Iluka	Section 8 - Management Zone – Iluka Area (IL)
Hickey Island and Whiting Beach	Figure 33: CMP actions – Hickey Island and Whiting Beach	Section 9 - Management Zone – Hickey Island and Whiting Beach
Yamba Main Beach and Pilot Hill	Figure 41: CMP actions – Yamba Main Beach and Pilot Hill	Section 10 - Management Zone – Yamba Main Beach and Pilot Hill
Convent Beach	Figure 44: CMP actions – Convent Beach	Section 11 - Management Zone – Convent Beach (CB)
Angourie	Figure 47: CMP actions – Angourie	Section 12 - Management Zone – Angourie (AN)
Brooms Head and Lake Cakora	Figure 64: CMP actions – Brooms Head and Lake Cakora	Section 13 - Management Zone - Brooms Head and Lake Cakora (BH)
Sandon	Figure 68: CMP actions – Sandon	Section 14 - Management Zone – Sandon
Minnie Water	Figure 71: CMP actions – Minnie Water	Section 15 - Management Zone – Minnie Water
Diggers Camp	Figure 74: CMP actions – Diggers Camp	Section 16 - Management Zone – Diggers Camp
Wooli	Figure 82: CMP actions – Wooli	Section 17 - Management Zone - Wooli (W)
Bundjalung National Park	Figure 91: CMP actions – Bundjalung National Park	Section 19 – Management Zone – NPWS Estate
Lake Arragan	Figure 92: CMP actions – Lake Arragan and Red Cliff	Section 22 - Management Zone – Lake Arragan and Redcliff (LR)

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GLOSSARY AND ABBREVIATIONS

4WD	Four Wheel Drive/ing
AEP	Annual exceedance probability
AHD	See Australian Height Datum
Amenity	A desirable or useful feature or facility of a building or place
Aquatic	Living or growing in water, not on land.
Australian Height Datum	The national vertical datum for Australia. An elevation of 0 m AHD approximates mean sea level.
CBP	Community Building Partnership program administered by the NSW Department of Communities and Justice
CEGP	NSW Government's Coastal and Estuary Grants Program administered by DCCEEW
CMP	Coastal Management Program
Coastal hazard	Either or a combination of the following: beach erosion; shoreline recession; coastal lake or watercourse entrance instability; coastal inundation; coastal cliff or slope instability; tidal inundation; erosion and inundation of foreshores caused by tidal waters and the action of waves, including the interaction of those waters with catchment floodwaters.
Council	Clarence Valley Council
CRIF	Crown Reserves Improvement Fund administered by DPHI-Crown Lands
CSP	Community Strategic Plan
CVC	Clarence Valley Council
CZMP	Coastal Zone Management Plan
DCP	Development Control Plan
DCCEEW	NSW Department of Climate Change, Energy, Environment and Water
DPE	NSW Department of Planning and Environment (now DCCEEW)
DPIRD	(NSW) Department of Primary Industries and Regional Development
DPIE	Department of Planning, Industry & Environment (now DCCEEW)
DPIRD-Fisheries	NSW Department of Primary Industries and Regional Development–Fisheries
DPIRD-Marine Parks	NSW Department of Primary Industries and Regional Development–Marine Parks
DRF	Disaster Ready Fund administered by the Australian Government
Ecosystem	Refers to all the biological and physical parts of a biological unit (e.g. an estuary, forest, or planet) and their interconnections.
EP	Exceedance probability
EPA	NSW Environment Protection Authority
Estuarine	Part of the river channel with a mix of fresh water and salt (tidal) water
ET	NSW Environment Trust grants
Foreshore	That part of the shore that lies between the mean high tide mark and the mean low tide mark
GIS	Geographic Information System
Geomorphology	Characteristics, origin and development of landforms.
Ha	Hectares
IAS	Indigenous Advancement Strategy administered by the National Indigenous Australians Agency

ICOLL	Intermittently Closed and Open Lake or Lagoon
Inundation	Rising and spreading of water over land
IP&R	Integrated Planning and Reporting
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Area
Littoral	Related to or near the coastline.
Longshore drift	the movement of material along a coast by waves which approach at an angle to the shore but recede directly away from it (i.e. sand moves in the same general direction as the predominant swell direction).
MEMA	Marine Estate Management Authority
MEMS	Marine Estate Management Strategy
NEAPP	Department of Regional NSW Riparian Stabilisation Package (NSW Estuarine Asset Protection Program) administered by DPIRD-Fisheries
NPWS	National Parks and Wildlife Service
OEH	Office of Environment and Heritage (now DCCEEW)
REF	Review of Environmental Factors
RFT	Recreational Fishing Trust administered by DPIRD-Fisheries
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
SOS	Saving our Species program administered by DCCEEW
TARA	Threat and Risk Assessment
Terrestrial	Living or growing on land (not aquatic)
TfNSW	Transport for NSW
TOAC	Traditional Owners Aboriginal Corporation

APPENDIX 1 CMP OBJECTIVES AND MANDATORY REQUIREMENTS

Table 34: Statutory requirements set out in the *Coastal Management Act 2016*

CM Act	Issue	Where addressed in CMP and additional notes
s13(2)	A coastal management program may be made in relation to the whole, or any part, of the area included within the coastal zone.	Section 2.2: Areas covered by this CMP. The area covered by this CMP is entirely within the Clarence Valley LGA.
s14(3)(a)	In preparing a coastal management program, a local council must consider and promote the objects of this Act.	The objects of the CM Act are reflected in the local objectives for the CMP (Section 2.3). The CMP actions are consistent with the objects of the Act as shown in Table 35.
s14(3)(b)	In preparing a coastal management program, a local council must give effect to the management objectives for the coastal management areas covered by the program.	The CMP actions are consistent with the objectives of the coastal management areas as shown in Table 36.
s14(3)(c)	In preparing a coastal management program, a local council must consider the State and regional policies and plans prescribed by the regulations for this section	Legislation relating to the management of the Clarence Valley open coast is considered in Sections 2.1 and 2.4, and relevant state and regional policies in Section 2.5.
s15(1)(a)	A coastal management program must identify the coastal management issues affecting the areas to which the program is to apply	The issues affecting the CMP area are summarised in Section 5: A Snapshot of Issues and discussed in detail in the *Stage 1 Scoping Study* (Hydrosphere Consulting, 2021), *Stage 2 Vulnerabilities and Opportunities* (Hydrosphere Consulting, 2023) and detailed coastal hazard assessments (JBP, 2022; JBP, 2023).
S15(1)(b)	A coastal management program must identify the actions required to address those coastal management issues in an integrated and strategic manner.	Sections 7 to 24 provides the coastal management actions required to address the identified coastal management issues. The detailed multi-criteria assessment of the options is summarised in Section 6.1 and provided in full in the *Stage 3 Identification and Evaluation of Options* (Hydrosphere Consulting, 2023).

CM Act	Issue	Where addressed in CMP and additional notes
s15(1)(c)	A coastal management program must identify how and when those actions are to be implemented, including those to be implemented by local councils under Chapter 13 of the *Local Government Act 1993*, those to be implemented under environmental planning instruments and development control plans under the *Environmental Planning and Assessment Act 1979* and those to be implemented by public authorities (other than the local council).	Sections 7 to 24 provide details of how and when actions are to be implemented and responsibilities for implementation (lead and support), including CVC and other public authorities. The Business Plan (Section 26) provides details to enable the actions to be implemented through CVC's IP&R Framework.
s15(1)(d)	A coastal management program must identify the costs of those actions and proposed cost-sharing arrangements and other viable funding mechanisms for those actions to ensure the delivery of those actions is consistent with the timing for their implementation under the coastal management program.	The Business Plan (Section 26) and CMP Action descriptions in Sections 7 to 24 provide estimated costs for the actions, timing and potential funding mechanisms.
s15(1)(e)	A coastal management program must if the local council's local government area contains land within the coastal vulnerability area and beach erosion, coastal inundation or cliff instability is occurring on that land, include a coastal zone emergency action sub plan.	The Coastal Zone Emergency Action Subplan for the Clarence Valley open coast is provided in Appendix 3 (refer Section 27).
s15(4)	A coastal management program must not include the following: a) matters dealt with in any plan made under the *State Emergency and Rescue Management Act 1989* in relation to the response to emergencies b) proposed actions or activities to be carried out by any public authority or relating to any land or other assets owned or managed by a public authority, unless the public authority has agreed to the inclusion of those proposed actions or activities in the program.	a) The CMP does not deal with these matters. b) CVC has lead responsibility for all actions except for actions described in Sections 19 to 24. Agencies other than CVC with responsibility for delivery of actions in this CMP will confirm their commitment to implementation of these actions during finalisation of the CMP.

CM Act	Issue	Where addressed in CMP and additional notes
s16(1)	Before adopting a coastal management program, a local council must consult on the draft program with: a) the community b) if the local council's local government area contains: (i) land within the coastal vulnerability area, any local council whose local government area contains land within the same coastal sediment compartment (as specified in Schedule 1) (ii) an estuary that is within two or more local government areas (as specified in Schedule 1), the other local councils c) other public authorities if the coastal management program: (i) proposes actions or activities to be carried out by that public authority (ii) proposes specific emergency actions or activities to be carried out by a public authority under the Coastal Zone Emergency Action Subplan relates to, affects or impacts on any land or assets owned or managed by that public authority	a) Section 3 discusses consultation undertaken as part of this CMP including public exhibition of the draft CMP. b) CVC will liaise with Richmond Valley Council and City of Coffs Harbour during finalisation of the CMP as they share sediment compartments with CVC. c) i. CVC has consulted closely with other public authorities with responsibility for delivery of actions in this CMP. Support from these agencies will be confirmed during finalisation of the CMP. c) ii. The SES, NPWS and DPHI-Crown Lands have been consulted regarding the CZEAS.

Table 35: Achievement of *Coastal Management Act 2016* (and *Marine Estate Management Act 2014*) objects

CM Act objects	Sections in this CMP	CMP consideration and promotion of the objects
The objects of this Act are to manage the coastal environment of New South Wales in a manner consistent with the principles of ecologically sustainable development for the social, cultural and economic well-being of the people of the State, and in particular:		
(a) to protect and enhance natural coastal processes and coastal environmental values including natural character, scenic value, biological diversity and ecosystem integrity and resilience	Section 2.3 - Vision, Objectives and Strategic Direction Section 4.2 - Coastal Processes Section 4.4 - Environmental Values Section 4.5 - Community Uses and Values Section 5 - A Snapshot of Issues including Section 5.2 - Coastal Uses and Access and Section 5.3 - Ecological Condition Section 26 - Business Plan	Protection and enhancement of natural coastal processes and coastal environmental values is a key focus of the CMP which includes environmental protection and restoration strategies and actions such as: • Foreshore management • Coastal habitat restoration • Mitigate coastal erosion/ shoreline recession • Recreational improvements • Water quality management • ICOLL management • River bank management/ bank erosion • Marine vegetation management • Seagrass management • Breakwall management

CM Act objects	Sections in this CMP	CMP consideration and promotion of the objects
(b) to support the social and cultural values of the coastal zone and maintain public access, amenity, use and safety	Section 2.3 - Vision, Objectives and Strategic Direction Section 4.2 - Coastal Processes Section 4.3 - Culture and Heritage Section 4.5 - Community Uses and Values Section 5 - A Snapshot of Issues including Section 5.2 - Coastal Uses and Access and Section 5.3 - Ecological Condition Section 26 - Business Plan	Supporting the social and cultural values of the coastal zone and maintaining public access, amenity, use and safety are key considerations in the CMP strategies and actions particularly: • Cultural heritage • Foreshore management • Coastal habitat restoration • Mitigate coastal erosion/ shoreline recession • Recreational improvements • Water quality management • ICOLL management • River bank management/ bank erosion • Marine vegetation management • Seagrass management • Breakwall management • Beneficial use of sand from navigational dredging for beach nourishment
(c) to acknowledge Aboriginal peoples' spiritual, social, customary and economic use of the coastal zone	Section 2.3 - Vision, Objectives and Strategic Direction Section 4.3 - Culture and Heritage Section 26 - Business Plan	The CMP acknowledges the Yaegl people who have occupied and skilfully managed the coastal zone for thousands of years and contains actions to enhance involvement into the future such as cultural heritage management and the development of mechanisms to ensure native title rights and interests are considered as part of CMP actions.

CM Act objects	Sections in this CMP	CMP consideration and promotion of the objects
(d) to recognise the coastal zone as a vital economic zone and to support sustainable coastal economies	Section 2.3 - Vision, Objectives and Strategic Direction Section 4.5 - Community Uses and Values Section 5.2 - Coastal Uses and Access Section 26 - Business Plan	The CMP recognises the economic value of the coastal zone through strategies and actions that support sustainable tourism and visitor use.
(e) to facilitate ecologically sustainable development in the coastal zone and promote sustainable land use planning decision-making	Section 2.3 - Vision, Objectives and Strategic Direction Section 4.4 - Environmental Values Section 4.5 - Community Uses and Values Section 5 - A Snapshot of Issues including Section 5.1 - Coastal Hazards, Section 5.2 - Coastal Uses and Access and Section 5.3 - Ecological Condition Section 26 - Business Plan	The CMP promotes ecologically sustainable development through actions to preserve cultural and environmental values as well as review and implement planning and development controls to address coastal hazards and incorporate coastal hazard risks into asset management strategies.
(f) to mitigate current and future risks from coastal hazards, taking into account the effects of climate change	Section 2.3 - Vision, Objectives and Strategic Direction Section 4.2 - Coastal Processes Section 5 - A Snapshot of Issues including Section 5.1 - Coastal Hazards Section 26 - Business Plan	Mitigating current and future risks from coastal hazards is a key focus of the CMP through strategies and actions such as: • Coastal hazard adaptation • Coastal habitat restoration • Mitigation of coastal erosion/ shoreline recession • Management of slope instability • Beneficial use of sand from navigational dredging for beach nourishment

CM Act objects	Sections in this CMP	CMP consideration and promotion of the objects
(g) to recognise that the local and regional scale effects of coastal processes, and the inherently ambulatory and dynamic nature of the shoreline, may result in the loss of coastal land to the sea (including estuaries and other arms of the sea), and to manage coastal use and development accordingly,	Section 2.3 - Vision, Objectives and Strategic Direction Section 4.2 - Coastal Processes Section 5 - A Snapshot of Issues including Section 5.1 - Coastal Hazards Section 26 - Business Plan	The CMP strategies and actions recognise that the local and regional scale effects of coastal processes ambulatory and dynamic nature of the shoreline through the development of coastal hazard adaptation strategies.
(h) to promote integrated and co-ordinated coastal planning, management and reporting	Section 2.3 - Vision, Objectives and Strategic Direction Section 26 - Business Plan	The CMP has been compared in collaboration with NSW Government agencies, community and first nations stakeholders and includes actions that are supported by and will be delivered by a range of state government agencies in addition to CVC.
(i) to encourage and promote plans and strategies to improve the resilience of coastal assets to the impacts of an uncertain climate future including impacts of extreme storm events	Section 2.3 - Vision, Objectives and Strategic Direction Section 4.2 - Coastal Processes Section 5 - A Snapshot of Issues including Section 5.1 - Coastal Hazards Section 26 - Business Plan	The CMP includes a range of strategies to improve the resilience of coastal assets including planning and development controls, asset management, emergency management, mitigation of coastal erosion/ shoreline recession, management of slope instability and the development of coastal hazard adaptation strategies.
(j) to ensure co-ordination of the policies and activities of government and public authorities relating to the coastal zone and to facilitate the proper integration of their management activities	Section 2.3 - Vision, Objectives and Strategic Direction Section 26 - Business Plan	The CMP recognises and supports the policies and activities of government and public authorities relating to the coastal zone including projects and programs delivered as part of the Marine Estate Management Strategy (refer Appendix 2).
(k) to support public participation in coastal management and planning and greater public awareness, education and understanding of coastal processes and management actions	Section 2.3 - Vision, Objectives and Strategic Direction Section 3 - Consultation Section 26 - Business Plan	The CMP has been prepared with significant community input and the delivery of CMP actions will continue to include community engagement in the selection of preferred approaches and delivery of on-ground actions. The CMP also includes an action to provide access to education materials.

CM Act objects	Sections in this CMP	CMP consideration and promotion of the objects
(l) to facilitate the identification of land in the coastal zone for acquisition by public or local authorities in order to promote the protection, enhancement, maintenance and restoration of the environment of the coastal zone	Section 26 - Business Plan	The CMP includes the development of coastal hazard adaptation strategies which will facilitate the identification of land in the coastal zone for acquisition by public or local authorities.
(m) to support the objects of the Marine Estate Management Act 2014 which are:		
(a) to provide for the management of the marine estate of New South Wales consistent with the principles of ecologically sustainable development in a manner that: (i) promotes a biologically diverse, healthy and productive marine estate, and (ii) facilitates: • economic opportunities for the people of New South Wales, including opportunities for regional communities, and • the cultural, social and recreational use of the marine estate, and • the maintenance of ecosystem integrity, and • the use of the marine estate for scientific research and education.	Section 26 - Business Plan	The CMP supports the objects of the *Marine Estate Management Act 2014* at a local scale through strategies and actions that promote biological diversity, ecosystem health, cultural, social and recreational use of the coastal zone.

CM Act objects	Sections in this CMP	CMP consideration and promotion of the objects
(b) to promote the co-ordination of the exercise, by public authorities, of functions in relation to the marine estate	Section 26 - Business Plan	The CMP recognises and supports the policies and activities of government and public authorities relating to the coastal zone including projects and programs delivered as part of the Marine Estate Management Strategy.
(c) to provide for the declaration and management of a comprehensive system of marine parks and aquatic reserves	Section 26 - Business Plan	The CMP includes actions to enhance the values of the Solitary Islands Marine Park including waterway access, seagrass management and water quality management.

Table 36: Achievement of coastal management area objectives

Coastal management area objectives	Sections in this CMP	CMP consideration and promotion of the objectives
Coastal wetlands and littoral rainforests area		
(a) to protect coastal wetlands and littoral rainforests in their natural state, including their biological diversity and ecosystem integrity	Section 2.2 - Areas Covered by this CMP Section 4.4 - Environmental Values Section 5 - A Snapshot of Issues including Section 5.3 - Ecological Condition Section 26 - Business Plan Section 25 - Whether the CMP Identifies Recommended Changes to the Relevant Planning Controls, Including Any Proposed Maps	The extensive areas of coastal wetlands within the CMP coastal zone are recognised in the CMP and actions that enhance coastal habitats. The CMP recognises that CWLRA mapping amendments may be required as part of future versions of the Open Coast CMP or the Clarence River Estuary CMP to afford the ecological communities the required level of protection from future land use pressures, development and coastal hazards.
(b) to promote the rehabilitation and restoration of degraded coastal wetlands and littoral rainforests	Section 26 - Business Plan	The CMP includes actions to rehabilitate and restore degraded coastal wetlands.

Coastal management area objectives	Sections in this CMP	CMP consideration and promotion of the objectives
(c) to improve the resilience of coastal wetlands and littoral rainforests to the impacts of climate change, including opportunities for migration	Section 26 - Business Plan	The CMP includes actions to rehabilitate and restore degraded coastal wetlands and intertidal marine vegetation strategies to address threats and risks to estuarine vegetation including identified potential migration pathways.
(d) to support the social and cultural values of coastal wetlands and littoral rainforests	Section 4.4 - Environmental Values Section 4.5 - Community Uses and Values Section 5 - A Snapshot of Issues including Section 5.1 - Coastal Hazards, Section 5.2 - Coastal Uses and Access and Section 5.3 - Ecological Condition Section 26 - Business Plan	The CMP acknowledges and supports the cultural heritage and social values of coastal habitats through actions to rehabilitate and restore degraded coastal wetlands and involvement of Yaegl people in rehabilitation actions.
(e) to promote the objectives of State policies and programs for wetlands or littoral rainforest management	Section 2.1 - The Coastal Management Framework in NSW Section 26 - Business Plan	The CMP considers and promotes the objectives of State policies and programs for wetlands or littoral rainforest management including the Resilience and Hazards SEPP.
Coastal vulnerability area		
(a) to ensure public safety and prevent risks to human life	Section 2.3 - Vision, Objectives and Strategic Direction Section 4.2 - Coastal Processes Section 5 - A Snapshot of Issues including Section 5.1 - Coastal Hazards Section 26 - Business Plan Section 27 - Coastal Zone Emergency Action Subplan and Appendix 3	The CMP provides information on coastal hazards and actions to manage risks including planning and development controls, emergency response, coastal hazard mitigation and coastal hazard adaptation.

