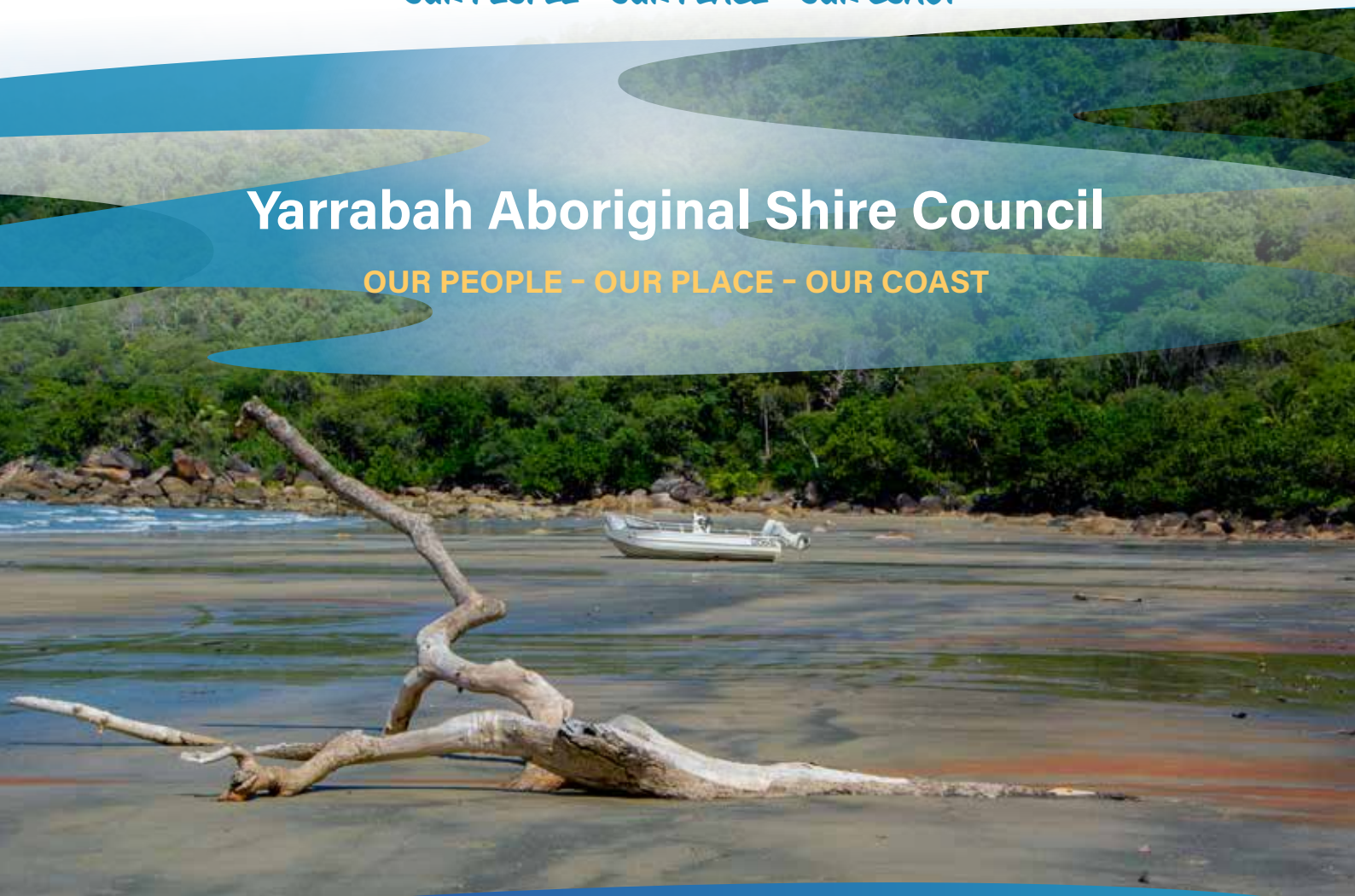




OUR PEOPLE - OUR PLACE - OUR COAST

Yarrabah Aboriginal Shire Council

OUR PEOPLE - OUR PLACE - OUR COAST



COASTAL HAZARD ADAPTATION STRATEGY
JUNE 2022

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Acknowledgement to Country

We acknowledge the Gunggandji and Mandingalbay Yidinji peoples as the Traditional Owners of the Yarrabah area. We pay our respects to their Elders past, present and emerging and acknowledge their continued connection to the land and waters of this area.