Coastal management area objectives	Sections in this CMP	CMP consideration and promotion of the objectives
(b) to mitigate current and future risk from coastal hazards by taking into account the effects of coastal processes and climate change	Section 4.2 - Coastal Processes Section 5 - A Snapshot of Issues including Section 5.1 - Coastal Hazards Section 26 - Business Plan Section 27 - Coastal Zone Emergency Action Subplan and Appendix 3	The CMP provides information on coastal hazards and actions to reduce those risks.
(c) to maintain the presence of beaches, dunes and the natural features of foreshores, taking into account the beach system operating at the relevant place	Section 4.2 - Coastal Processes Section 5 - A Snapshot of Issues including Section 5.1 - Coastal Hazards Section 26 - Business Plan	The CMP includes actions to manage risks including coastal hazard mitigation and coastal hazard adaptation.
(d) to maintain public access, amenity and use of beaches and foreshores	Section 4.2 - Coastal Processes Section 5 - A Snapshot of Issues including Section 5.1 - Coastal Hazards Section 26 - Business Plan	The CMP includes actions to manage risks including coastal hazard mitigation, coastal habitat restoration, waterway access, foreshore management and coastal hazard adaptation.
(e) to encourage land use that reduces exposure to risks from coastal hazards, including through siting, design, construction and operational decisions	Section 4.2 - Coastal Processes Section 5 - A Snapshot of Issues including Section 5.1 - Coastal Hazards Section 26 - Business Plan	The CMP provides information on coastal hazards and actions to manage risks including planning and development controls and asset management strategies.

Coastal management area objectives	Sections in this CMP	CMP consideration and promotion of the objectives
(f) to adopt coastal management strategies that reduce exposure to coastal hazards - (i) in the first instance and wherever possible, by restoring or enhancing natural defences including coastal dunes, vegetation and wetlands, and (ii) if that is not sufficient, by taking other action to reduce exposure to those coastal hazards	Section 4.2 - Coastal Processes Section 5 - A Snapshot of Issues including Section 5.1 - Coastal Hazards Section 26 - Business Plan	The CMP includes management actions that reduce exposure to coastal hazards, including restoring/ enhancing natural defences including coastal dunes and vegetation through habitat restoration, access management and beach nourishment. In some locations, other actions including coastal protection works and adaptation strategies will be required to reduce expose to coastal hazards.
(g) if taking that other action to reduce exposure to coastal hazards - (i) to avoid significant degradation of biological diversity and ecosystem integrity, and (ii) to avoid significant degradation of or disruption to ecological, biophysical, geological and geomorphological coastal processes, and (iii) to avoid significant degradation of or disruption to beach and foreshore amenity and social and cultural values, and (iv) to avoid adverse impacts on adjoining land, resources or assets, and (v) to provide for the restoration of a beach, or land adjacent to the beach, if any increased erosion of the beach or adjacent land is caused by actions to reduce exposure to coastal hazards	CMP strategies: Mitigate coastal erosion/ shoreline recession. Section 26 - Business Plan	The CMP actions involving coastal protection works will be designed to avoid significant degradation and adverse impacts and provide for beach restoration where required.

Coastal management area objectives	Sections in this CMP	CMP consideration and promotion of the objectives
(h) to prioritise actions that support the continued functionality of essential infrastructure during and immediately after a coastal hazard emergency	Section 7.7 - Strategy EM1 - Emergency Management Section 27 - Coastal Zone Emergency Action Subplan and Appendix 3 Section 26 - Business Plan	The CMP includes emergency management actions and a CZEAS.
(i) to improve the resilience of coastal development and communities by improving adaptive capacity and reducing reliance on emergency responses	CMP strategies: Coastal hazard adaptation Section 26 - Business Plan	The CMP includes coastal hazard adaption strategies and updated planning and development controls to improve the resilience of coastal development and communities.
Coastal environment area		
(a) to protect and enhance the coastal environmental values and natural processes of coastal waters, estuaries, coastal lakes and coastal lagoons, and enhance natural character, scenic value, biological diversity and ecosystem integrity	Section 4.4 - Environmental Values Section 4.5 - Community Uses and Values Section 5 - A Snapshot of Issues including Section 5.2 - Coastal Uses and Access and Section 5.3 - Ecological Condition Section 26 - Business Plan	Protection and enhancement of natural coastal processes and coastal environmental values is a key focus of the CMP which includes environmental protection and restoration strategies.
(b) to reduce threats to and improve the resilience of coastal waters, estuaries, coastal lakes and coastal lagoons, including in response to climate change	Section 4.4 - Environmental Values Section 4.5 - Community Uses and Values Section 5 - A Snapshot of Issues including Section 5.1 - Coastal Hazards, Section 5.2 - Coastal Uses and Access and Section 5.3 - Ecological Condition Section 26 - Business Plan	The CMP includes actions to rehabilitate and restore degraded coastal habitats, intertidal marine vegetation strategies to address threats and risks to estuarine vegetation including identified potential migration pathways, water quality management and ICOLL management.

Coastal management area objectives	Sections in this CMP	CMP consideration and promotion of the objectives
(c) to maintain and improve water quality and estuary health	Section 4.4 - Environmental Values Section 4.5 - Community Uses and Values Section 5 - A Snapshot of Issues including Section 5.1 - Coastal Hazards, Section 5.2 - Coastal Uses and Access and Section 5.3 - Ecological Condition Section 26 - Business Plan	The CMP includes actions relating to water quality management and ICOLL management as well as estuary health monitoring and reporting.
(d) to support the social and cultural values of coastal waters, estuaries, coastal lakes and coastal lagoons	Section 4.4 - Environmental Values Section 4.5 - Community Uses and Values Section 5 - A Snapshot of Issues including Section 5.1 - Coastal Hazards, Section 5.2 - Coastal Uses and Access and Section 5.3 - Ecological Condition Section 26 - Business Plan	The CMP includes actions relating to bank management, water quality management and ICOLL management as well as water quality monitoring, estuary health monitoring and reporting.
(e) to maintain the presence of beaches, dunes and the natural features of foreshores, taking into account the beach system operating at the relevant place	Section 4.2 - Coastal Processes Section 5 - A Snapshot of Issues including Section 5.1 - Coastal Hazards Section 26 - Business Plan	The CMP includes actions to manage risks including coastal hazard mitigation and coastal hazard adaptation.
(f) to maintain and, where practicable, improve public access, amenity and use of beaches, foreshores, headlands and rock platforms	Section 4.5 - Community Uses and Values Section 5 - A Snapshot of Issues including Section 5.1 - Coastal Hazards, Section 5.2 - Coastal Uses and Access Section 26 - Business Plan	The CMP includes actions relating to enhanced waterway access, water quality improvement, slope stability and accessible access to beaches.

Coastal management area objectives	Sections in this CMP	CMP consideration and promotion of the objectives
Coastal use area		
(a) to protect and enhance the scenic, social and cultural values of the coast by ensuring that - (i) the type, bulk, scale and size of development is appropriate for the location and natural scenic quality of the coast, and (ii) adverse impacts of development on cultural and built environment heritage are avoided or mitigated, and (iii) urban design, including water sensitive urban design, is supported and incorporated into development activities, and (iv) adequate public open space is provided, including for recreational activities and associated infrastructure, and (v) the use of the surf zone is considered,	Section 4.5 - Community Uses and Values Section 5 - A Snapshot of Issues including Section 5.1 - Coastal Hazards, Section 5.2 - Coastal Uses and Access Section 26 - Business Plan	The CMP recognises the importance of protecting and enhancing the scenic, social and cultural values of the coast. It supports the application of planning controls to mitigate development impacts on scenic quality, cultural values and includes coastal habitat restoration of public reserves.
(b) to accommodate both urbanised and natural stretches of coastline	Section 2.2 - Areas Covered by this CMP Section 4.4 - Environmental Values Section 26 - Business Plan	The CMP coastal zone covers urban areas and significant components of Bundjalung and Yuraygir National Parks and Solitary Islands Marine Park. CMP actions cover coastal rehabilitation and management across all these areas.

Table 37: CMP mandatory requirements - *NSW Coastal Management Manual Part A* (OEH, 2018a)

Mandatory requirement		Where documented in CMP and additional notes
MR2	A CMP is to consider a range of timeframes and planning horizons including immediate, 20 years, 50 years, 100 years and (if council considers it relevant based on expert advice) beyond.	The timeframe of risks assessed are summarised in Section 5.5 and include the current timeframe, 20 years, 50 years and 100 years. The risk assessment is discussed in detail in the *Stage 1 Scoping Study* (Hydrosphere Consulting, 2021) and *Stage 2 Vulnerabilities and Opportunities* (Hydrosphere Consulting, 2023).
MR3	A CMP is to consider a broad range of coastal management issues and management actions with a focus on achieving the objects and objectives of the *Coastal Management Act 2016*.	The coastal management issues are summarised in Section 5 and in Sections 8 to 24 for each management zone and discussed in detail in the *Stage 1 Scoping Study* (Hydrosphere Consulting, 2021), *Stage 2 Vulnerabilities and Opportunities* (Hydrosphere Consulting, 2023). A broad range of management options was assessed as part of the *Stage 3 Identification and Evaluation of Options* (Hydrosphere Consulting, 2024a) and refined and presented in the CMP. The descriptions of the actions include the priority threats addressed by the actions.

Mandatory requirement		Where documented in CMP and additional notes
MR4	A CMP must include the rationale for selecting the area to be covered by a CMP and identify whether it applies to: (i) all or part of the coastal zone of one local government area; or (ii) all or part of the coastal zone of adjoining local government areas that share a coastal sediment compartment or estuary (where adjoining local government areas share a coastal sediment compartment or estuary - refer to Schedule 1 of the *Coastal Management Act 2016* - a CMP that addresses an area comprising that coastal sediment compartment or estuary must reflect this regional context).	Section 2.2: Areas covered by this CMP. i. The area covered by this CMP is entirely within the Clarence Valley LGA but excludes the Clarence River estuary upstream of the entrance. ii. CVC will liaise with Richmond Valley Council and City of Coffs Harbour during finalisation of the CMP as they share sediment compartments with CVC.
MR5i	A CMP must identify any proposed amendments to mapping of the relevant coastal management areas.	This CMP does not include any changes to existing mapping. However, mapping amendments may be pursued as part of future versions of this Open Coast CMP or the Clarence River Estuary CMP as discussed in Section 25.
MR5ii	A CMP must identify evidence to support any proposed amendments or additions to the area of the four coastal management areas in the relevant area.	This CMP does not include any changes to existing mapping. However, mapping amendments may be pursued as part of future versions of this Open Coast CMP or the Clarence River Estuary CMP as discussed in Section 25.

Mandatory requirement		Where documented in CMP and additional notes
MR5iii	A CMP must identify information about these proposed amendments that can support the preparation of a planning proposal and, in particular, that could be forwarded along with a planning proposal to the Greater Sydney Commission (if the planning proposal relates to the Greater Sydney Region) or the Minister (for elsewhere) to inform a Gateway determination under section 3.34 of the Environmental Planning and Assessment Act 1979.	This CMP does not include any changes to existing mapping. However, mapping amendments may be pursued as part of future versions of this Open Coast CMP or the Clarence River Estuary CMP as discussed in Section 25.
MR6i	During preparation of a CMP, a council is to identify the scope of the CMP	The scope is identified in Section 2.2 and the *Stage 1 Scoping Study* (Hydrosphere Consulting, 2021).
MR6ii	During preparation of a CMP, a council is to determine and assess coastal risks, vulnerabilities and opportunities (including without limitation risks to environmental, social and economic values and benefits).	The range of coastal risks, vulnerabilities and opportunities are summarised in Section 5 and in Sections 8 to 24 for each management zone and discussed in detail in the *Stage 1 Scoping Study* (Hydrosphere Consulting, 2021) and *Stage 2 Vulnerabilities and Opportunities* (Hydrosphere Consulting, 2023).
MR6iii	During preparation of a CMP, a council is to evaluate and select coastal management options	The options assessment process is summarised in Section 6.1 and detailed in the *Stage 3 Identification and Evaluation of Options* (Hydrosphere Consulting, 2024a).
MR8i	A CMP must describe how the objects of the *Coastal Management Act 2016* have been considered and promoted in preparing the CMP	The objects of the CM Act are reflected in the CMP objectives (Section 2.3). The CMP actions are consistent with the objects of the Act as shown in Table 35.

Mandatory requirement		Where documented in CMP and additional notes
MR8ii	A CMP must provide a description of how the objectives of the coastal management areas covered by the CMP have been given effect to in preparing the CMP.	The management objectives for the coastal management areas are reflected in the CMP objectives (Section 2.3). CMP actions are consistent with the objectives for the coastal management areas as shown in Table 38 to Table 41.
MR8iii	A CMP must identify the key coastal management issues affecting the areas to which the CMP is to apply and how these have been considered.	The range of coastal management issues are summarised in Section 5 and in Sections 8 to 24 for each management zone and discussed in detail in *Stage 1 Scoping Study* (Hydrosphere Consulting, 2021) and *Stage 2 Vulnerabilities and Opportunities* (Hydrosphere Consulting, 2023). The high priority threats relevant to each coastal management area are shown in Table 4. The descriptions of the actions include the priority threats addressed by the actions.
MR8iv	A CMP must identify any coastal management actions required to address those key coastal management issues in an integrated and strategic manner.	Sections 7 to 24 provides the coastal management actions required to address the identified coastal management issues. The development and assessment of options is summarised in Section 6.1 and provided in full in the *Stage 3 Identification and Evaluation of Options* (Hydrosphere Consulting, 2023).
MR8v	A CMP must identify how the coastal management actions in (iv) have been considered and evaluated (including, without limitation, how the council has evaluated the coastal management actions in light of the functions and responsibilities council has under legislation other than the *Coastal Management Act 2016).*	The options assessment process is summarised in Section 6.1 and detailed in *Stage 3 Identification and Evaluation of Options* (Hydrosphere Consulting, 2024a).

Mandatory requirement		Where documented in CMP and additional notes
MR8vi	A CMP must identify any environmental protection works, on land identified as 'coastal wetlands' or 'littoral rainforests' on the Coastal Wetlands and Littoral Rainforests Area Map under the *State Environmental Planning Policy (Coastal Management) 2018*, that are proposed to be carried out by or on behalf of a public authority.	The exact locations of many on-ground actions will be confirmed during CMP implementation including through coastal habitat restoration actions and *Action F1-1: Intertidal marine vegetation strategies*. Actions within or near mapped CWLRA include: • Planning and development controls • Coastal hazard adaption at Hickey Island, Brooms Head, Wooli and Woody Head campground • Coastal habitat restoration at Hickey Island, Brooms Head, Wooli and NPWS Estate • On-site sewerage management (Brooms Head, Wooli) • ICOLL management (Lake Cakora) • Bank management (Wooli Wooli River) • Recreational improvements (Lake Cakora, Wooli Wooli River) • Incorporating coastal hazard risks into NPWS Reserve Plans of Management • Intertidal marine vegetation strategies (Clarence River Estuary, Lake Cakora, Lake Arragan, Sandon River and Wooli Wooli River) • Seagrass investigations (Sandon River and Wooli Wooli River) • Cultural heritage management.

Mandatory requirement		Where documented in CMP and additional notes
MR8vii	A CMP must identify any coastal protection works that are proposed to be carried out by or on behalf of a public authority.	Coastal protection works are planned for: • Whiting Beach - *Action HW1-1: Sand nourishment – Whiting Beach*. • Yamba Main Beach - *Action Y1-2: Replace/upgrade Yamba Main Beach seawall.* • Brooms Head - *Action BH1-3: Coastal protection works (stage 1, temporary)* and *Action BH1-4: Extension of Brooms Head Reserve revetment.* • Woody Head - *Action WH1-2: Values, asset and infrastructure management (Woody Head campground).* Emergency coastal protection works may also be installed (*Action EM1-1: Implement emergency response procedures*) in accordance with the CZEAS at: • Iluka Road and Shark Bay. • Woody Head campground. • Red Cliff campground. • Ocean Road, Brooms Head and Brooms Head Reserve. • Sandon River Road and Sandon River campground. • Minnie Water. • Diggers Camp.
MR8viii	A CMP must set out the recommended timing for the proposed coastal management actions.	The proposed timing of actions is specified in the descriptions of the actions (Sections 7 to 24) and the Business Plan (Section 26).
MR8ix	A CMP must identify a proposed monitoring, evaluation and reporting program in relation to the CMP, including by identifying key indicators, trigger points and thresholds relevant to the CMP	The proposed monitoring, evaluation and reporting program is provided in Section 18.
MR8x	A CMP must include a business plan	The Business Plan is included in Section 26.

Mandatory requirement		Where documented in CMP and additional notes
MR9i	The business plan included in the CMP must identify all proposed coastal management actions identified elsewhere in the CMP.	The Business Plan (Section 26) includes all management actions identified in the CMP.
MR9ii	The business plan included in the CMP must identify the full proposed capital, operational and maintenance costs, and recommended timing, of proposed coastal management actions	The Business Plan (Section 26) includes costs and timing for coastal management actions.
MR9iii	The business plan included in the CMP must identify any proposed cost-sharing arrangements and any other viable funding mechanisms for the proposed coastal management actions to ensure delivery of those actions is consistent with the timing for their implementation under the CMP	The Business Plan (Section 26) includes potential funding arrangements.
MR9iv	The business plan included in the CMP must identify the distribution of costs and benefits of all proposed coastal management actions.	The Business Plan (Section 26) includes the distribution of costs and benefits for each action.
MR10	Where coastal hazards have been identified in a coastal management area, a CMP must identify proposed coastal management actions for those hazards.	CMP actions to address coastal hazards are discussed in Sections 7 to 24.

Mandatory requirement		Where documented in CMP and additional notes
MR11	If the *Coastal Management Act 2016* requires that a Coastal Zone Emergency Action Subplan be prepared, it must identify any requirements for how emergency coastal protection works, within the meaning of the *State Environmental Planning Policy (Coastal Management) 2018*, are to be carried out.	The Coastal Zone Emergency Action Subplan for the Clarence Valley open coast is provided in Appendix 3 (refer Section 27).
MR12i	A CMP must demonstrate how a council has considered projected population growth and demographic changes	Projected population growth and land use changes are discussed in Section 2.5.1 and detailed further in *Stage 1 Scoping Study* (Hydrosphere Consulting, 2021).
MR12ii	A CMP must demonstrate how a council has considered projected use of coastal land for infrastructure, housing, commercial, recreational and conservation purposes.	Projected population growth and land use changes are discussed in Section 2.5.1 and detailed in the *Stage 1 Scoping Study* (Hydrosphere Consulting, 2021). *Action PD1-1: Review and implement planning controls to address coastal hazards* incorporates provisions to control development in the coastal zone at risk of current or future coastal hazards.
MR13i	A CMP must demonstrate how a council has considered: current and future risks, at timeframes of immediate, 20 years, 50 years, 100 years and (if council considers it relevant based on expert advice) beyond.	The risk assessment summarised in Section 5.5 and detailed in the *Stage 1 Scoping Study* (Hydrosphere Consulting, 2021) and *Stage 2 Vulnerabilities and Opportunities* (Hydrosphere Consulting, 2023) includes the current timeframe, 20 years, 50 years and 100 years.
MR13ii	A CMP must demonstrate how a council has considered (if council considers it relevant) current and future risks of potentially high consequence, low probability events that may affect the relevant area	Coastal events such as a tsunami (a wave of magnitude that presents a risk to land and marine elements) are addressed through the *NSW State Emergency Management Plan* (EMPLAN, NSW Government, 2023) and subplans including the *Clarence Valley Local EMPLAN* (Clarence Valley Local Emergency Management Committee, 2023).