We also acknowledge the historical people brought to Yarrabah from various locations by government policies of the past.

We respect the connection to Country of all Aboriginal and Torres Strait Islander peoples of this region and their role in caring for and maintaining land and sea Country over thousands of years.

Our People – Our Place – Our Coast: Summary



Situated to the south-east of Cairns in Far North Queensland, the Yarrabah Aboriginal Shire Council (YASC) coastal areas are home to unique landscapes, history and peoples. Surrounded by tropical seas of the Great Barrier Reef Marine Park and continental islands, the Yarrabah Shire is a distinctive place where culture and Country thrive together.

Yarrabah is a Deed of Grant in Trust (DOGIT) community, which means that Yarrabah Aboriginal Shire Council has the dual responsibility of being a local government under the Local Government Act 2009 and being a trustee of Aboriginal DOGIT land under the Land Act 1994. There are two other trustee owners of significant areas of Aboriginal land in the Shire: the Gunggandji Prescribed Body Corporate (PBC) Aboriginal Corporation Registered Native Title Body Corporate (RNTBC), referred to as GPBC throughout this document, and the Gunggandji-Mandingalbay Yidinji Peoples PBC Aboriginal Corporation RNTBC, referred to as GMYPPBC throughout this document. Native Title has been determined across the Shire.

Residents and Traditional Owners alike enjoy access to the coast, maintaining important cultural connections to the sea. The coastal areas are home to many culturally and ecologically important plants and animals.

Coastlines are dynamic, ever-changing with each tide and storm event. Erosion and flooding by sea water (also referred to as storm tide inundation) are natural processes that have shaped and will continue to shape the coast into the future.

These processes are referred to as coastal hazards when they impact on how we use and enjoy the coast. The Yarrabah coast is prone to coastal hazard impacts, driven by tropical cyclones and storm events. Coastal hazard impacts are predicted to increase with a changing climate.

The Queensland Government and Local Government Association of Queensland (LGAQ) provided funding to Queensland coastal councils to develop a strategic long-term approach to managing coastal hazards. With the funding awarded to YASC, we have been able to develop this Coastal Hazard Adaptation Strategy: Our People – Our Place – Our Coast.

The Our People – Our Place – Our Coast Strategy enables us to be better prepared in the future to reduce the negative impacts of coastal hazards on our communities, environment, cultural values, infrastructure, liveability and essential services. This Strategy is designed to benefit the Yarrabah community both now and into the future so that our children and our children's children can continue their connection to Land and Sea Country.

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1. Introduction

1.1 Our coastline

The coastline of the Yarrabah Aboriginal Shire Council area extends approximately 60 km from False Cape to approximately 6 km north of the Russel River mouth. Yarrabah Beach is bordered by False Cape and Cape Grafton and is 3.3 km long. This beach is a narrow, low energy high tide strip of sand, fronted by tidal flats. Along the exposed, eastern coastline, there are a number of sandy beaches bound by rocky headlands, including King Beach, Oombunghi Beach, Wungu, Jilgi, and Buddabadoo, as well as Ganyjira with Ganyjira Island adjacent (Figure 1).

The coastal zone holds significance for the local community. Beachside lands around Cape Grafton have long provided food and building materials for our people. The sandy beaches, tidal inlets and wetlands, and local waterways are defining features of the coastal landscape. The coastline is also home to vulnerable and valuable ecosystems, including mangroves, saltmarsh and coastal wetlands.



Figure 1. Yarrabah Aboriginal Shire Council LGA

The landscape has been shaped through the millennia by natural processes involving the wind, water and waves. The continual cycles of sand loss (erosion) and rebuilding (accretion) of the shoreline, and flooding of coastal areas by sea water and king tides, are all part of these natural processes. These processes are referred to as coastal hazards when they have the potential to impact on infrastructure, access, services, our lifestyle and the economy.

Yarrabah Shire is home to Queensland's largest Aboriginal and Torres Strait Islander community (ABS 2020). Yarrabah is the traditional home of the Gunggandji Peoples at Mission Bay near the main Yarrabah township, and the Mandingalbay Yidinji Peoples to the south. In more recent history, a mission established at Cape Grafton brought in children from camps along Cairns inlet, including Wanjuru, Madjanydji and Tjapukai people. The diversity of residents and ancestors make Yarrabah a place of rich cultural and ecological significance.