Mandatory requirement		Where documented in CMP and additional notes
MR13iii	A CMP must demonstrate how a council has considered the effects of projected climate change and how it may affect the relevant area.	Climate change impacts are summarised in Section 5.4 and discussed in detail in the *Stage 1 Scoping Study* (Hydrosphere Consulting, 2021), *Stage 2 Vulnerabilities and Opportunities* (Hydrosphere Consulting, 2023) and detailed coastal hazard assessments (JBP, 2022; JBP, 2023).
MR13iv	A CMP must demonstrate how a council has considered the local and regional scale effects of coastal processes.	Coastal processes are summarised in Section 4.2 of this CMP and discussed in detail in the *Stage 1 Scoping Study* (Hydrosphere Consulting, 2021), *Stage 2 Vulnerabilities and Opportunities* (Hydrosphere Consulting, 2023) and detailed coastal hazard assessments (JBP, 2022; JBP, 2023).
MR13v	A CMP must demonstrate how a council has considered the ambulatory and dynamic nature of the shoreline and how it may affect the relevant area.	Coastal processes are summarised in Section 4.2 of this CMP and discussed in detail in the *Stage 1 Scoping Study* (Hydrosphere Consulting, 2021), *Stage 2 Vulnerabilities and Opportunities* (Hydrosphere Consulting, 2023) and detailed coastal hazard assessments (JBP, 2022; JBP, 2023).

Mandatory requirement		Where documented in CMP and additional notes
MR14	A CMP is to include the following sections: • Executive summary • Introduction • A snapshot of issues • Actions to be implemented by the council or by public authorities • Whether the CMP identifies recommended changes to the relevant planning controls, including any proposed maps • A business plan • Coastal zone emergency action subplan, if the Coastal Management Act 2016 requires that subplan to be prepared • Monitoring, evaluation and reporting program • Maps • Reference list	The CMP has been formatted according to MR14. The Coastal Zone Emergency Action Subplan is provided in Appendix 3 (refer Section 27).
MR15	A draft CMP must be exhibited for public inspection at the main offices of the councils of all local government areas within the area to which the CMP applies, during the ordinary hours of those offices, for not less than 28 calendar days before it is adopted. This mandatory requirement does not prevent community consultation, or other consultation, in other ways.	The draft CMP and associated documents will be publicly exhibited during June/ July 2024 in accordance with MR15 (refer Section 2).

Mandatory requirement		Where documented in CMP and additional notes
MR16	When implementing a CMP, a council must: • carry out the monitoring, evaluation and reporting program in the CMP (MER) • monitor key indicators, trigger points and thresholds identified in the MER	A MER program is provided in Section 18 with performance targets provided in action descriptions in Sections 7 to 24.
MR17	Councils must report on the implementation of a CMP through the IP&R framework on an annual, four yearly and ten-yearly basis.	Action MER3: Review of CMP progress and monitoring of performance targets includes annual reporting of CMP progress towards performance targets as part of the IP&R framework. The Business Plan (Section 26) and action descriptions in Sections 7 to 24 provide details to enable the actions to be implemented through council's IP&R Framework.
MR18	When an adjoining council or a public authority is affected, or is likely to be affected, by implementation of some aspect of a CMP, a council must liaise with that authority when implementing that aspect of the CMP.	CVC will liaise with Richmond Valley Council and City of Coffs Harbour during finalisation of the CMP as they share sediment compartments with CVC. CVC has consulted closely with other public authorities with responsibility for delivery of actions in this CMP. Support from these agencies will be confirmed during finalisation of the CMP. The SES, NPWS and DPHI-Crown Lands have been consulted regarding the CZEAS.
MR19	Councils must maintain sufficient information and records about its management of the relevant parts of the coastal zone that will enable it to demonstrate: (i) how the CMP has been implemented; and (ii) what has been achieved in connection with the CMP, including whether coastal management actions have been carried out within the timeframes identified in the CMP	A MER program is provided in Section 18, including actions Action MER3: Review of CMP progress and monitoring of performance targets and Action MER5: Ten-year review of CMP.

Table 38: Management objectives for the coastal wetlands and littoral rainforests area (Section 6 *Coastal Management Act 2016*)

No.	Management objective	Where addressed in CMP and additional notes
a)	to protect coastal wetlands and littoral rainforests in their natural state, including their biological diversity and ecosystem integrity	The environmental values of the Clarence Valley Open Coast include healthy and diverse natural environments and biodiversity values. The CMP includes objectives relevant to the protection, rehabilitation and restoration of coastal wetlands and littoral rainforests, improving resilience to coastal hazards and supporting social and cultural values (Section 2.3). Several management strategies and actions aim to protect, promote the rehabilitation and restoration, improve resilience and social and cultural values of coastal wetlands and littoral rainforests including: • Planning and development controls. • Coastal hazard adaption at Hickey Island, Brooms Head, Wooli and Woody Head campground. • Coastal habitat restoration at Hickey Island, Brooms Head, Wooli and NPWS Estate. • On-site sewerage management (Brooms Head, Wooli). • ICOLL management (Lake Cakora). • Bank management (Wooli Wooli River). • Recreational improvements (Lake Cakora, Wooli Wooli River). • Incorporating coastal hazard risks into NPWS Reserve Plans of Management • Intertidal marine vegetation strategies (Clarence River Estuary, Lake Cakora, Lake Arragan, Sandon River and Wooli Wooli River) • Seagrass investigations (Sandon River and Wooli Wooli River) • Cultural heritage management.
b)	to promote the rehabilitation and restoration of degraded coastal wetlands and littoral rainforests	
c)	to improve the resilience of coastal wetlands and littoral rainforests to the impacts of climate change, including opportunities for migration.	
d)	to support the social and cultural values of coastal wetlands and littoral rainforests.	
e)	to promote the objectives of State policies and programs for wetlands or littoral rainforest management.	The CMP promotes the objectives of the CM Act, MEMA Act, Resilience and Hazards SEPP, NPWS park management policies and the MEMS.

Table 39: Management objectives for the coastal vulnerability area (Section 7 *Coastal Management Act 2016*)

No.	Management objective	Where addressed in CMP and additional notes
a)	To ensure public safety and prevent risks to human life	The CVA is not mapped in the CMP study area. Along the Clarence coastline many beaches are vulnerable to coastal erosion/ recession. Areas within close proximity to estuary entrances are most vulnerable to inundation with oceanic inundation of lesser concern along the Clarence Valley coastline. Areas of potential slope instability include Pilot Hill, Cakora Point and Convent Beach. Bank erosion in Wooli Wooli River has been attributed to a variety of causes including removal of riparian vegetation combined with tidal and flood flows or boat wake and wind waves. The CMP includes objectives relevant to management of coastal hazards (Section 2.3). Coastal hazard adaptation strategies have been developed for each management zone. Planning and development controls will be developed to address coastal hazards. Other CMP actions addressing coastal hazards include dune restoration, beach nourishment, maintenance/ upgrade of coastal protection works, new coastal protection works and bank rehabilitation. Recreational improvements are included to enhance public access, amenity and use of the coast. Asset management planning will include consideration of coastal hazards.
b)	To mitigate current and future coastal hazards.	
c)	To maintain the presence of beaches, dunes and other natural features.	
d)	To maintain public access, amenity and use of the coast.	
e)	To encourage land use that reduces exposure to hazards, including through siting, design, construction and operational decisions.	
f)	To adopt coastal management strategies that reduce exposure to hazards, in the first instance by restoring or enhancing natural defences such as dunes, and thereafter by taking other action and if taking other action, to: • avoid significant degradation or disruption of biological diversity, ecosystem integrity, coastal processes (ecological, biophysical, geological, geomorphological), beach and foreshore amenity, and social and cultural values. • avoid adverse offsite impacts, or otherwise restore the land if any impacts are caused by the action to reduce exposure to hazards.	
g)	To maintain essential infrastructure	
h)	To improve community resilience and reduce reliance on emergency responses	

Table 40: Management objectives for the coastal environment area (Section 8 *Coastal Management Act 2016*)

No.	Management objective	Where addressed in CMP and additional notes
a)	to protect and enhance the coastal environmental values and natural processes of coastal waters, estuaries, coastal lakes and coastal lagoons, and enhance natural character, scenic value, biological diversity and ecosystem integrity,	The open coast and estuaries are dynamic and diverse encompassing a broad range of natural features including sandy beaches, coastal dunes, rocky headlands, marine areas, lakes, estuary entrances, littoral rainforest, wetlands/ heathlands and estuarine environments. The beaches and waterways provide a place for social interaction, recreation, relaxation, nature appreciation, connection, exercise and commercial activities. The CMP includes objectives relevant to protection and enhancement of coastal environmental values (Section 2.3). Relevant CMP actions include: • Planning and development controls. • Coastal habitat restoration at Hickey Island, Brooms Head, Wooli and NPWS Estate. • On-site sewerage management (Brooms Head, Wooli). • ICOLL management (Lake Cakora). • Bank management (Wooli Wooli River). • Recreational improvements (Pilot Hill, Lake Cakora, Wooli Wooli River). • Intertidal marine vegetation strategies (Clarence River Estuary, Lake Cakora, Lake Arragan, Sandon River and Wooli Wooli River). • Seagrass investigations (Sandon River and Wooli Wooli River). • Cultural heritage management. • Estuary health monitoring.
b)	to reduce threats to and improve the resilience of coastal waters, estuaries, coastal lakes and coastal lagoons, including in response to climate change,	
c)	to maintain and improve water quality and estuary health,	
d)	to support the social and cultural values of coastal waters, estuaries, coastal lakes and coastal lagoons,	
e)	to maintain the presence of beaches, dunes and the natural features of foreshores, taking into account the beach system operating at the relevant place,	
f)	to maintain and, where practicable, improve public access, amenity and use of beaches, foreshores, headlands and rock platforms.	

Table 41: Management objectives for the coastal use area (Section 9 *Coastal Management Act 2016*)

No.	Management objective	Where addressed in CMP and additional notes
a)	to protect and enhance the scenic, social and cultural values of the coast by ensuring that: (i) the type, bulk, scale and size of development is appropriate for the location and natural scenic quality of the coast, and (ii) adverse impacts of development on cultural and built environment heritage are avoided or mitigated, and (iii) urban design, including water sensitive urban design, is supported and incorporated into development activities, and (iv) adequate public open space is provided, including for recreational activities and associated infrastructure, and (v) the use of the surf zone is considered,	The open coast and estuaries are dynamic and diverse encompassing a broad range of natural features including sandy beaches, coastal dunes, rocky headlands, marine areas, lakes, estuary entrances, littoral rainforest, wetlands/ heathlands and estuarine environments. For many community members, interaction with the coast and estuaries is a highly valued part of life. The beaches and waterways provide a place for social interaction, recreation, relaxation, nature appreciation, connection, exercise and commercial activities. Community land is valued for its important role in the social, intellectual, spiritual and physical enrichment and health benefits of residents, workers, and visitors. The CMP study area comprises significant and valuable parks and reserves that are easily accessible to the local community and visitors attracted to the opportunities the area provides, such as beaches, coastal lakes and significant open space areas for multiple recreational, social and cultural purposes. The CMP includes objectives relevant to protection and enhancement of scenic, social and cultural values (Section 2.3). Relevant CMP actions include: • Planning and development controls. • Coastal habitat restoration at Hickey Island, Brooms Head, Wooli and NPWS Estate. • On-site sewerage management (Brooms Head, Wooli). • ICOLL management (Lake Cakora). • Bank management (Wooli Wooli River). • Recreational improvements (Pilot Hill, Lake Cakora, Wooli Wooli River). • Intertidal marine vegetation strategies (Clarence River Estuary, Lake Cakora, Lake Arragan, Sandon River and Wooli Wooli River). • Seagrass investigations (Sandon River and Wooli Wooli River). • Cultural heritage management. • Recreational water quality monitoring.
b)	to accommodate both urbanised and natural stretches of coastline.	

APPENDIX 2 LINKS TO THE MARINE ESTATE MANAGEMENT STRATEGY

The *Marine Estate Management Strategy 2018 - 2028* (MEMS, MEMA, 2018) provides an overarching strategic approach to the coordinated management of the NSW marine estate (the coastal waters, estuaries, lakes, lagoons and coastal wetlands). The MEMS sets out nine initiatives and the actions needed to deliver improved management of the marine estate over ten years from 2018 - 2028. The initiatives were developed based on the threat and risk assessment (TARA) prepared for the MEMS (BMT WBM, 2017), stakeholder and community feedback and marine estate values.

This CMP supports the objectives of the *Marine Estate Management Act 2014* and the CMP actions are strongly aligned with improving outcomes for the marine estate. The CMP risk assessment used qualitative scales to assess the risk of identified issues impacting the values and assets of the study area under current management practices based on the framework adopted for the TARA. Threats (uses, activities and stressors) to the values of the CMP study area align with the state-wide TARA priority threats to estuaries and coastal and marine areas including:

- T6 - Erosion of foreshores.
- T7 - Historic clearing of riparian vegetation and adjacent habitat.
- T8 - Foreshore development.
- T17 - 4WD/ motorbikes on beaches.
- T23 - Urban stormwater pollution.
- T33 - Estuary entrance modifications.
- T24 - Pollution from on-site wastewater systems.

Further detail on the risk assessment is included in Section 5.5 and the supporting information for this CMP - Stage 1, Hydrosphere Consulting (2021) and Stage 2 (Hydrosphere Consulting, 2023a).

The CMP actions align with relevant initiatives in the MEMS:

1. Improving water quality and reducing litter:
    - *Action FM1-4: Reduce litter and marine debris.*
    - *Action BH4-1: On-site sewerage management (Brooms Head).*
    - *Action BH4-2: ICOLL management strategy (Lake Cakora).*
    - *Action S1-1: On-site sewerage management (Sandon village).*
    - *Action W3-1: On-site sewerage management (Wooli)*.
2. Delivering healthy coastal habitats with sustainable use and development:
    - *Action FM1-1: Kelp management.*
    - *Action FM1-2: Manage vehicular beach access.*
    - *Action FM1-3: Dog management.*
    - *Action IL2-1: Coastal habitat restoration (Iluka)*
    - *Action HW3-1: Coastal habitat restoration (Hickey Island).*

- *Action Y5-1: Coastal habitat restoration (Yamba).*
- *Action CB3-1: Coastal habitat restoration (Lovers Point and Pippi Beach).*
- *Action AN2-1: Coastal habitat restoration (Angourie).*
- *Action BH5-1: Coastal habitat restoration (Brooms Head).*
- *Action S3-1: Coastal habitat restoration (Sandon).*
- *Action MW2-1: Coastal habitat restoration (Minnie Water).*
- *Action DC2-1: Coastal habitat restoration (Diggers Camp).*
- *Action W4-1: Coastal habitat restoration (Wooli).*
- *Action W5-1: Bank management and waterway access (Wooli Wooli River).*
- *Action* MER1: Estuary health monitoring program.
- *Action NP3-1: Coastal habitat restoration and management (NPWS Estate).*
- *Action F1-1: Intertidal marine vegetation strategies.*
- *Action F3-1: Seagrass investigations.*
- *Action F2-1: Wooli Wooli riverbank and riparian condition assessment.*

3. Planning for climate change:
    - *Action PD1-1: Review and implement planning controls to address coastal hazards.*
    - *Action AM1-1: Incorporate coastal hazard risks in CVC asset management planning.*
    - *Action AM1-2: Provide coastal hazard information to non-Council asset managers.*
    - *Action EM1-1: Implement emergency response procedures.*
    - *Coastal hazard adaptation strategies for Iluka, Hickey Island, Brooms Head, Sandon, Wooli, Woody Head campground and Sandon River campground.*
4. Protecting the Aboriginal cultural values of the marine estate:
    - *Action CH1-1: Protection of cultural heritage.*
    - *Action NP1-1: Conservation and protection of NPWS estate values, assets and heritage items.*
    - *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions.*
5. Reducing impacts on threatened and protected species:
    - *Action FM1-2: Manage vehicular beach access.*
    - *Action FM1-3: Dog management.*
    - *Action IL2-1: Coastal habitat restoration (Iluka).*
    - *Action HW3-1: Coastal habitat restoration (Hickey Island).*
    - *Action Y5-1: Coastal habitat restoration (Yamba).*
    - *Action CB3-1: Coastal habitat restoration (Lovers Point and Pippi Beach).*
    - *Action AN2-1: Coastal habitat restoration (Angourie).*
    - *Action BH5-1: Coastal habitat restoration (Brooms Head).*
    - *Action S3-1: Coastal habitat restoration (Sandon).*

- *Action MW2-1: Coastal habitat restoration (Minnie Water).*
- *Action DC2-1: Coastal habitat restoration (Diggers Camp).*
- *Action W4-1: Coastal habitat restoration (Wooli).*
- *Action* MER1: Estuary health monitoring program*.*
- *Action NP3-1: Coastal habitat restoration and management (NPWS Estate).*
- *Action F1-1: Intertidal marine vegetation strategies.*
- *Action F3-1: Seagrass investigations.*

6. Enhancing social, cultural and economic benefits.
    - *Action FM1-2: Manage vehicular beach access.*
    - *Action FM1-3: Dog management.*
    - *Action MER2: Recreational water quality monitoring.*
    - Recreational improvements at Pilot Hill, Lake Cakora and Wooli.
7. Delivering effective governance.
    - *Action PD1-1: Review and implement planning controls to address coastal hazards.*
    - *Action AM1-1: Incorporate coastal hazard risks in CVC asset management planning.*
    - *Action AM1-2: Provide coastal hazard information to non-Council asset managers.*
    - *Action LA1-1: Identify mechanisms to facilitate approvals for CMP actions.*
    - *Action FS1-1: Develop a CMP funding strategy.*
    - *Action MER3: Review of CMP progress and monitoring of performance targets.*

The implementation of the MEMS since 2018 aims to address many of the key issues impacting the health of the Clarence Valley open coast. The CMP draws on the outcomes and key learnings from projects undertaken through the MEMS to help inform the design and implementation of local management actions (e.g. *Action* MER1: Estuary health monitoring program*, Action F1-1: Intertidal marine vegetation strategies, Action F2-1: Wooli Wooli riverbank and riparian condition assessment)*.

APPENDIX 3 COASTAL ZONE EMERGENCY ACTION SUBPLAN

Clarence Valley Open Coast Coastal Management Program

Coastal Zone Emergency Action Subplan

Final for certification

October 2024

Disclaimer:

This report has been prepared on behalf of and for the exclusive use of Clarence Valley Council and is subject to and issued in accordance with the agreement between Clarence Valley Council and Hydrosphere Consulting. Hydrosphere Consulting accepts no liability or responsibility whatsoever for it in respect of any use of or reliance upon this report by any third party.

Acknowledgement of Country:

Clarence Valley Council and Hydrosphere Consulting acknowledge the Yaegl peoples, Traditional Custodians of the lands discussed in this plan and pay tribute and respect to the Elders past and present and emerging of the Yaegl nation.

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JOB 22-009: CLARENCE VALLEY OPEN COAST COASTAL MANAGEMENT PROGRAM COASTAL ZONE EMERGENCY ACTION SUBPLAN

REV	DESCRIPTION	AUTHORS	REVIEW	APPROVAL	DATE
0	Draft for CVC and DPE review	K. Pratt, R. Campbell	M. Howland	M. Howland	9 Feb 2024
1	Updated for CMP public exhibition	R. Campbell	M. Howland	M. Howland	17 June 2024
2	Updated for certification	R. Campbell	M. Howland	M. Howland	14 August 2024
3	Minor edits required by state agencies	R. Campbell		M. Howland	4 September 2024
4	Minor edits	R. Campbell			21 October 2024

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1. INTRODUCTION

1.1 Background

This Coastal Zone Emergency Action Subplan (CZEAS) forms part of the Clarence Valley Open Coast Coastal Management Program (CMP, Hydrosphere Consulting, 2024). This CZEAS applies to the beaches and coastal locations at risk within the CMP study area (Figure 1) which are further described in Section 3. This CZEAS has been prepared in accordance with the requirements of the:

- *Coastal Management Act 2016* (the CM Act).
- *Coastal Management Manual* (OEH, 2018) (the Manual).
- *Guideline for Preparing a Coastal Zone Emergency Action Subplan* (DPIE, 2019) (the Guideline).

This CZEAS replaces previous Emergency Action Sub Plans (EASPs) which had been prepared under the now repealed *Coastal Protection Act, 1979* for Brooms Head Beach (SMEC, 2015) and Wooli Beach (CVC, 2015). The geographic coverage of the CZEAS is outlined in Section 3.