The coastal landscape also has cultural, social and economic significance for the local community, who value the protection and sustainability of Land and Sea Country.

Important environmental features of the Yarrabah coastline include:

- diverse coastal landscapes including sandy beaches, rocky headlands and offshore reefs
- highly ecologically significant freshwater and intertidal wetlands, seagrass and mangrove forests
- endangered or vulnerable wildlife that depend on the ocean and coastal zone for food, breeding and protection
- river and creek entrances
- healthy coastal dune systems.

Yarrabah communities are located generally across two tenures: Aboriginal Deed of Grant in Trust (DOGIT) and Aboriginal freehold. Most of the developed area, including Yarrabah township, is DOGIT land owned in trust by YASC (Figure 2). The less developed areas to the north and south are Aboriginal freehold owned in trust by GPBC and GMYPPBC respectively. These trustee arrangements have governance implications in matters such as leasing and development of land that may be subject to coastal hazards¹.

¹ DNRME, Land and Native Title Services 2020

Tourism has been recognised as a sector for future growth in Yarrabah Shire, with several parcels of land identified as suitable for tourism development. This includes facilities and entertainment for visiting tourists. The current Yarrabah Master Plan outlines that the region's cultural assets should be the key drivers for tourism, and there is also increasing interest in developing ecotourism opportunities.

The construction of a new jetty (Walba Nguymbi) at Gribble Point near the Yarrabah township is also likely to enhance accessibility of future tourism ventures. The jetty has been designed with potential future ferry operations in mind.

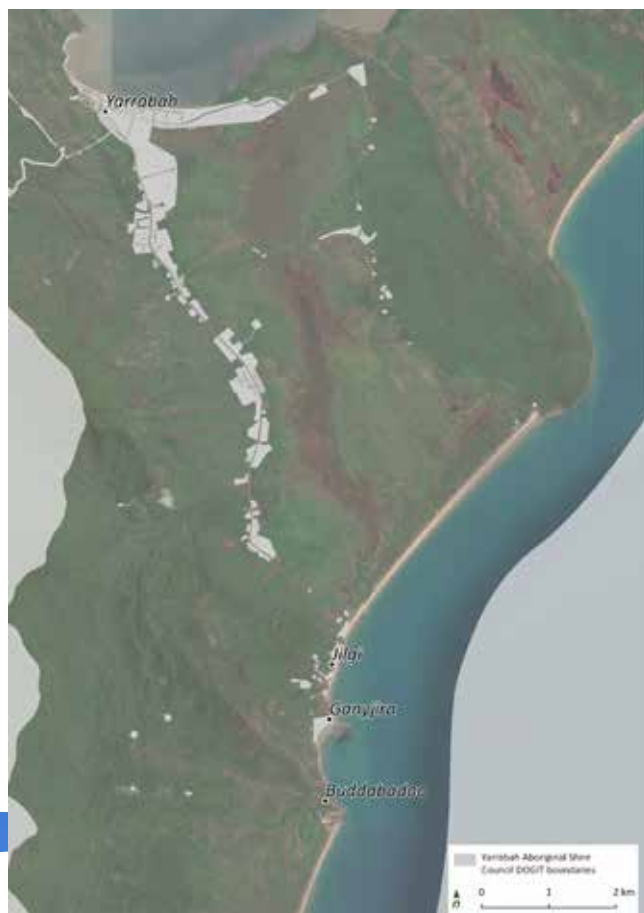


Figure 2. DOGIT areas in Yarrabah Shire

The new Walba Nguymbi jetty at Gribble Point



1. Introduction

1.2 A Strategy for our children and our children's children

Context

The QCoast₂₁₀₀ program is a state-wide initiative of the Queensland Government and Local Government Association of Queensland (LGAQ). Its purpose is to help coastal councils proactively plan for managing coastal hazard impacts, from present day to 2100.

The Yarrabah Aboriginal Shire Council was awarded funding through the QCoast₂₁₀₀ program to establish the Our People – Our Place – Our Coast Strategy and develop a locally specific Coastal Hazard Adaptation Strategy (CHAS).

The Our People – Our Place – Our Coast Strategy (the Strategy) has been:

- developed to proactively manage the impact of coastal hazards for our children and our children's children
- developed in consultation with Council, Traditional Owner groups, Elders, local stakeholders, and community members
- tailored to include the whole coastal landscape and community.

Purpose

The purpose of Our People – Our Place – Our Coast Strategy (and Coastal Hazard Adaptation Strategy) is to:

- inform future decisions regarding the protection and management of our coast and foreshore areas
- inform future land use and master planning
- guide the management of public utilities, facilities and services such as water supply, wastewater, roads and boat ramps
- inform the management of areas of environmental and cultural significance
- foster collaboration and the shared custodianship of our coastline.

² (LGAQ and DEHP 2016)



How we developed the Strategy

The Our People – Our Place – Our Coast Strategy has been developed using a specific process outlined in the QCoast₂₁₀₀ Minimum Standards and Guideline² (Figure 3).

The process has included a series of technical studies and activities that have:

- identified coastal hazard areas
- identified vulnerabilities and risks to local community assets and infrastructure (e.g. roads and boat ramps)
- engaged with the Council and community to understand their preferred approach to managing coastal hazards known as adaptation
- determined adaptation actions, costs, priorities, and timeframes for implementation.

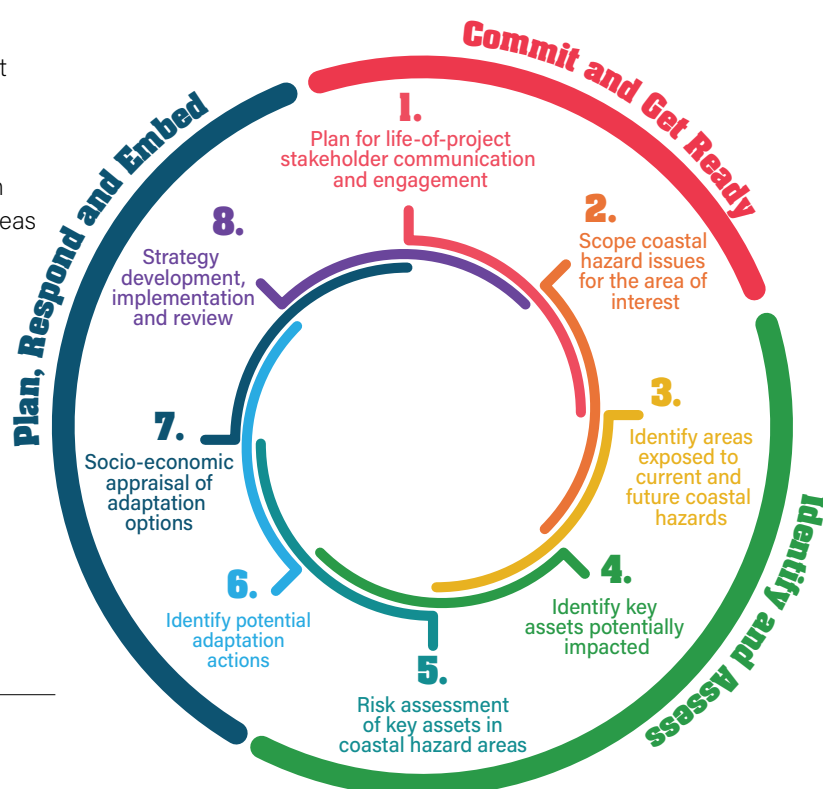


Figure 3. QCoast₂₁₀₀ process for developing a Coastal Hazard Adaptation Strategy

1.3 Listening to the community

The Our People – Our Place – Our Coast Strategy has been informed by conversations with Council, community leaders, and key stakeholder groups over a period of nearly 18 months in 2020-2022.

A number of engagement activities were undertaken during the development of the Strategy including:

- targeted conversations with Councillors, Council CEO and senior staff, Traditional Owners, Elders and community leaders
- targeted conversations with Gunggandji PBC, Gunggandji-Mandingalbay Yidinji Peoples PBC and other key stakeholders

Articles in the Yarrabah Community Newsletter as well as Council's social media pages were used to introduce the project, share information about coastal hazards, and encourage participation.

In May-June 2022, the community also had an opportunity to provide their feedback on the Draft Our People - Our Place - Our Coast Strategy during a public exhibition period.