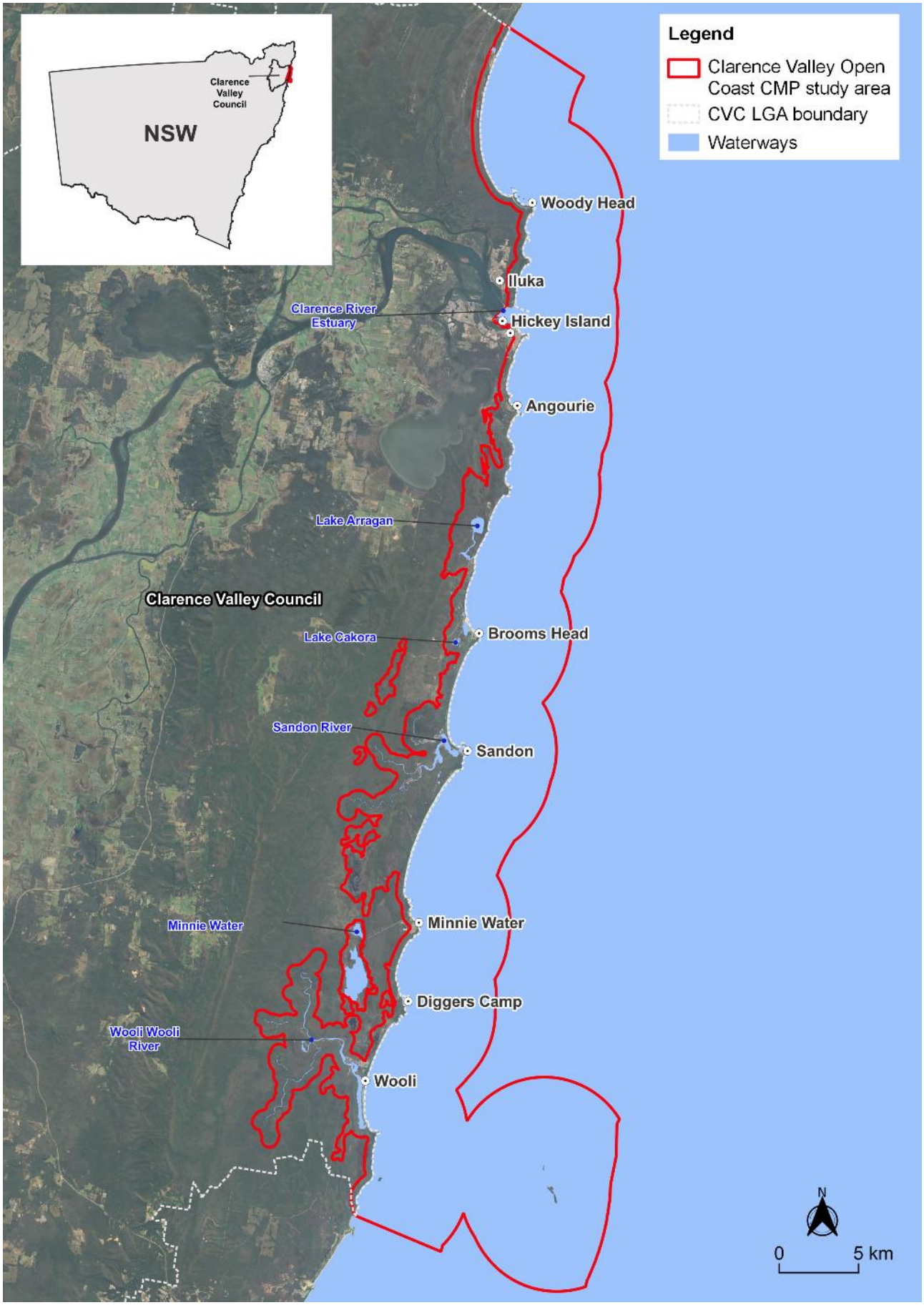

Figure 1: The Clarence Valley Open Coast CMP study area

1.2 NSW and Local Emergency Management Arrangements

The *State and Emergency Rescue Management Act 1989* (SERM Act) establishes the overarching framework for emergency management in NSW. The SERM Act outlines roles and responsibilities for all emergency management and specifies:

- That emergency management committees are established at the state, regional and local levels.
- That emergency management plans (EMPLANs) are prepared and reviewed at the state, regional and local level.
- Arrangements for controlling emergency operations.
- Responsibilities of emergency operations controllers.

The *NSW State Emergency Management Plan* (EMPLAN, NSW Government, 2023) describes the NSW approach to emergency management, the governance and coordination arrangements, and roles and responsibilities of agencies across all levels. The plan is supported by hazard specific subplans and functional area supporting plans including:

- The *NSW State Storm Plan* (SES, 2023a).
- The *NSW State Flood Plan* (SES, 2021).
- The *NSW State Tsunami Plan* (SES, 2023b)
- The *North Coast Regional EMPLAN* (North Coast Regional Emergency Management Committee, 2019).
- The *Clarence Valley Local EMPLAN* (Clarence Valley Local Emergency Management Committee, 2023).
- The *Clarence Valley Flood Emergency Subplan* (SES, 2023c).

A CZEAS must not include matters dealt with in any plan made under the SERM Act (in accordance with section 15(4) of the CM Act). This is to ensure there is no duplication or ambiguity in emergency response planning. The relationship between the SERM Act and CM Act and relevant planning documents is detailed in Figure 2.

The NSW State Emergency Service (SES) is the designated combat agency for management of floods, tsunami and storms, including severe storms which cause coastal erosion. Where no specific combat agency is nominated, the Emergency Operations Controller has responsibility for operations (DPIE, 2019).

The *Clarence Valley Local EMPLAN* identifies hazards with the potential to create an emergency event and the risk of causing loss of life, property, utilities, services and/or the community's ability to function within its normal capacity. Hazards relevant to coastal emergencies are listed in Table 1. The local EMPLAN will be updated with information from the CMP coastal hazard assessments and consequently risk levels and priorities in the local EMPLAN may change.

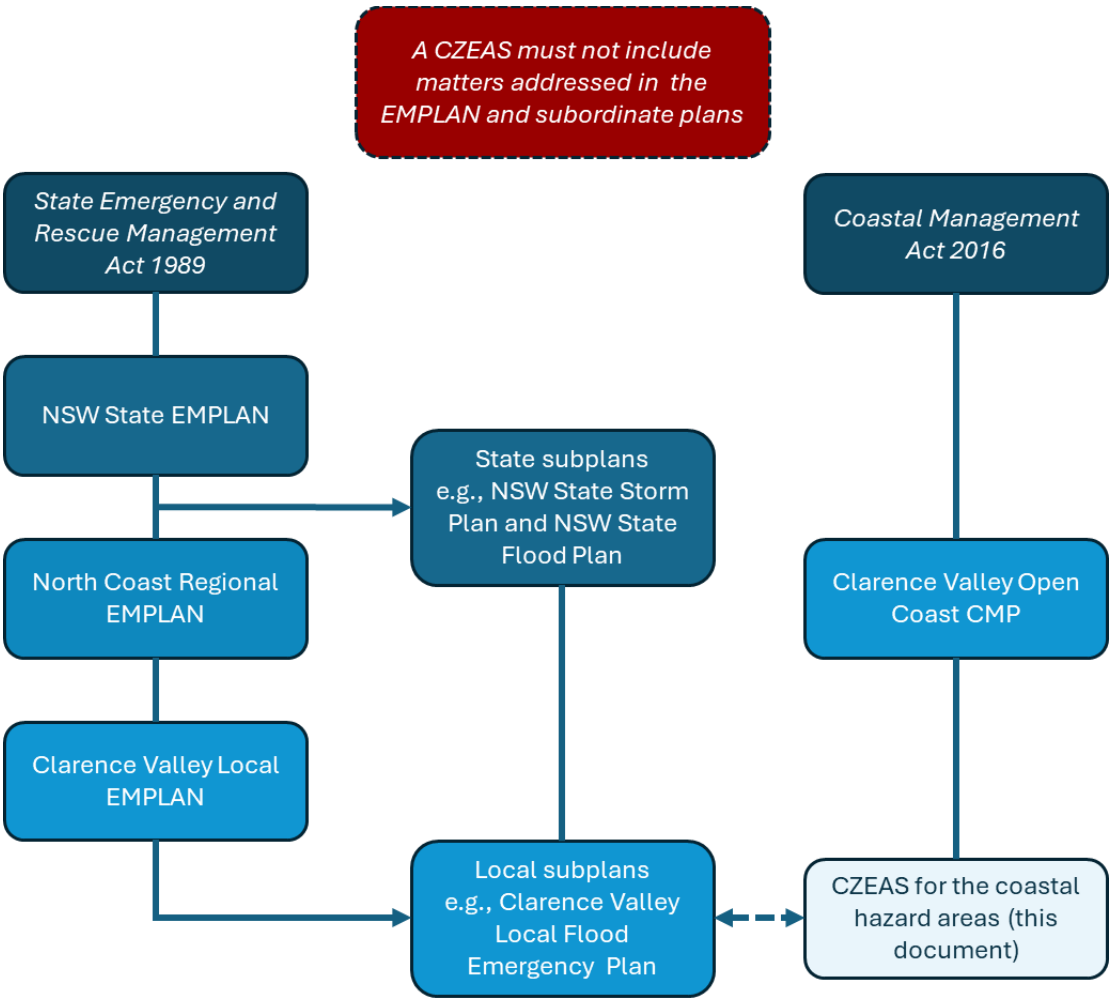

Figure 2: NSW emergency legislative and planning context

Source: Adapted from DPIE (2019)

Table 1: Coastal related hazards identified in the Local EMPLAN

Hazard	Risk statement	Likelihood	Consequence	Priority
Landslip	Landslip/ landslide resulting in localised or widespread damage.	Likely	Minor	Low
Landslip (Pilot Hill)	Landslip/ landslide resulting in localised damage at Pilot Hill.	Likely	Minor – Moderate	High
Storm/ East Coast Low	Severe storm with accompanying lightning, hail, wind, and/or rain that causes severe damage and/or localised flooding (includes tornado).	Almost certain	Minor – Moderate	High
Coastal erosion	The loss of land along the shoreline due to the natural removal of beach and dune material in response to changing wave and water level conditions.	Likely	Insignificant – moderate	Low
Tsunami	A tsunami wave of magnitude that presents a risk to land and marine elements.	Extremely Rare	Major - Catastrophic	Extreme

Source: Clarence Valley Local Emergency Management Committee (2023)

Flooding is within the scope of the *NSW State Flood Plan* (SES, 2021) and the *Clarence Valley Flood Emergency Subplan* (SES, 2023c), which defines flood as relatively high water level which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with drainage before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences, including Tsunami.

1.3 Purpose and Scope

The CM Act (section 15(1)(e)) outlines that a CZEAS must be included in a CMP if the local government area (LGA) contains land within the coastal vulnerability area (CVA) and beach erosion, coastal inundation or cliff/ slope instability/ landslip is occurring on that land. The CMP study area is subject to the coastal hazards of beach erosion and coastal inundation (as mapped in JBP, 2022 and JBP, 2023) and cliff/ slope instability/ landslip. The CVA for the Clarence Valley LGA may be included in the *State Environmental Planning Policy (Resilience and Hazards) 2021* (Resilience and Hazards SEPP) through an action implemented as part of the CMP.

This CZEAS is a plan that outlines the roles and responsibilities of all public authorities (including Clarence Valley Council - CVC) in response to emergencies immediately preceding or during periods of beach erosion, coastal inundation or cliff instability, where the beach erosion, coastal inundation or cliff instability occurs through storm activity or an extreme or irregular event.

CVC has developed and will implement the Open Coast CMP and this CZEAS in accordance with the requirements of the CM Act. CVC will activate the CZEAS and implement emergency works (including construction of physical works where appropriate) in accordance with this plan as required.

The roles and responsibilities defined in a CZEAS include the carrying out of emergency coastal protection works for the protection of property and assets affected or likely to be affected by coastal emergency events. This CZEAS details actions to be implemented in the four emergency phases of emergency management (prevention, preparation, response and recovery, Figure 3) to manage coastal emergency events relating to coastal erosion, coastal inundation and coastal cliff/ slope instability.

Figure 3: Coastal management emergency response phases

Source: DPIE (2019)

In accordance with the Guideline (DPIE, 2019), the purpose of this CZEAS is to identify and facilitate the implementation of appropriate emergency response actions to:

- Protect human life and public safety.
- Minimise damage to property and assets.
- Minimise impacts on social, environmental and economic values.

- Not create additional hazards or risks.

This CZEAS:

- Defines the triggers which identify when a 'coastal emergency' is occurring (Section 2).
- Identifies the locations at risk during coastal emergencies (Section 3).
- Outlines the roles and responsibilities of all public authorities, including CVC during coastal emergencies (Section 4).
- Outlines the actions required to mitigate, prepare for, respond to and recover from coastal emergencies (Section 5).
- Identifies the potential location and types of works that may be undertaken for the protection of property and assets (Section 5).
- Outlines communications required before during and after an emergency (Section 6) to inform the public and potentially affected property owners about their responsibilities during a coastal emergency and what actions they are and are not permitted to undertake.

1.4 Consultation

In addition to CVC, the NSW Government agencies with land and asset management responsibilities involved in the implementation of this CZEAS include:

- National Parks and Wildlife Service (NPWS).
- Transport for NSW – Maritime (TfNSW – Maritime).

Other stakeholders include:

- NSW Department of Planning, Housing and Infrastructure - Crown Lands (DPHI-Crown Lands).
- NSW Department of Climate Change, Energy the Environment and Water (DCCEEW).
- Yaegl Traditional Owners Aboriginal Corporation (YTOAC).
- Birrigan Gargle Local Aboriginal Land Council (LALC).
- Yamba and Minnie Water Surf Lifesaving Clubs (SLSC).
- NSW Department of Primary Industries - Marine Parks (DPI – Marine Parks).

All stakeholders were provided a copy of the draft CZEAS for review and comment as part of the draft CMP consultation process. The final CZEAS has addressed any feedback received.

2. TRIGGERS FOR CZEAS COASTAL EMERGENCIES

For the purposes of this CZEAS a coastal emergency event is occurring when one or more of the following triggers occurs:

- When a public authority advises of coastal storm activity or an extreme or irregular coastal event that could impact any of the locations at risk identified in Section 3.
- Beach erosion is occurring or expected to occur at key locations at risk of beach erosion identified in Section 3, impacting or with potential to impact on public or private assets, public safety or safe access/ egress.
- Coastal inundation is occurring or expected to occur at the key locations at risk of coastal inundation identified in Section 3, impacting or with potential to impact on public or private assets, public safety or safe access/ egress.
- Cliff/ slope instability/ landslip occurring or expected to occur, impacting or with potential to impact on public or private assets, public safety or safe access/ egress at any of the locations at risk identified in Section 3. Coastal cliff/ slope instability/ landslip is caused by a variety of geotechnical processes on coastal cliffs and bluffs, including rock fall, slumps and landslides. It may be driven by coastal processes such as wave undercutting and overtopping, or by differential weathering of rock layers in cliffs and bluffs or by surface and groundwater flows. Instability may occur during or following a coastal storm event but may also occur at other times. There may be very little warning that a cliff/ slope instability/ landslip incident is imminent. Signs of cliff/ slope instability/ landslip include (DPIE, 2019):
    - Open cracks, or steps, along contours.
    - Ground water seepage, or springs.
    - Bulging in the lower part of the slope.
    - Trees leaning down slope, or with exposed roots.
    - Debris/fallen rocks at the foot of a cliff.
    - Tilted power poles, or fences.
    - Cracked or distorted structures.
- In certain rainfall events, there may be a risk to slope stability in the areas at Pilot Hill, Yamba defined as LRZ 1a, 1b and 2 (refer Appendix 1), and hence, possible risk to improvements and occupants. Emergency response in accordance with the *Yamba Coastline Interim Emergency Management Strategy* (CVC, 2024, attached in Appendix 1) will be implemented when antecedent rainfall reaches the yellow, orange or red levels identified in Appendix 1.

The above situations can result in threats to property and assets or risk to public safety which require emergency response. In practice, expert engineering judgement may need to be applied to decide if a coastal emergency is occurring and the CZEAS should be activated. This relies on continuous monitoring of conditions including beach behaviour and cliff stability preceding and during a coastal event. CVC may seek appropriate support and advice from experienced coastal and/or geotechnical engineers if required to assist with decision-making during an event.

Once a coastal emergency event is determined, CVC will activate this CZEAS and follow the actions detailed in Section 5.

3. LOCATIONS AT RISK

This CZEAS applies to locations where beach erosion, coastal inundation or cliff/ slope instability/ landslip is occurring on land within the CMP study area (Figure 1). The CMP identifies areas along the Clarence coastline at moderate or high risk of coastal hazards under present day and projected 2043, 2073 and 2123 conditions based on mapping provided in JBP (2022) and JBP (2023). Further detail on the risk assessment process and outcomes is provided in the CMP and supporting documents.

Specific locations known to be or potentially affected by beach erosion, coastal inundation or cliff/ slope instability/ landslip are discussed in this section. Table 2, Table 3 and Table 4 outline the locations, land tenure, agencies responsible for CZEAS actions, other stakeholders, assets with the potential to be impacted and the present-day risk identified in the CMP risk assessment (Hydrosphere Consulting, 2023). It is possible that beach erosion, coastal inundation or cliff/ slope instability/ landslip will affect additional locations along the Clarence coastline not currently assessed or known to be at risk. In this event CVC will assess these locations and the need for emergency response and potentially revise this CZEAS to include new locations at risk, as the need arises (refer Section 7).

Table 2: Present day (2023) beach erosion risks (north to south)

Location	Land tenure and reserve	CZEAS responsibility	Other stakeholders	Assets potentially impacted	Risk level
Shark Bay	Bundjalung National Park above MHWM Crown land below MHWM (R1011268 & R1011748)	Iluka Road: CVC Bundjalung National Park: NPWS	YTOAC	• Beach and dunes • 4WD and pedestrian beach accessways • Shark Bay Road, Shark Bay picnic area and toilets • Iluka Road	Moderate
Woody Bay	Bundjalung National Park above MHWM Crown land below MHWM (R1011268 & R1011748)	Bundjalung National Park: NPWS	YTOAC, DPHI-Crown Lands	• Beach and dunes • Iluka Road	High
Woody Head campground	Bundjalung National Park above MHWM Crown land below MHWM (R1011268 & R1011748, Lot 7303 DP1143443 – R63682)	Bundjalung National Park: NPWS	YTOAC, DPHI-Crown Lands	• Beach and dunes • Woody Head Road and campground access road • Pedestrian beach accessways • Woody Head campground assets and amenities • Services (water, sewer, power and telecommunications), stormwater drainage.	High
Hickey Island and Whiting Beach	Part R1003009 - Hickey Island Reserve Crown land below MHWM (R56146 & R1011748)	Hickey Island Reserve: CVC	YTOAC, DPHI-Crown Lands	• Beach and dunes • Pedestrian beach accessways • Carpark • Amenities • Services (water, sewer, power and telecommunications), stormwater drainage • Geobag revetment	Moderate

Location	Land tenure and reserve	CZEAS responsibility	Other stakeholders	Assets potentially impacted	Risk level
Yamba Main Beach and Pilot Hill	R85724 – Flinders Park (7031//1128361 & 7308//1147276) Crown land below MHWM Private freehold land	Flinders Park/ Marine Parade and foreshore: CVC	Yamba SLSC, private property owners, commercial businesses, DPHI-Crown Lands	• Beach and dunes • Pedestrian beach accessways • Pathways, roads and carparks • Residential properties • Hotel • Surf lifesaving facilities • Amenities • Services (water, sewer, power, telecommunications), stormwater drainage • Ocean pool • Rock revetment	Moderate
Convent Beach / McKittricks Beach	Private freehold land Convent Beach Reserve (6//19456) Crown land below MHWM (R1011268 & R1011748)	Convent Beach Reserve: CVC	Private property owners, YTOAC, DPHI-Crown Lands	• Beach and dunes • Pedestrian beach accessways • Ritz Street and Ocean Street • Services (water, sewer, power, telecommunications), stormwater drainage • Residential properties	Moderate
Lake Cakora entrance and Ocean Road	Lake Cakora entrance and R1010649 – Crown Land Private freehold land	Ocean Road: CVC	Private property owners, YTOAC, DPHI-Crown Lands	• Beach and dunes • Ocean Road and bridge • Rock revetment (bridge abutment) • Residential properties • Services (water, power, telecommunications), stormwater drainage • On-site sewer management systems.	High

Location	Land tenure and reserve	CZEAS responsibility	Other stakeholders	Assets potentially impacted	Risk level
Brooms Head (foreshore reserve)	R65975 - Brooms Head Reserve (2//1095139) Crown land below MLWM (7017//1108436) (R1011268 & R1011748)	Brooms Head Reserve: CVC	YTOAC, DPHI-Crown Lands	• Beach and dunes • Pedestrian and 4WD beach accessways, stairs • Ocean Road and bridge • Holiday Park, amenities and roads • Rock revetment (foreshore reserve and bridge abutment) • Services (water, power, telecommunications), stormwater drainage • On-site sewer management systems	High
Sandon River Road (CVC)	CVC road reserve	CVC	YTOAC, DPHI-Crown Lands, NPWS	• Sandon River road	High
Sandon River campground and Sandon River Road (NPWS)	Yuraygir National Park Crown land below MHWM (R1011268 & R1011748)	Yuraygir National Park: NPWS	YTOAC, DPHI-Crown Lands, CVC	• Beach and dunes • Pedestrian and 4WD beach accessways • Services (water, power, telecommunications), stormwater drainage • Sandon River road • Sandon River campground, campground assets and amenities • On-site sewer management systems, roads, boat ramp.	High

Location	Land tenure and reserve	CZEAS responsibility	Other stakeholders	Assets potentially impacted	Risk level
Sandon Village	R97031 - Sandon Public Reserve (Part 31//43869) R751359 - Candole Parish Reserve (Part 31//43869) – Crown Land Yuraygir National Park Crown land below MHWM (R1011268 & R1011748) Private freehold land	Sandon Public Reserve: CVC Yuraygir National Park: NPWS	Private property owners, YTOAC, DPI – Marine Parks, DPHI-Crown Lands	• Beach and dunes • Pedestrian and 4WD beach accessways • Roads • Services (power, telecommunications), stormwater drainage • Residential properties • On-site sewer management systems.	Moderate
Minnie Water	R84129 – Minnie Water Foreshore Reserve	Minnie Water Foreshore Reserve: CVC	Private property owners, YTOAC, Minnie Water SLSC	• Beach and dunes • SLSC • Pedestrian and 4WD beach accessways • Amenities • Roads • Carpark • Stormwater drainage	Moderate
Diggers Camp	R44430 - Diggers Headland Reserve Yuraygir National Park Solitary Islands Marine Park Private freehold land	Diggers Headland Reserve: CVC Yuraygir National Park: NPWS	Private property owners, YTOAC, DPI – Marine Parks	• Beach and dunes • Pedestrian and 4WD beach accessways • Amenities • Roads • Carpark • Campground • Stormwater drainage • Residential properties • On-site sewer management systems.	Moderate

Location	Land tenure and reserve	CZEAS responsibility	Other stakeholders	Assets potentially impacted	Risk level
Wooli village (south) and Wooli Beach	R97501 - Public Reserve - Wooli Sand Drift Protection R56099 - Wooli Bowling Green Reserve R41752 - South Terrace Solitary Islands Marine Park Private freehold land	Wooli Sand Drift Protection Reserve; Wooli Bowling Green Reserve & South Terrace: CVC	Private property owners, YTOAC, DPI – Marine Parks	• Beach and dunes • Pedestrian and 4WD beach accessways • Amenities • Roads • Carparks • Services (water, power, telecommunications), stormwater drainage • Marine Rescue facilities • Residential properties • On-site sewer management systems • Breakwater.	High

Table 3: Present day (2023) cliff/ slope instability/ landslip risks (north to south)

Location	Land tenure and reserve	CZEAS responsibility	Other stakeholders	Assets potentially impacted	Risk level
Pilot Hill	R85724 – Flinders Park (7031//1128361 & 7308//1147276) Crown land below MHWM Private freehold land	Flinders Park/ Marine Parade and foreshore: CVC Landslide Risk Zones[2] (LRZ) 1a, 1b and 2: CVC	Yamba SLSC, private property owners, commercial businesses, DPHI-Crown Lands	• Pedestrian beach accessways • Pathways • Roads • Carparks • Residential properties • Hotel • Surf lifesaving facilities • Amenities • Services (water, sewer, power, telecommunications), stormwater drainage • Rock revetment.	High
Convent Beach	Private freehold land Convent Beach Reserve (6//19456) Crown land below MHWM (R1011268 & R1011748)	Convent Beach Reserve: CVC	Private property owners, YTOAC, DPHI-Crown Lands	• Beach and dunes • Pedestrian beach accessways • Roads • Services (water, sewer, power, telecommunications), stormwater drainage • Residential properties.	Moderate
Red Cliff area[1]	Yuraygir National Park	Yuraygir National Park: NPWS	YTOAC	• Dunes • Pedestrian beach accessways • Campground and amenities • Roads, carparks.	High

1. Risks at Red Cliff and Lake Arragan were identified by NPWS after the completion of the CMP risk assessment.
2. As identified in the Yamba Coastline Interim Emergency Management Strategy (Appendix 1).

Table 4: Present day (2023) coastal inundation risks (north to south)

Location	Land tenure and reserve	CZEAS responsibility	Other stakeholders	Assets potentially impacted	Risk Level
Hickey Island and Whiting Beach	Part R1003009 - Hickey Island Reserve Crown land below MHWM (R56146 & R1011748)	Hickey Island Reserve: CVC	YTOAC, DPHI-Crown Lands	• Beach and dunes • Pedestrian beach accessways • Tracks • Geobag revetment • Boat ramp, boat sheds	Moderate
Lake Cakora entrance and Ocean Road	Lake Cakora entrance and R1010649 – Crown Land Private freehold land	Ocean Road: CVC	Private property owners, YTOAC, DPHI-Crown Lands	• Beach and dunes • Pedestrian accessways • Ocean Road and bridge • Residential properties • Services (water, power, telecommunications), stormwater drainage • On-site sewer management systems.	High
Brooms Head (foreshore reserve)	R65975 - Brooms Head Reserve (2//1095139) Crown land below MLWM (7017//1108436) (R1011268 & R1011748)	Brooms Head Reserve: CVC	YTOAC, DPHI-Crown Lands	• Beach and dunes • Pedestrian and 4WD beach accessways • Ocean Road and bridge • Services (water, power, telecommunications), stormwater drainage. • On-site sewer management systems	Moderate

Location	Land tenure and reserve	CZEAS responsibility	Other stakeholders	Assets potentially impacted	Risk Level
Brooms Head (village)	Private freehold land R65975 (7004//92466) – Public Reserve R140032 (7003//92467) – Public Recreation Reserve Crown land below MHWM	Reserves: CVC	Private property owners, YTOAC, DPHI-Crown Lands	• Roads • Sports field • Residential properties • Services (water, power, telecommunications), stormwater drainage • On-site sewer management systems.	High
Sandon campground and access road	Yuraygir National Park Crown land below MHWM (R1011268 & R1011748)	Yuraygir National Park: NPWS	YTOAC, DPHI-Crown Lands	• Beach and dunes • Pedestrian beach accessways • Services (water, power, telecommunications), stormwater drainage • Sandon River campground, campground assets and amenities • Roads • Boat ramp.	High
Wooli village (north)	R44430 - Wooli Public Reserve & Sportsground (7003//1032248 & 7011//1035042) Solitary Islands Marine Park	Wooli Public Reserve & Sportsground: CVC	YTOAC, DPI – Marine Parks	• Roads, carparks • Services (water, power, telecommunications), stormwater drainage • Residential properties • On-site sewer management systems	High

Location	Land tenure and reserve	CZEAS responsibility	Other stakeholders	Assets potentially impacted	Risk Level
Wooli village (south)	R97501 - Public Reserve - Wooli Sand Drift Protection R56099 - Wooli Bowling Green Reserve R41752 - South Terrace Solitary Islands Marine Park Private freehold land	Wooli Sand Drift Protection Reserve; Wooli Bowling Green Reserve & South Terrace: CVC	Private property owners, YTOAC, DPI – Marine Parks	• Roads, carparks • Services (water, power, telecommunications), stormwater drainage • Residential properties • On-site sewer management systems	High

4. ROLES AND RESPONSIBILITIES

Personnel and agencies with roles and responsibilities under this CZEAS are listed in Table 5. The general responsibilities of emergency services organisations and support agencies are further detailed in the local and state EMPLANs. Liaison with other stakeholders such as SLSCs, private property owners and YTOAC may also be required for some locations.

Table 5: CZEAS roles and responsibilities

Authority	Roles and responsibilities
Clarence Valley Council	• Prepare, maintain and update this CZEAS as necessary and provide the SES and all public authorities with responsibility for action in Table 6 to Table 10 with a copy. • Implement the prevention and preparation phase emergency actions prior to a coastal emergency event occurring (Table 6 and Table 7). • In the event of a coastal emergency, activate this CZEAS and implement the Response Phase emergency actions for the duration of the coastal emergency event (Table 8). • Implement the recovery phase emergency actions following a coastal emergency event (Table 10). • Implement (or authorise and coordinate) emergency coastal protection works, including construction of physical works where appropriate, to protect property and public assets from beach erosion and cliff/ slope instability/ landslip. Note: Private landholders are responsible for private land. CVC does not have an obligation to take particular action to protect private property from erosion events. Private property owners at risk from coastal erosion can submit a development application for the implementation of emergency coastal protection works on their land (refer Appendix 2). • Assist the SES with reconnaissance of areas susceptible to beach erosion. • Liaise with the SES Incident Controller to provide advice regarding the need for response actions by the SES such as evacuations. • Assist, at their request, SES, Local Emergency Operations Controller (LEOCON) and the Police, in dealing with a coastal emergency. • Closure of Council-managed roads/ sites affected by beach erosion, or cliff/ slope instability/ landslip hazards. • Provide engineering and other resources required for response and recovery phases. • Provide information on the status of roads and other accessways in the emergency impacted areas. • Provide a range of support to the LEOCON. • Communication of emergency management information e.g. via social media, CVC website.

Authority	Roles and responsibilities
Local Emergency Operations Controller (LEOCON)	• Monitor coastal emergency event operations. • Act as the combat/responsible agency in the event of coastal erosion that is not caused by storm activity by controlling and coordinating emergency management of the coastal emergency event. • Act as the combat/ responsible agency in the event of a landslip • Coordinate support to the SES Incident Controller, if requested to do so.
Local Emergency Management Officer (LEMO)	• Provide executive support to the Clarence Valley Local Emergency Management Committee (LEMC) and LEOCON in accordance with the *Clarence Valley Local EMPLAN* (Clarence Valley Local Emergency Management Committee, 2023).

NSW State Emergency Service (SES) Upper Clarence and Lower Clarence Unit Members	• Act as the combat/responsible agency for damage control and the coordination of community evacuation during the following coastal hazards as per the *Clarence Valley Local EMPLAN* (Clarence Valley Local Emergency Management Committee, 2023):
	  ○ Flooding
	  ○ Storms
	  ○ Tsunamis
	• Act as the combat/ responsible agency in the event of coastal erosion that is caused by storm activity.
	• Act as the combat/ responsible agency in the event of coastal inundation emergencies. Note: The role of the SES as a combat agency for storms does not include coastal erosion caused by astronomical high tides when severe weather is not actually developing or occurring.
	• Carry out required response tasks. These may include:
	  ○ Assist in the collection of flood and coastal erosion/ inundation information for the development of intelligence.
	  ○ Evacuation.
	  ○ Delivery of warnings.
	  ○ Assisting with road closures and traffic control operations.

Authority	Roles and responsibilities
SES Upper Clarence and Lower Clarence Commanders	• Deal with floods as per the *Clarence Valley Flood Emergency Subplan* (SES, 2023c). • Identify and monitor people and/or communities at risk of flooding, including coastal inundation. • Provide an information service in relation to coastal erosion emergency management. • Road conditions and closures. • Confirmation of evacuation warnings and evacuation orders released by the NSW SES Incident Controller. • Direct the evacuation of people and/or communities to the evacuation point/ centre as determined by the LEOCON. • Ensure caravan parks are advised of flood/ coastal inundation warnings. • Coordinate the collection of flood and coastal inundation information for development of intelligence.
National Parks and Wildlife Service (NPWS)	Implement actions with NPWS responsibility in Table 6 to Table 10 (i.e. where actions are required on NPWS managed land).
DPHI-Crown Lands	As appropriate, authorise emergency actions under the *Crown Land Management Act 2016*.
TfNSW-Maritime	Implement actions with TfNSW - Maritime responsibility in Table 6 to Table 10 (i.e. where actions are required on TfNSW - Maritime managed land).
The Ambulance Service of NSW	During an emergency, the Ambulance Service of NSW will manage on-site operations, communications and transport requirements for the health response (NSW Health, 2013).
NSW Police Force	• Assist the SES with delivery of evacuation warnings and evacuation orders and the conduct of evacuations. • Conduct road and traffic control operations in conjunction with CVC and/or TfNSW. • Coordinate the registration of evacuees. • Secure evacuated areas.
Fire and Rescue NSW	• Assist the SES with delivery of evacuation warnings and evacuation orders and the conduct of evacuations. • Provide equipment for pumping flood water out of buildings and from low-lying areas. • Provide back-up radio communications.
BoM	• Issue public weather and storm warning products before and during a storm for the Clarence Valley LGA.
Marine Rescue NSW	• Assist the SES with delivery of evacuation warnings and evacuation orders and the conduct of evacuations (SES, 2021).
Surf Life Saving NSW	• Assist the SES with the warning and/or evacuation of at-risk communities and flood rescue operations (SES, 2021).

5. EMERGENCY RESPONSE ACTIONS FOR LOCATIONS AT RISK

Actions in this CZEAS aim to reduce risk:

- In areas where other coastal protection works have not been implemented.
- Where coastal hazard risks have not been reduced or eliminated because an agreed action in a CMP has not yet been implemented.
- Where coastal hazard risks remain after other CMP actions have been implemented (residual risk).
- When rare and very large or unexpected events occur, outside the design criteria or capacity of coastal protection works and agreed management actions in the CMP.

Under the Resilience and Hazards SEPP, emergency coastal protection works to be undertaken by a public authority may comprise the placement of sand, or the placing of sandbags for a period of not more than 90 days, on a beach, or a sand dune adjacent to the beach, to mitigate the effects of coastal hazards on land (refer Appendix 2). The CMP includes an action to implement emergency response procedures which includes the installation of emergency coastal protection works (refer Section 5.3.1). The CMP also includes an action to implement the Wooli Beach Management Strategy which includes beach scraping and sand back-passing scenarios triggered by erosion events/ scenarios. The *Yamba Coastline Interim Emergency Management Strategy* (CVC, 2024, attached in Appendix 1) applies to land specified as Landslide Risk Zones (LRZ) 1a, 1b and 2 at Pilot Hill, Yamba.

The ability to undertake the actions identified in this CZEAS will be dependent on the availability of resources during emergency events.

Actions undertaken should not impede, conflict, or overlap with the actions of agencies operating under the SERM Act, including the SES or DCCEWW.

All actions must not put personnel staff or volunteers in danger. Emergency management works must not be undertaken during extreme weather unless environmental conditions permit the works to be undertaken safely.

Private landholders are responsible for private land. Council does not have an obligation to take action to protect private property from coastal hazard events. Private landowners who are seeking to undertake activities in the event of an emergency need to obtain prior approval from CVC or the regional planning panel as outlined in Appendix 2.

5.1 Prevention Actions

Table 6 details the coastal emergency actions to be undertaken during the Prevention phase of emergency response that apply to the locations at risk along the Clarence Valley coastline listed in Section 3.

Table 6: Coastal management emergency response phase - Prevention actions

Action	Responsibility	Trigger	Relevant locations
Provide up-to-date copies of this CZEAS to all relevant CVC staff and other stakeholders including those with dedicated roles and responsibilities as outlined in Section 4.	CVC	CZEAS finalisation and further updates	All locations
Provide advice to the community, landholders and the SES about the potential for a coastal emergency event and the types of responses that are permitted and not permitted.	CVC	In accordance with CMP[1]	All locations
Make the public aware of the hazards and risks and intended erosion emergency responses through publication of the CMP and this CZEAS, and associated education campaigns.	SES, CVC, NPWS	CZEAS and CMP finalisation and further updates	All locations
Storm prediction and monitoring, including issuing hazard alerts i.e. Coastal Hazard Warnings by the BoM and other available tools.	SES, BoM	Ongoing	All locations
Consult with SES, DCCEEW, Local Police, LEOCON to ensure this CZEAS remains consistent with (but not duplicating any actions of) the relevant local, regional, and state-based emergency management plans.	LEMC	CZEAS updates, emergency management plan updates	All locations
Review and update this CZEAS in line with any future updates to the coastal hazard mapping or outcomes of CMP review in consultation with other land and asset managers.	CVC	CMP review	All locations

1. The Clarence Valley Open Coast CMP includes an action to provide access to educational materials for private landholders, lessees of public land, land managers and developers regarding the implications of coastal hazards on land use and future development and appropriate emergency responses via a dedicated coastal hazard webpage.

5.2 Preparation Actions

Table 7 details the coastal emergency actions to be undertaken during the Preparation phase of emergency response that apply to the locations at risk along the Clarence Valley coastline listed in Section 3.

Table 7: Coastal management emergency response phase - Preparation actions

Action	Responsibility	Trigger	Relevant locations
Maintain up to date contact details for key staff involved in coordinating actions under this CZEAS, personnel from other emergency sectors, other stakeholders and experts providing advice (such as DCCEEW staff or consultants).	CVC, NPWS	Annually	All locations
Monitor conditions during events to assess whether triggers are reached that will activate the Response phase.	SES, BoM, CVC, NPWS	As determined through CMP implementation[1]	All locations
Implement the "Yellow Alert Level" actions documented in the *Yamba Coastline Interim Emergency Management Strategy* (CVC, 2024, attached in Appendix 1).	CVC	Antecedent rainfall reaches the "Yellow Alert Level"	Pilot Hill
Ensure availability of temporary fencing, hazard tape and signage to close foreshore and clifftop accessways and roadways and facilitate general warnings during coastal emergencies.	CVC, SES NPWS	CZEAS finalisation and further updates	All locations
Maintain stockpiles of sandbags for the purpose of emergency coastal protection works. Ensure sand source for filling bags is compatible with the placement area.	CVC, NPWS	CZEAS finalisation and further updates	All stockpile locations
Ensure availability of plant, equipment and adequately experienced and trained personnel for implementation of coastal management works.	CVC, SES NPWS	CZEAS finalisation and further updates	All locations
Obtain all necessary permits, approvals or licences from public authorities that are required to enable implementation of the activities outlined within the CZEAS. This includes permits, approvals, or licences for emergency coastal protection works including beach nourishment, beach scraping and sand back-passing and the placement of sandbags.	CVC, NPWS	CZEAS finalisation and further updates	All locations for emergency coastal protection works (Section 5.3.1

1. The Clarence Valley Open Coast CMP includes actions to develop and implement coastal hazard monitoring and reporting programs at key locations to assist in identifying changes to the coastal environment to inform decision making, management responses and community education.

5.3 Response Actions

Table 8 details the coastal emergency actions to be undertaken during the Response phase of emergency response that apply to the locations at risk along the Clarence Valley coastline listed in Section 3.