1.4 What information is in the Strategy

The Strategy includes an overview of:

- coastal features that are important and meaningful to the local community (values)
- a description of the types of coastal hazards that may be experienced in the Yarrabah region including areas that may be exposed in the future to erosion and flooding by sea water (or tidal inundation)
- the implications of this exposure (risk) including potential cultural, environmental and economic impacts
- Council's approach to managing these impacts and details on how the Council and community can adapt to future coastal hazards, including a framework for shared responsibilities, adaptation responses and options
- location summaries with specific adaptation actions for each community
- a plan for implementation and continual review and improvement.

To support this Strategy fact sheets are provided in Supplement A. The fact sheets include:

- Fact Sheet 1: What is a Coastal Hazard Adaptation Strategy
- Fact Sheet 2: Sand dunes
- Fact Sheet 3: Resilient homes.

2. A vision for a clean and safe Yarrabah Shire coast

During the development of the Strategy, Council staff, community leaders and key stakeholders were invited to identify:

- why the coast was important to them;
- what issues were currently a cause for concern;
- what their aspirations and ideas were for a well-managed coastline.

This information provides the foundation of the Strategy, ensuring that the values and needs of the YASC and local community lie at the heart of future management and investment.

2.1 What is a resilient coast?

The coastline experiences constant and often rapid change. Wind, waves, tides and currents continually work to move sand and sediment to shape the shoreline. Extreme weather events such as tropical cyclones can periodically result in significant erosion and flooding by sea water. When these processes threaten local values, properties, or our local way of life, they can be considered coastal hazards.

A well-managed, safe and resilient coast has social, economic and environmental strategies in place to avoid and reduce the impact of hazardous events or disturbances (e.g. coastal hazards). These strategies are discussed in Section 4. Caring for our coast and keeping it clean and healthy increases the natural resilience of our coast. Understanding natural processes helps to avoid and reduce exposure to coastal hazards, making our beaches safer and more resilient.

Resilience also means the ability for the beaches and coastlines to respond to or reorganise in ways that maintain natural processes and the values of the region, while also being able to proactively adapt to change.



Resilience

Resilience is the ability for something to withstand stress and continue to function and recover from damage. Resilience applies to the coastal environment as well as the community. Resilience happens when coastal ecosystems are clean and healthy, and when the community is prepared for and safe from coastal hazards.

2.2 What the community values about their coastline

The rich and diverse community and landscape of the Yarrabah region supports a number of interrelated values. Values are those aspects that the local community has identified as being important and meaningful to their lifestyle and wellbeing.

Some coastal values important to the local community are provided in Figure 4.



Showcasing our environment and community in ways that are respectful of our Country

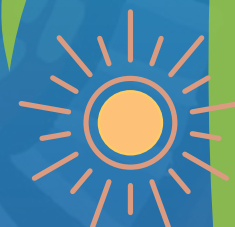
Safe and easy access to communities within Yarrabah as well as other communities such as Cairns and Gordonvale



Healthy lands and seas are inseparable parts of Country and culture



Cultural knowledge practices – especially sustainable hunting and gathering and being able to adapt to the seasons



Healthy Land and Sea Country adjacent to two World Heritage Areas

Fishing, hunting and camping near the water, beaches and surrounding areas



Our sacred sites, spaces and Dreaming tracks



Local employment opportunities and business creation



Appropriate housing close to the coast accessible to family and friends

Figure 4. What is important and meaningful to the Yarrabah community

2. A vision for a clean and safe Yarrabah Shire coast

2.3 What are our goals and aspirations for a resilient coast?

The goals and aspirations (Figure 5) of the community are important to consider when developing objectives for future coastal hazard adaption, management and investment. The goals and aspirations represent what the community want the coastline to look like for their children and their children's children.

Community concerns about threats to achieving these goals and aspirations have also been identified and will help to prioritise the selection of adaptation options. The threats directly and indirectly relate to the risk of coastal hazards in Yarrabah.



Figure 5. Yarrabah coastal goals and aspirations

Housing is safe, resilient and adequate for our needs



We have safe and easy access to beaches and surrounding waters for fishing and boating



Our coastline and coastal areas attract visitors from all over



Our important cultural places and sites are protected

Our cultural knowledge and understanding of how to manage Country is passed down to future generations



We work with Mother Nature, not against her



Our children and our children's children know how to care for Country



3. What are coastal hazards?

Coastal hazards include temporary flooding of low-lying coastal land (storm tide inundation), and / or erosion of the shoreline (both short-term and long-term).