Table 8: Coastal management emergency response phase - Response actions

Action	Responsibility	Trigger	Relevant locations
Implement the communication protocol (Section 6) in conjunction with the combat agency (SES) to advise landholders, residents, public authorities and other organisations that a coastal emergency is likely or is occurring and that actions in the CZEAS are to be implemented.	CVC, NPWS, SES	Coastal emergency (Section 2)	All locations
Alert relevant land managers about access requirements.	CVC, NPWS	Coastal emergency (Section 2)	All locations
Implement the "Orange Alert Level" actions documented in the *Yamba Coastline Interim Emergency Management Strategy* (CVC, 2024, attached in Appendix 1).	CVC	Antecedent rainfall reaches the "Orange Alert Level"	Landslide Risk Zones (LRZ) 1a, 1b and 2 at Pilot Hill, Yamba
Implement the "Red Alert Level" actions documented in the *Yamba Coastline Interim Emergency Management Strategy* (CVC, 2024, attached in Appendix 1).	CVC	Antecedent rainfall reaches the "Red Alert Level"	Landslide Risk Zones (LRZ) 1a, 1b and 2 at Pilot Hill, Yamba
Increase surveillance of beach erosion and cliff/ slope instability/ landslip hazards if required.	CVC, NPWS	Coastal emergency (Section 2)	All locations
Place appropriate equipment (back up radios, signage, plant, barricades etc.) and relevant personnel on standby.	CVC, NPWS	Coastal emergency (Section 2)	All locations

Action	Responsibility	Trigger	Relevant locations
Consider the need for, and install if required, temporary fencing and/or signage at foreshore reserves and beach accessways affected by beach erosion, or cliff/ slope instability/ landslip where this has resulted in unsafe conditions. Geotechnical, structural and/or coastal engineering advice may be required.	CVC, NPWS	Access is unsafe due to: • Damaged accessway, steps, slats, platforms, posts etc. • An erosion escarpment is present. • Dangerous waves or excessive wave run-up progressing into accessways. • Signs of cliff/ slope instability/ landslip. • Other factors.	All locations where access is unsafe due to beach erosion, coastal inundation or cliff/ slope instability/ landslip.
Consider the need for, and install if required, emergency coastal protection works to address beach erosion or cliff/ slope instability/ landslip, in accordance with the CMP, CM Act and Resilience and Hazards SEPP requirements. SES may assist with coordination. Geotechnical, structural and/or coastal engineering advice may be required.	CVC, NPWS	Refer Section 5.3.1	Refer Section 5.3.1
Close roads affected by beach erosion, or cliff/ slope instability/ landslip hazards. Geotechnical, structural and/or coastal engineering advice may be required.	CVC, TfNSW, NPWS	Roads or vehicle access tracks are unsafe due to: • Coastal erosion resulting in instability or undermining. • Cliff/ slope instability/ landslip.	All roads that are unsafe due to beach erosion, coastal inundation or cliff/ slope instability/ landslip.
Shutdown water and sewer infrastructure affected by beach erosion or cliff/ slope instability/ landslip hazards.	CVC	Conditions present, or are likely to present, a potential for damage to water and sewer infrastructure or pollution of the environment.	All locations where assets affected by beach erosion, coastal inundation or cliff/ slope instability/ landslip hazards.

5.3.1 Emergency coastal protection works

Emergency coastal protection works may be required to protect public assets and/or ensure public safety on public land. The public assets potentially requiring protection and the triggers for implementation of emergency coastal protection works are listed in Table 9. Potential locations for emergency coastal protection works are shown on Figure 5 to Figure 15 for:

- Moderate and high-risk locations where high value public infrastructure is located within the present day 1% EP (exceedance probability) beach erosion zone (without protection) as mapped in JBP (2023).
- Moderate and high-risk locations where high value public infrastructure may be impacted by cliff/ slope instability/ landslip.

Sand nourishment may be implemented where a feasible sand source has been identified (Woody Head campground or Wooli Beach). Sandbags may also be installed (for up to 90 days) in these and other locations. Typical design details for sandbags are provided in Figure 4.

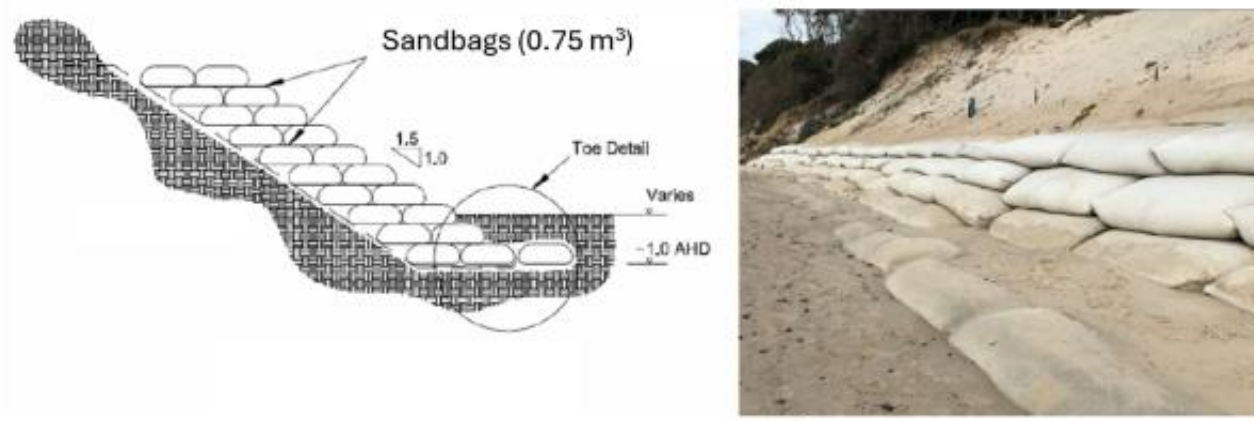

Figure 4: Sandbag revetment wall – left: typical cross-section (revetment height varies, adapted from Coghlan *et al.* (2009)), right: sandbag revetment wall at Clarkes Beach, Byron Bay (image: J. Carley)

Private landowners who are seeking to undertake short term coastal protection works or activities in the event of an emergency need to obtain prior approval from CVC or the regional planning panel as outlined in Appendix 2.

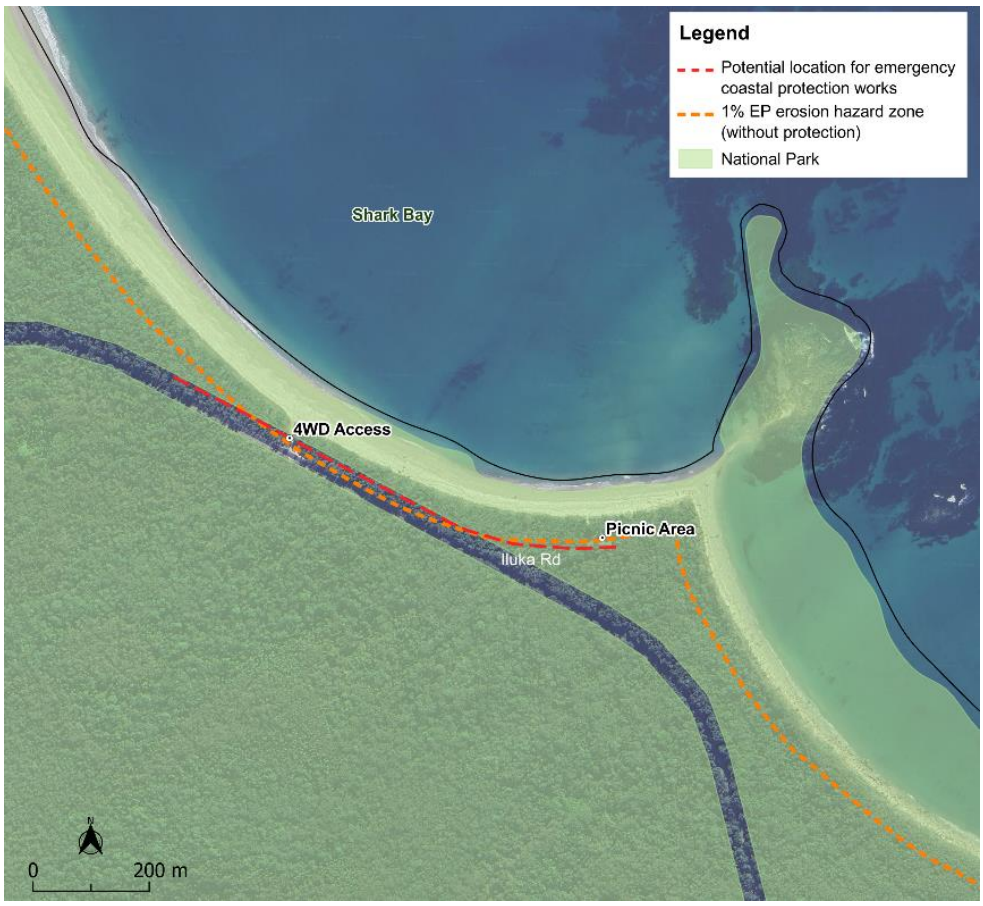

Figure 5: Potential locations for emergency coastal protection works – Shark Bay

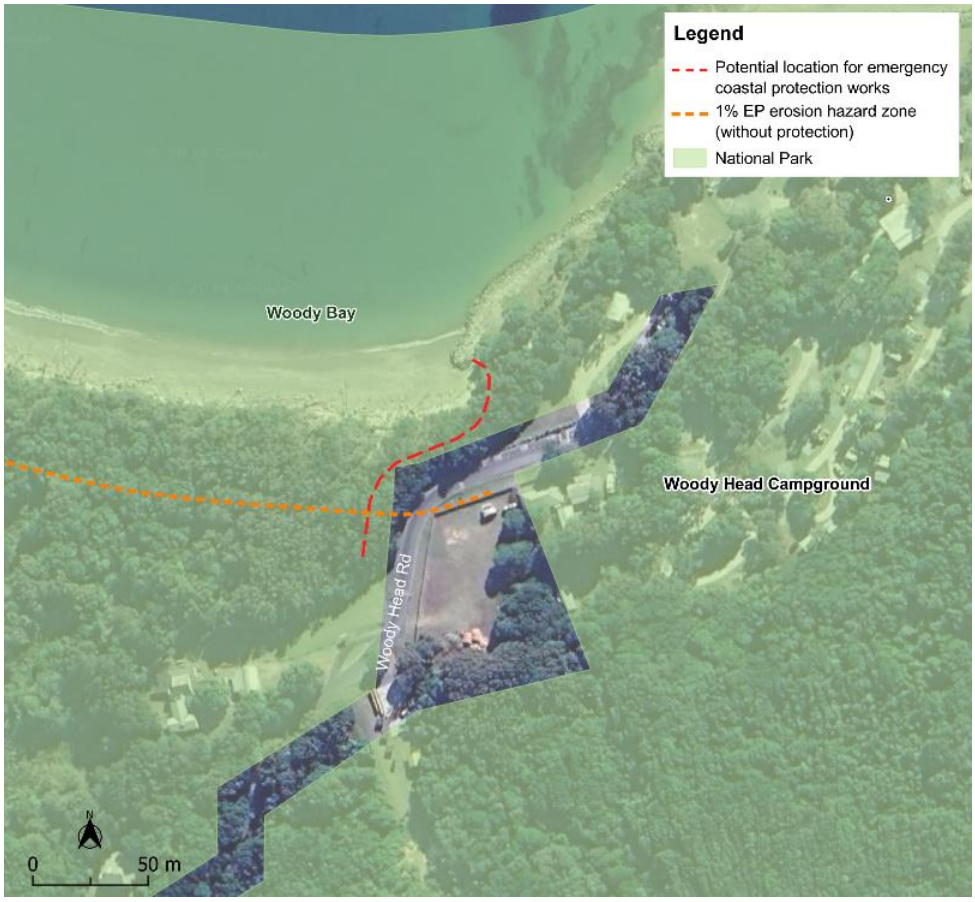

Figure 6: Potential locations for emergency coastal protection works – Woody Head campground

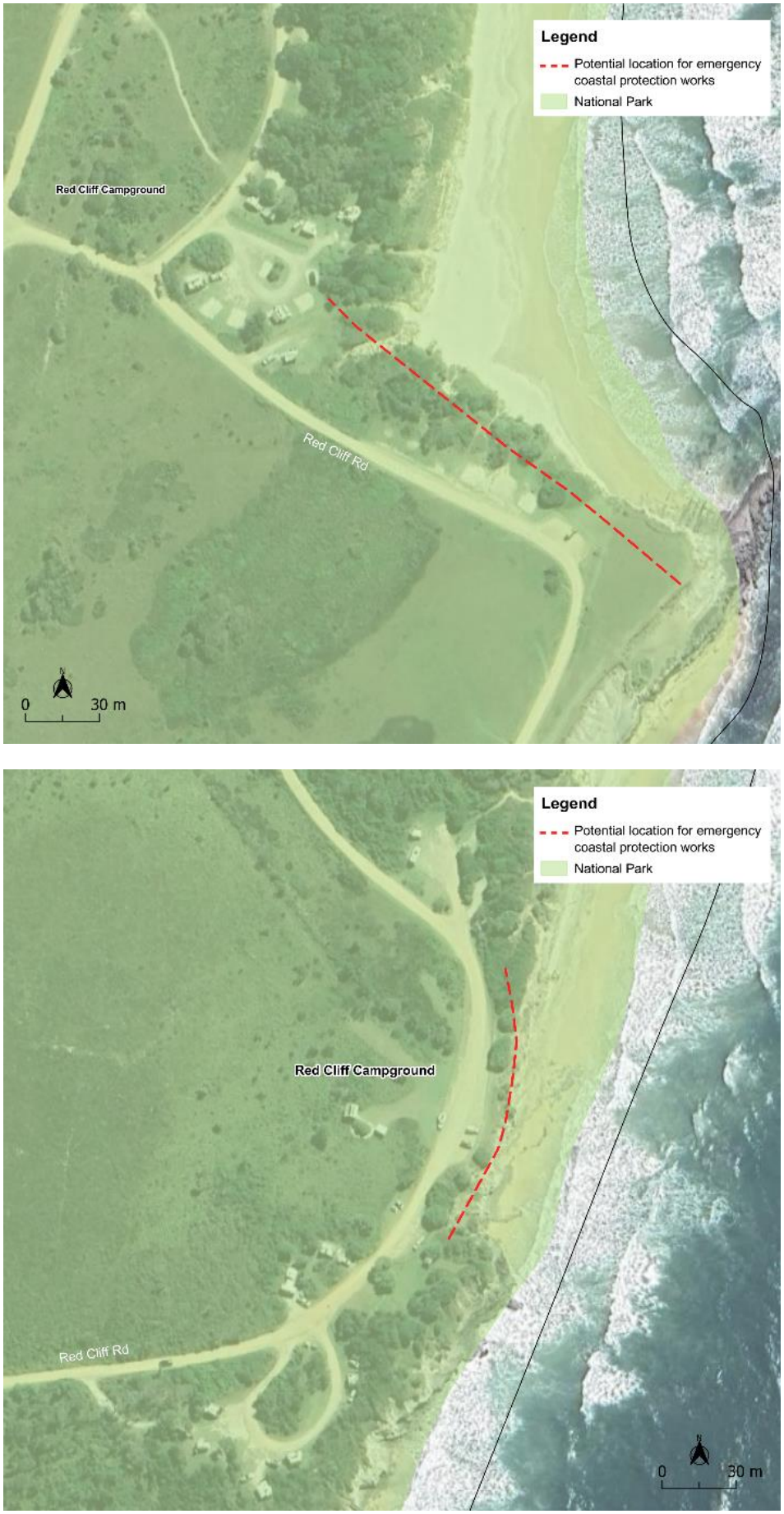

Figure 7: Potential locations for emergency coastal protection works – Red Cliff area

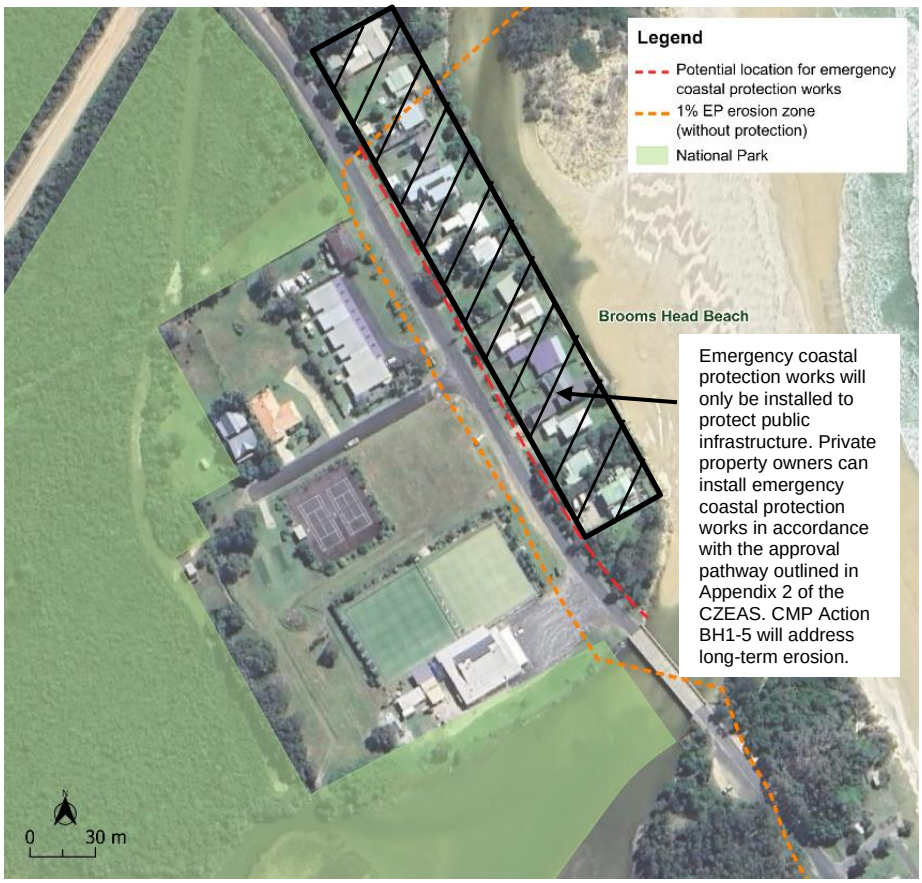

Figure 8: Potential locations for emergency coastal protection works – Ocean Road, Brooms Head

Figure 9: Potential locations for emergency coastal protection works – Brooms Head foreshore reserve

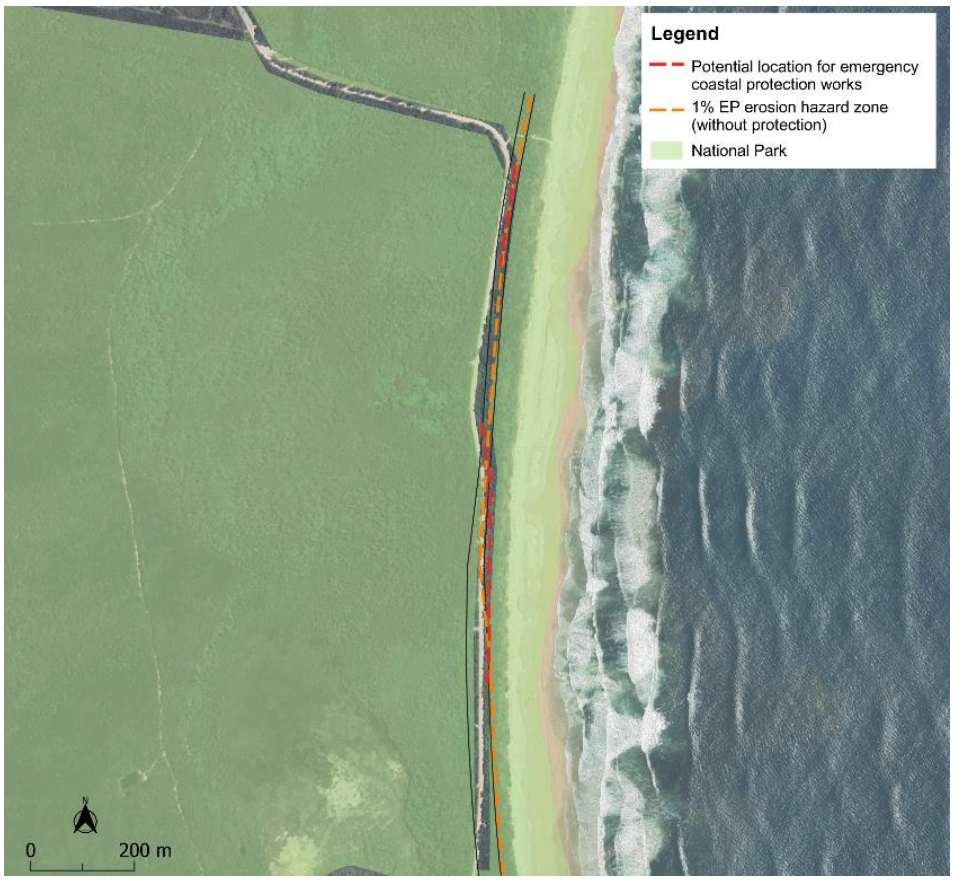

Figure 10: Potential locations for emergency coastal protection works – Sandon River Road (CVC)

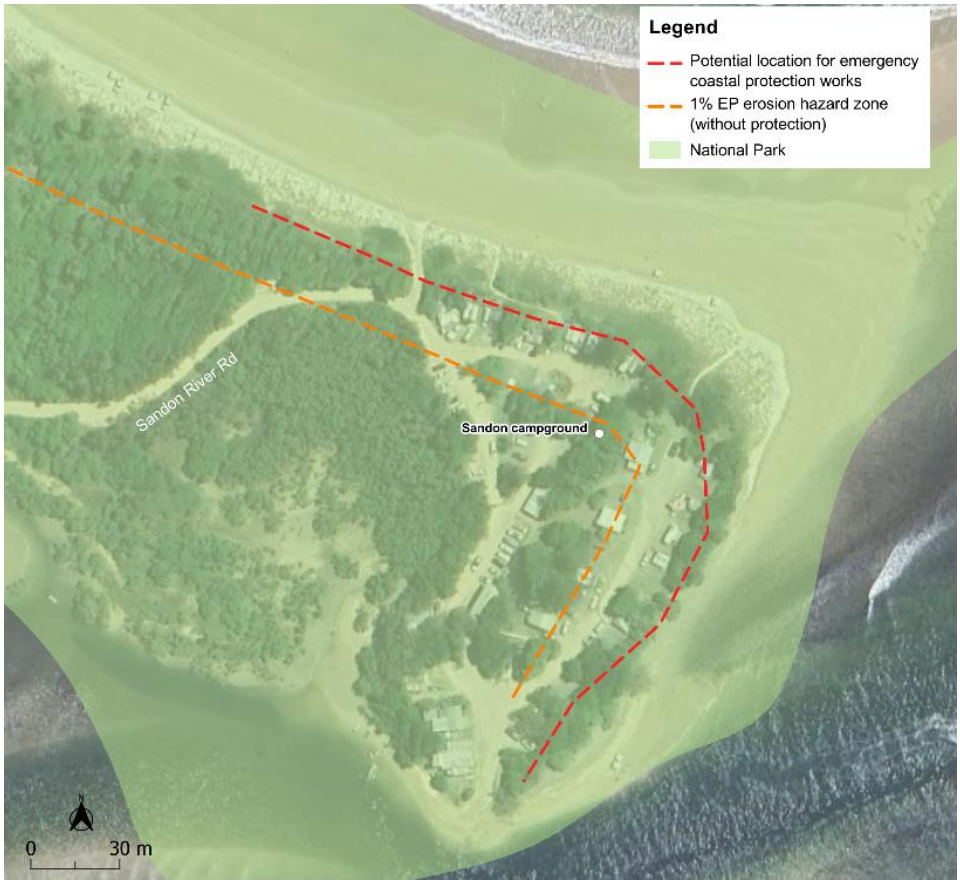

Figure 11: Potential locations for emergency coastal protection works – Sandon River campground (NPWS)

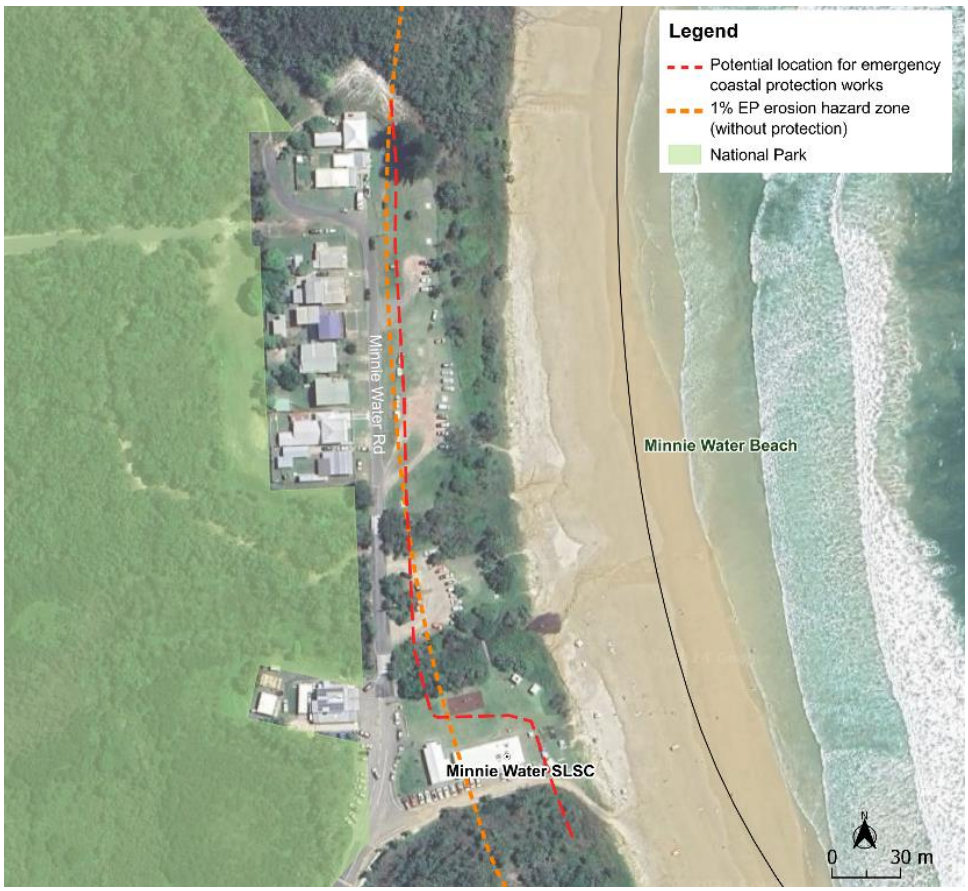

Figure 12: Potential locations for emergency coastal protection works – Minnie Water

Figure 13: Potential locations for emergency coastal protection works – Diggers Camp

Figure 14: Wooli beach management strategy – beach scraping

Source: Royal HaskoningDHV (2021)

Figure 15: Wooli beach management strategy – sand back-passing

Source: Royal HaskoningDHV (2021c)

Table 9: Potential locations for emergency coastal protection works

Location	CZEAS responsibility	Other stakeholders	Assets potentially requiring protection	Emergency coastal protection works	
				Type	Trigger
Shark Bay	Iluka Road: CVC Bundjalung National Park: NPWS	YTOAC	• Iluka Road • 4WD and pedestrian beach accessways • Shark Bay Road, Shark Bay picnic area and toilets	Sandbags[1]	Erosion scarp within 20 m of Iluka Road or 5 m from Shark Bay picnic area/ Shark Bay Road (Figure 5)
Woody Head campground	Bundjalung National Park: NPWS	YTOAC, DPHI-Crown Lands	• Woody Head Road and campground access road • Pedestrian beach accessways • Services (water, sewer, power and telecommunications), stormwater drainage.	Sandbags[1] or sand nourishment[2]	Erosion scarp within 15 m of campground access road (Figure 6)
Red Cliff area	Yuraygir National Park: NPWS	YTOAC	• Pedestrian beach accessways • Campground and amenities • Roads, carparks.	Sandbags[1]	Cliff instability within 10 m of campsites or road (Figure 7)
Lake Cakora entrance and Ocean Road	CVC	Private property owners, YTOAC	• Ocean Road and bridge • Services (water, power, telecommunications), stormwater drainage	Sandbags[1]	Erosion scarp within 5 m of Ocean Road (Figure 8)
Brooms Head (foreshore reserve)	Brooms Head Reserve: CVC	YTOAC, DPHI-Crown Lands	• Pedestrian and 4WD beach accessways • Ocean Road and bridge • Holiday Park, amenities and roads • Services (water, power, telecommunications), stormwater drainage	Sandbags[1]	Erosion scarp within 30 m of Ocean Road or within 5 m of the Brooms Head Holiday Park reserve access road (Figure 9)
Sandon River Road (CVC)	CVC	YTOAC, DPHI-Crown Lands, NPWS	• Sandon River road	Sandbags[1]	Erosion scarp within 10 m of Sandon River Road (Figure 10)

Location	CZEAS responsibility	Other stakeholders	Assets potentially requiring protection	Emergency coastal protection works	
				Type	Trigger
Sandon River campground	Yuraygir National Park: NPWS	YTOAC, DPHI-Crown Lands, CVC	• Pedestrian and 4WD beach accessways • Services (water, power, telecommunications), stormwater drainage • Sandon River road • Sandon River campground, campground assets and amenities • On-site sewer management systems, roads, boat ramp.	Sandbags[1]	Erosion scarp within 5 m from northern and eastern edge of campsites (Figure 11)
Minnie Water	Minnie Water Foreshore Reserve: CVC	Private property owners, YTOAC, Minnie Water SLSC	• SLSC • Pedestrian and 4WD beach accessways • Amenities • Roads • Carpark • Stormwater drainage	Sandbags[1]	Erosion scarp within 10 m of public infrastructure (Figure 12)
Diggers Camp	Diggers Headland Reserve: CVC Yuraygir National Park: NPWS	Private property owners, YTOAC, DPI – Marine Parks	• Pedestrian and 4WD beach accessways • Roads • Carpark • Stormwater drainage	Sandbags[1]	Erosion scarp within 10 m of public infrastructure (Figure 13)
Wooli village (south) and Wooli Beach	Wooli Sand Drift Protection Reserve; Wooli Bowling Green Reserve & South Terrace: CVC	Private property owners, YTOAC, DPI – Marine Parks	• Pedestrian and 4WD beach accessways • Amenities • Roads • Carparks • Services (water, power, telecommunications), stormwater drainage	Beach scraping or back-passing[3]	As defined in the Wooli Beach Management Strategy (scenario 1 or 2, Figure 14 and Figure 15)[3]

1. Refer Figure 4
2. Sand would be sourced from the hind dune between the campground and Iluka Back Beach which was the source of sand used to construct the artificial dune in 2004 and the sand nourishment in June 2024 (refer CMP Strategy WH1 – Coastal Hazard Adaptation (Woody Head Campground)).
3. The CMP includes an action to implement the Wooli Beach Management Strategy (Action W1-1) which includes beach scraping and sand back-passing triggered by erosion events/ scenarios.

5.4 Recovery Actions

Table 10 details the coastal emergency actions to be undertaken during the Recovery phase of emergency response that apply to the locations at risk along the Clarence Valley coastline listed in Section 3.

Table 10: Coastal management emergency response phase - Recovery actions

Action	Responsibility	Trigger	Relevant locations
Inspect the sites potentially affected by coastal emergency events, including the structural integrity of any assets/ infrastructure that were impacted or damaged. Geotechnical, structural and/or coastal engineering advice may be required.	CVC, NPWS	As soon as safe and practicable.	All locations affected by coastal emergency events.
Implement the "Post Alert" activities documented in the *Yamba Coastline Interim Emergency Management Strategy* (CVC, 2024, attached in Appendix 1).	CVC	Following an "Orange Alert Level" or "Red Alert Level"	Landslide Risk Zones (LRZ) 1a, 1b and 2 at Pilot Hill, Yamba
Issue orders under the *Local Government Act 1993* and/or the *Environmental Planning and Assessment Act 1979* when properties are deemed structurally unsafe or pose a risk to the public or clean-up is required.	CVC	Post-event inspections indicate unsafe conditions.	All locations where properties are deemed structurally unsafe or pose a risk to the public.
Repair or decommission/ remove damaged assets/ infrastructure, including stormwater pits and pipes, accessways, footpaths and roadways where considered necessary and as soon as practicable. Geotechnical, structural and/or coastal engineering advice may be required.	CVC, NPWS	Post-event inspections indicate damage	All locations where assets damaged by beach erosion, coastal inundation or cliff/ slope instability/ landslip hazards.
Stabilise or remove unsafe vegetation where considered necessary and as soon as practicable. Specialist advice may be required.	CVC, NPWS	Post-event inspections indicate damage	All locations where assets damaged by beach erosion, coastal inundation or cliff/ slope instability/ landslip hazards.

Action	Responsibility	Trigger	Relevant locations
Monitor the condition, performance and impact of any coastal protection works. Geotechnical, structural and/or coastal engineering advice may be required.	CVC, NPWS	As soon as safe and practicable	Where coastal protection works have been implemented.
Remove any emergency sandbags. Geotechnical, structural and/or coastal engineering advice may be required.	CVC, NPWS	As soon as safe and practicable, once the beach has sufficiently recovered or within 90 days	Where emergency sandbags have been installed.
Liaise with property owners to ensure any private and/or public structures do not pose a risk to the public. Geotechnical, structural and/or coastal engineering advice may be required.	CVC	As soon as safe and practicable.	All locations
Removal of beach/ storm debris and general clean up if required to mitigate risk to public safety.	CVC, NPWS	As soon as safe and practicable.	All locations
Remediate area to restore safe access to beaches or close access (as required) if beach erosion has caused a large escarpment / drop off, where considered necessary. Geotechnical, structural and/or coastal engineering advice may be required.	CVC, NPWS	As soon as safe and practicable.	All locations
Undertake works to re-establish or enhance the natural protective features of the coast, such as dune revegetation on a priority basis with available funding.	CVC, NPWS	As soon as safe and practicable.	All locations

Action	Responsibility	Trigger	Relevant locations
Undertake cliff stabilisation works if post-event geotechnical inspection indicates cliff/ slope instability/ landslip affects public assets and requires remediation. Installation of alternative accessways to be considered if stabilisation of cliff edges is not practical in the short-medium term. Geotechnical, structural and/or coastal engineering advice may be required.	CVC	As soon as safe and practicable.	All locations affected by cliff/ slope instability/ landslip.
Undertake cliff stabilisation works where required in accordance with NPWS procedures for landslides and rockfalls (DCCEEW, 2024).	NPWS	As soon as safe and practicable.	All locations affected by cliff/ slope instability/ landslip.
Maintain temporary barricades, safety fencing and associated warning signage, until risks have been mitigated.	CVC, NPWS	Following an event, until safe to remove.	Where emergency barricades and signage works have been established.
Erect warning signs if risks to public cannot be mitigated (e.g. for cliff/ slope instability/ landslip risks).	CVC, NPWS	Following an event, until safe to remove.	All locations that remain unsafe following an event.
Critically review this CZEAS, communications protocol and operational procedures to ensure they achieved their performance objectives. Amend if shortcomings or improvements are identified to improve the future effectiveness of coastal emergency response actions (refer Section 7).	CVC	Within 2 months of an emergency event	All locations
Replenish any used emergency materials and supplies for future emergency events.	CVC, NPWS	As soon as possible.	All locations
Continue to implement CMP actions as relevant to each location	CVC, NPWS	As per CMP actions	All locations

6. COMMUNICATION PROTOCOL FOR COASTAL EMERGENCY EVENTS

CVC and NPWS will provide information about anticipated coastal emergency events to potentially impacted residents, tourists, surf clubs and businesses through the following mechanisms:

- Provide routine emergency management briefings to staff to communicate the strategy outlined in this CZEAS, including coastal emergency event triggers, locations at risk, roles and responsibilities, relationship to other EMPLANs and subordinate plans and the proposed emergency response actions, including ensuring they have the capacity to respond.
- Provide access to educational materials for private landholders, lessees of public land, land managers and developers regarding the implications of coastal hazards on land use and future development and appropriate emergency responses via a dedicated coastal hazard webpage.
- Provide emergency management briefings to the public as needed, in particular affected landholders, to communicate the strategy outlined in this CZEAS, including coastal emergency event triggers, locations at risk, roles and responsibilities and the emergency response actions, including what actions a landholder may need to take and any assistance that may be available to them.
- Provide emergency management information (in the form of signage and brochures) at local community centres and at offices.
- In consultation with the SES and BoM, issue safety advice to landowners and the community regarding the likelihood of an impending emergency that would initiate actions under this CZEAS.
- Coordinate with SES to ensure residents are aware of urgent hazards during emergency events and provide assistance with door-to-door communication as necessary.
- Place barriers and signage at beach and foreshore accessways and roads that are closed due to coastal emergency impacts.
- Provide up to date information on websites and social media regarding closures of beach and foreshore accessway and roads, and subsequent re-openings.

7. MONITORING AND REVIEW

After a coastal emergency event, CVC will collect records of the event, resulting impacts and response actions undertaken along with decision-making processes. Records will be captured within a database and reviewed to learn from experience in order to improve efficiency of emergency response actions and to understand any changes in coastal conditions over time. Data and records to be collected should include:

- Details of any beach erosion or cliff/ slope instability/ landslip and the weather conditions under which they were caused, including photographs, locations of assets and infrastructure that were damaged by the storm and details of the extent of damage.
- Details of any emergency coastal protection works undertaken, including the cost and the installation date.
- Details of any survey of beach levels and other features that may be required to provide a greater understanding of the hazard or the event.
- Review and update (if required) of this CZEAS, in particular the emergency response actions (Section 5), in consultation with the SES and any other relevant agencies.

The records of storm events, extent of damage and coastal protection works will assist land managers to understand how climate change and/or extreme events are affecting the Clarence Valley coastline and to better plan for adaptation to the effects of sea level rise and other factors such as increasing storm frequency and intensity over time.

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SES (2023b) *NSW State Tsunami Plan.* A Sub Plan of the NSW State Emergency Management Plan (EMPLAN). Endorsed by the State Emergency Management Committee 13 December 2023.

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GLOSSARY AND ABBREVIATIONS

Term	Definition
Beach erosion/ coastal erosion	Landward movement of the shoreline and/or a reduction in beach volume, usually associated with storm events or a series of events, which occurs within the beach fluctuation zone.
BoM	The Bureau of Meteorology
Cliff/ slope instability/ landslip	Refers to geotechnical instabilities on coastal cliffs and bluffs, including rock falls, slumps and landslides.
CM Act	*Coastal Management Act 2016*
CMP	(Clarence Valley Open Coast) Coastal Management Program
Coastal emergency	An emergency due to actual or imminent coastal erosion or cliff/ slope instability/ landslip which (a) threatens endangers, or threatens to endanger, the safety or health of persons; or (b) destroys or damages, or threatens to destroy or damage, any property or the natural environment.
Coastal inundation	The flooding of low-lying coastal land by ocean waters caused by wave run-up overtopping dunes and coastal barriers.
Combat Agency	The agency identified in the DISPLAN or in this subplan as the agency primarily responsible for controlling the response to a particular emergency. (*SERM Act 1989*).
CVA	Coastal Vulnerability Area
CVC	Clarence Valley Council
CZEAS	Coastal Zone Emergency Action Subplan (this document)
Emergency coastal protection works	Emergency coastal protection works may comprise the placement of sand, or the placing of sand containers prior to or during an emergency for a period of not more than 90 days.
EMPLAN	Emergency Management Plan.
Flood	Relatively high-water level that overtops the natural or artificial banks in any part of a stream, river, estuary, lake, or dam, and/or local overland flooding associated with drainage before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves (including tsunami) overtopping coastline defences
LEMC	Local Emergency Management Committee - The committee constituted under the SERM Act for the local government area, responsible for the preparation of the local EMPLAN.
LEMO	Local Emergency Management Officer
LGA	Local Government Area
LEOCON	Local Emergency Operations Controller - A Police Officer appointed by the District Emergency Operations Controller as the Local Emergency Operations Controller for the Local Government Area.
LRZ	Land risk zone
NPWS	National Parks and Wildlife Service
DCCEEW	NSW Department of Climate Change, Energy the Environment, and Water
SES	NSW State Emergency Service
Resilience and Hazards SEPP	*State Environmental Planning Policy (Resilience and Hazards) 2021*
SERM Act	*State Emergency and Rescue Management Act 1989*

Storm	A weather event accompanied by wind, cyclones, tornadoes, intense rain, hail, snow, or marine wave/water action of sufficient severity to threaten lives and cause damage to property, vehicles, infrastructure, vegetation, and the coastal environment
Coastal Hazard Warning	The BoM specifies the following thresholds for issuing coastal hazard warnings (BoM, 2024): • Very large waves and high tides expected to cause unusually damaging or dangerous conditions on the coast.
TfNSW	Transport for NSW

APPENDIX 1 YAMBA COASTLINE INTERIM EMERGENCY MANAGEMENT STRATEGY (JUNE 2024)

YAMBA COASTLINE

INTERIM EMERGENCY MANAGEMENT STRATEGY

JUNE 2024

1. Where This Interim Strategy Applies

1.1 This interim emergency management strategy applies to land defined as Zone 1a, Zone 1B and Zone 2 in Figure 4 of the *Technical Report 3 – Risk Assessment and Stabilisation for Pilot Hill, Yamba NSW* (JK Geotechnics, 30 August 2017) adopted by Council at its meeting of 15 May 2018 (Resolution 14.051/18). A copy of the map defining this area is attached. The rainfall alert levels in this interim strategy were updated by JK Geotechnics in December 2021 and adopted by Council at its meeting of 26 April 2022 (Resolution 07.22.084).

1.2 As per Council resolution 07.22.221 at its meeting of 22 September 2022, subject to grant funding, Council will undertake a monitoring program review, additional geotechnical investigations, updated slope stability analysis and risk assessment and a review of the status of remediation measures at Pilot Hill. Following the completion of these actions this interim strategy (alert levels and application area) will be reviewed and updated to reflect the revised risk information.

2. Purpose of this Strategy

2.1 The JK Geotechnics Assessment has identified that in certain rainfall events, there may be a risk to slope stability in the areas defined as Landslip Risk Zone (LRZ) 1a, 1b and 2 and hence, possible risk to improvements and occupants.

2.2 This interim strategy intends to establish monitoring of rainfall and establish a process of alerting landowners and occupants where rainfall is received, or is anticipated, which may give rise to potential landslide events.

2.3 This interim strategy is intended to apply in the short term while treatment options are being prepared, evaluated and implemented.

2.4 This interim strategy will be revised once longer term treatment options have been completed and a management plan has been adopted and implemented.

2.5 Ensure Council actions are undertaken effectively through an appointed Coordinator. Council's officer for the coordination of Council actions will be Uriah Makings (Senior Coast and Estuary Officer), in the first instance, or Greg Mashiah (Manager Technical Services) as the delegated alternate contact. All actions below will be coordinated by these officers.

3. Notification – General Information

3.1 Landowners agree to provide Council with their preferred 24-hour contact details, including an alternative contact. If appropriate, this may include a local managing agent for the property.

3.2 Council shall make endeavour to contact the person nominated above.

3.3 Should Council be unable to contact owners within an acceptable timeframe, Council shall attempt to contact occupants directly by doorknocking and/or letterdrop.

3.4 Where it is identified within this interim strategy that Council will contact occupants, Council shall attempt to do so directly and will advise owners of this action as soon as practical afterwards.

3.5 Council shall advise land owners/site managers when the alert status changes.

3.6 Council will keep records of all contact, and attempts to contact, with landowners/residents.

4. Monitoring

4.1 Council will monitor daily rainfall in the area from an automatic measuring station located on Pilot Hill. Rainfall data can be accessed from the Manly Hydraulics Laboratory website. SMS alerts triggered by the levels identified in the Table A1 are sent to the following recipients: Greg Mashiah, Devin Simpson, Terry Day, Robyn Monk, Jamie Fleeting, Peter Hubbard, Bryan Green and Uriah Makings.

4.2 Once rainfall reaches the criteria defined in Table A1, Council will notify landowners and/or occupants in accordance with the agreed notification arrangements.

4.3 Council's responsibility under this Strategy is to monitor rainfall and to provide advice to property owners and/or residents when antecedent rainfall is received that, according to geotechnical advice received by Council, heightens the potential for land slip. It is not Council's responsibility to instruct evacuation.

4.4 The land owners' responsibility is to monitor their premises for any evidence of movement once an alert advice has been notified, and based on those observations and their own assessment of their building's structural design, make their own assessments as to whether further action is necessary.

4.5 The daily rainfall readings shall be recorded by Council's Coordinator on a spreadsheet titled Yamba Evac Rain Monitor which automatically determines alert levels.

5. Alert Levels

Table A1 Emergency Rainfall Warning levels

Antecedent Rainfall Period (days)	Yellow Alert Level (mm)	Orange Alert Level (mm)	Red Alert Level (mm)
1	130	125	190
2	150	170	250
5	155	230	320
8	190	260	365
15	240	300	425
30	355	420	540
45	420	515	650
60	510	630	775
90	640	775	955

Note : 1 day = 24 hours

5.1 A "**Yellow Alert Level**", is an internal "early warning" to alert Council officers that the formal alert levels within the interim emergency management strategy may be reached with continuing rain. Council will:

5.1.1 Nominate a sole contact officer for all enquiries during and following the alert.

5.1.2 Review this Interim Strategy and ensure necessary Council officers are available to respond if required.

5.1.3 Inspect drainage pits and lines in the affected area and to have them cleaned on a regular basis if necessary.

5.1.4 Organise professional geotechnical engineer or engineering geologist (not CVC-employed) to be available at short notice.

5.2 At "**Orange Alert Level**", Council will:

5.2.1 Advise owners/site managers and occupants that Orange Alert Level has been reached.

5.2.2 Advise owners/site managers and occupants that should another 100mm of daily rainfall be received, they should monitor their land and/or buildings for evidence of movement. Should any evidence of movement be detected, the landowner/site manager/occupant should consider evacuation of occupants, and advise Council of their action.

5.2.3 Advise appropriate authorities with regard to placing emergency evacuation and rescue procedures on standby status. In NSW there is no combat agency for Land slips, and as such the NSW Police Force's Local Emergency Operations Controller (LEOCON) shall be informed. Council's Local Emergency Management Officer (LEMO) should be contacted to inform the LEOCON.

5.2.4 Ensure that drainage lines and pits are inspected daily to ensure that they function appropriately.

5.2.5 Consider road closures around the Landslide Risk Zones.

5.2.6 Advise the Mayor and CVC Executive regularly of status and actions regularly.

5.3 At "**Red Alert Level**", Council shall :

5.3.1 Advise owners/site managers and occupants that Red Alert Level has been reached, and that occupants within LRZ 1 should consider evacuation to another location if another 50mm rainfall is forecast.

5.3.2 Advise owners/site managers and occupants that they should monitor their land and/or buildings for evidence of movement until the antecedent rainfall drops below Red Alert Level. Should any evidence of movement be detected, the landowner/site manager/occupant should consider evacuation of occupants, and advise Council of their action.

Advise appropriate authorities with regard to placing emergency evacuation and rescue procedures on standby status. In NSW there is no combat agency for Land slips, and as such the NSW Police Force's Local Emergency Operations Controller (LEOCON) shall be informed. Council's Local Emergency Management Officer (LEMO) should be contacted to inform the LEOCON.

5.3.3 Ensure that drainage lines and pits are inspected daily to ensure that they function appropriately.

5.3.4 Close roads around the Landslide Risk Zones and place pedestrian warning signs

5.3.5 Organise professional geotechnical or geological engineer and/or structural engineer (not CVC-employed) to be available to assess private dwelling-houses, other buildings, and Council assets in imminent danger due to post-storm conditions, and to assess public safety.

5.3.6 Advise the Mayor and CVC Executive of status regularly

6. Post Alert Activities:

6.1 Council will:

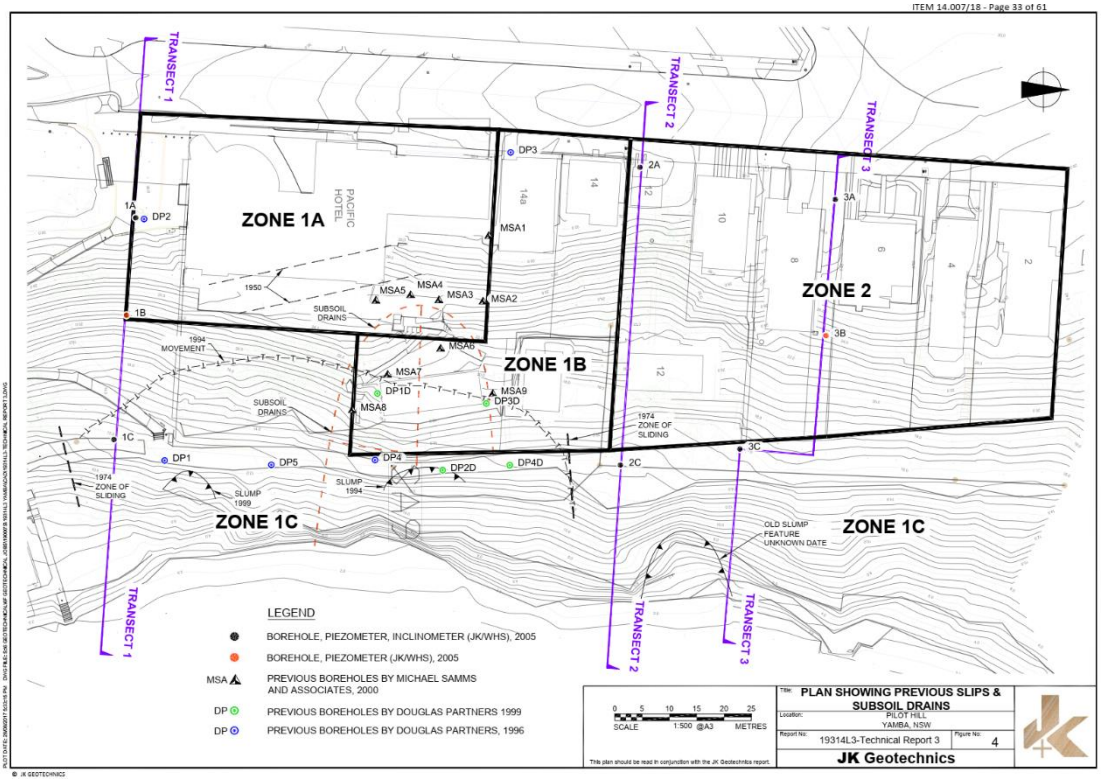
6.1.1 Organise professional geotechnical or geological engineer and/or structural engineer to assess private dwellings and other assets in immediate danger.

6.1.2 Advise landowner of properties threatened by coastal processes to seek independent engineering advice.

6.1.3 Provide advice to emergency authorities regarding the safe return of evacuees (if evacuations occurred).

6.1.4 Conduct a debriefing with all relevant staff following the conclusion of a rainfall event which triggered an alert.

6.1.5 Ensure a record will be kept of all events before, during and after the alert.


TRANSECT 1
TRANSECT 2
TRANSECT 3
ZONE 1A
ZONE 1B
ZONE 1C
ZONE 2
PACIFIC HOTEL
DP1
DP2
DP3
DP4
DP5
DP1D
DP2D
DP3D
DP4D
MSA1
MSA2
MSA3
MSA4
MSA5
MSA6
MSA7
MSA8
MSA9
1A
1B
1C
2A
2C
3A
3B
3C
1950
1994 MOVEMENT
SUBSOIL DRAINS
1974 ZONE OF SLIDING
SLUMP 1999
SLUMP 1994
OLD SLUMP FEATURE UNKNOWN DATE
LEGEND
BOREHOLE, PIEZOMETER, INCLINOMETER (JK/WHS), 2005
BOREHOLE, PIEZOMETER (JK/WHS), 2005
MSA PREVIOUS BOREHOLES BY MICHAEL SAMMS AND ASSOCIATES, 2000
DP PREVIOUS BOREHOLES BY DOUGLAS PARTNERS 1999
DP PREVIOUS BOREHOLES BY DOUGLAS PARTNERS, 1996
0 5 10 15 20 25
SCALE 1:500 @A3 METRES
This plan should be read in conjunction with the JK Geotechnics report.
Title: PLAN SHOWING PREVIOUS SLIPS & SUBSOIL DRAINS
Location: PILOT HILL, YAMBA, NSW
Report No: 19314L3-Technical Report 3
Figure No: 4
JK Geotechnics

APPENDIX 2 APPROVAL PATHWAYS

Information on approval pathways for emergency coastal protection works are set out in the coastal protection works fact sheet (DPE, 2018).

A public authority, such as CVC, can carry out emergency coastal protection works, as exempt development, where these works are in accordance with a CZEAS (this document) prepared by CVC and included in the relevant certified CMP (DPE, 2018). Other coastal protection works will require approval under part 5 of the *Environmental Planning and Assessment Act 1979* (section 2.16 (2) of the Resilience and Hazards SEPP). Coastal protection works that are not emergency coastal protection works are not covered under this CZEAS.

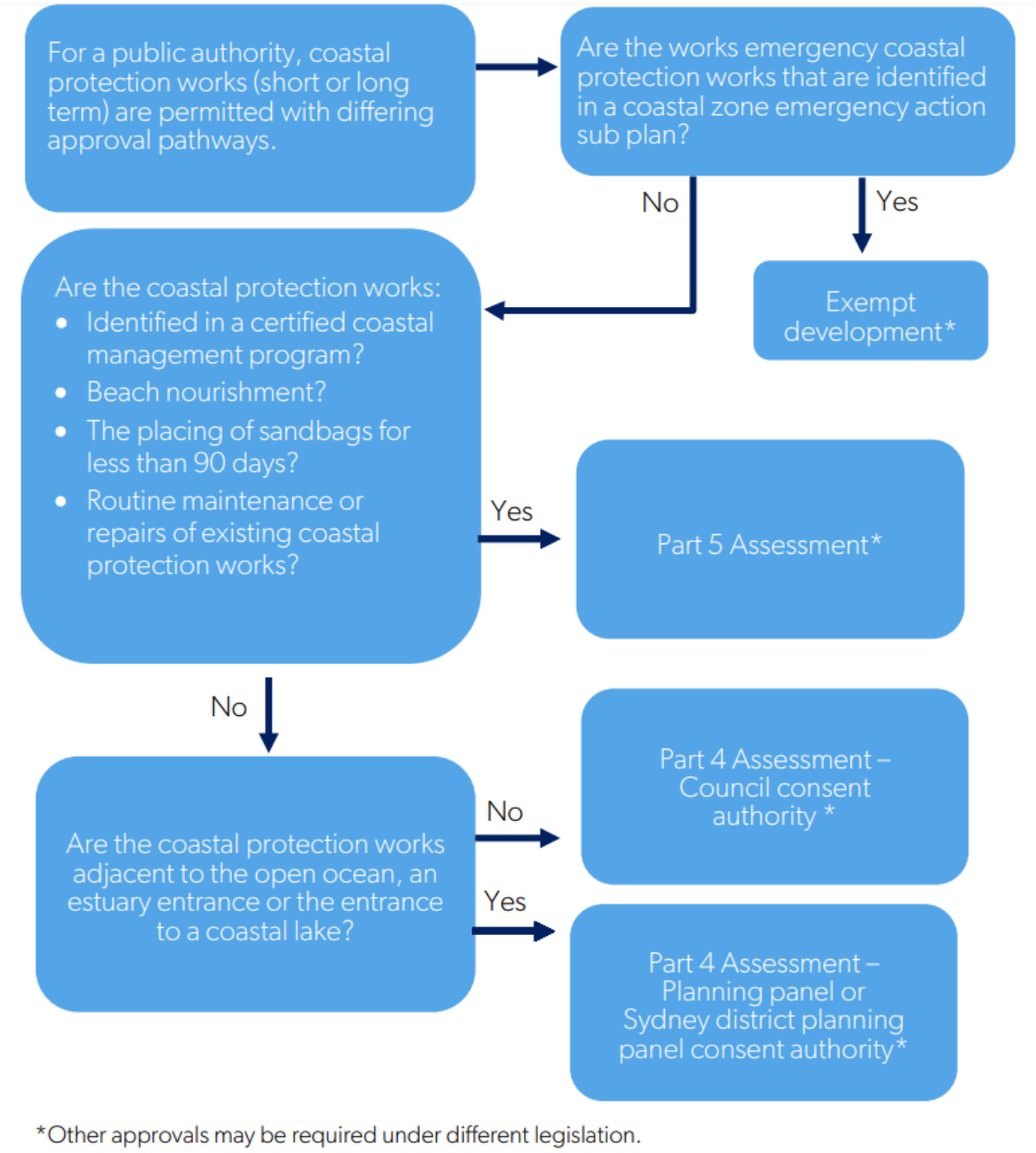


Figure 16: Coastal protection works assessment pathway for public authorities (including councils)

Source: DPE (2018)

The owner of a property has the right to undertake a wide variety of activities/ maintenance in relation to their property which may or may not result from damage during a storm event and which, generally are of a minor nature. As with all activities there is a common law obligation not to cause a nuisance to neighbours or damage to adjacent properties. Generally, works resulting in structural alterations to a building (including demolition or removal), or significant construction (such as a retaining wall or underpinning a structure) or significant earthworks (excavation or placement of fill) would require prior development/ building approval.

The approval pathway for coastal protection works undertaken by private landowners (DPE, 2018) is shown in Figure 17.

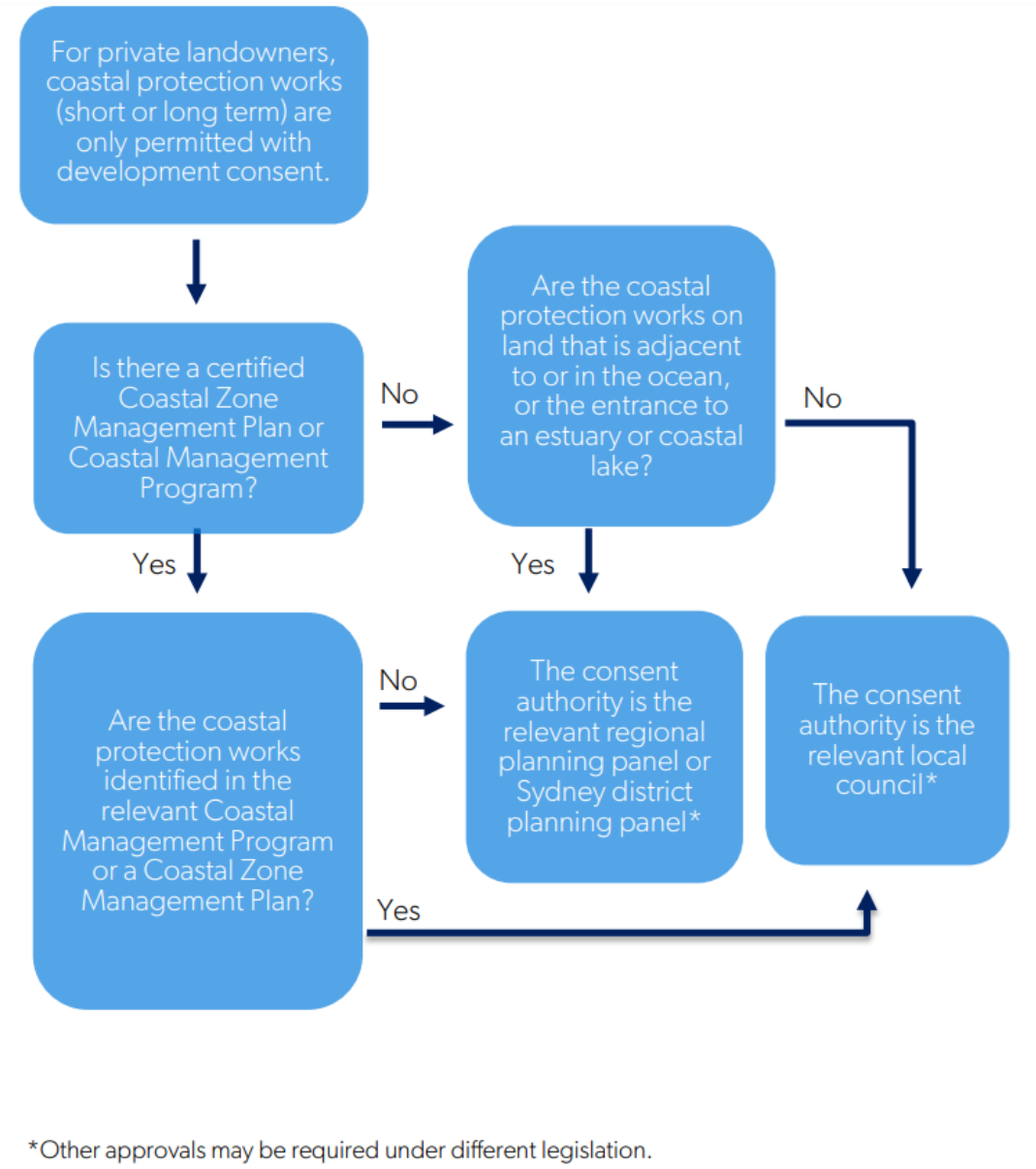


Figure 17: Coastal protection works assessment pathway for private landowners

Source: DPE (2018)