Inundation and erosion are natural processes that contribute to shaping the unique landforms of our coast. However, when these processes have an adverse impact on communities, infrastructure, culturally significant places and some natural assets, they are considered coastal hazards. In the Yarrabah Shire, major coastal hazard impacts are typically associated with monsoon weather patterns and tropical cyclones.



Coastal Hazards

Coastal hazards are when natural coastal processes threaten local values, properties, or our local way of life. Some coastal hazards include storm tide inundation, erosion, and tidal inundation.

Storm tide inundation

Storm tide inundation is when big storms cause temporarily higher water levels leading to flooding of normally dry land. Storm tide inundation is often accompanied by big waves and strong winds which together can cause widespread destruction.

3.1 Storm tide inundation

Storm tide inundation is the temporary flooding of low-lying coastal land from a locally raised sea level (the 'storm tide'). The storm tide is a combination of the normal tide, storm surge, and wave action (Figure 6). Storm surge is driven by the low atmospheric pressure and high winds associated with events such as tropical cyclones.

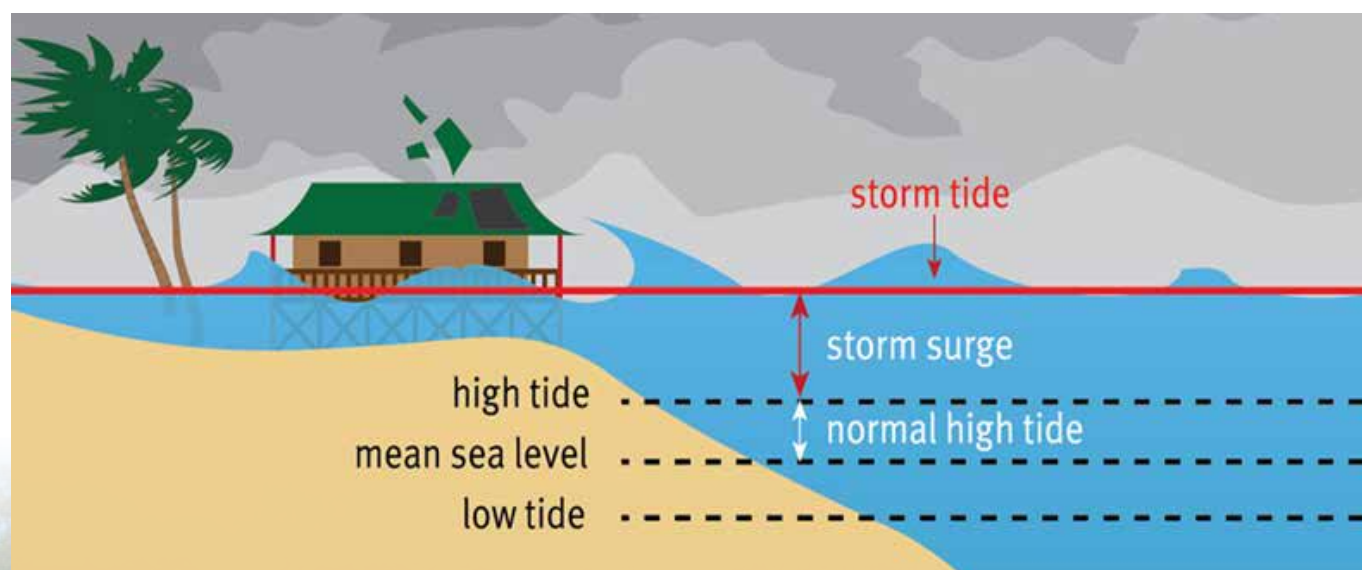


Figure 6. Components of storm tide (Source: coastadapt.com.au)

3.2 Coastal Erosion

Coastlines naturally erode and accrete periodically over time, driven by sediment supply, tidal currents and waves.



Short-term erosion

Coastal erosion occurs when winds, waves and coastal currents take sand away from the shoreline. This can be a temporary change, often associated with storm activity (termed storm bite), and the beach will then gradually rebuild (Figure 7).

When a beach is stable, all the sand moved offshore during a storm eventually moves back onto the beach (potentially taking months to years). In this case, short-term beach erosion does not result in a long-term landward movement of the shoreline.

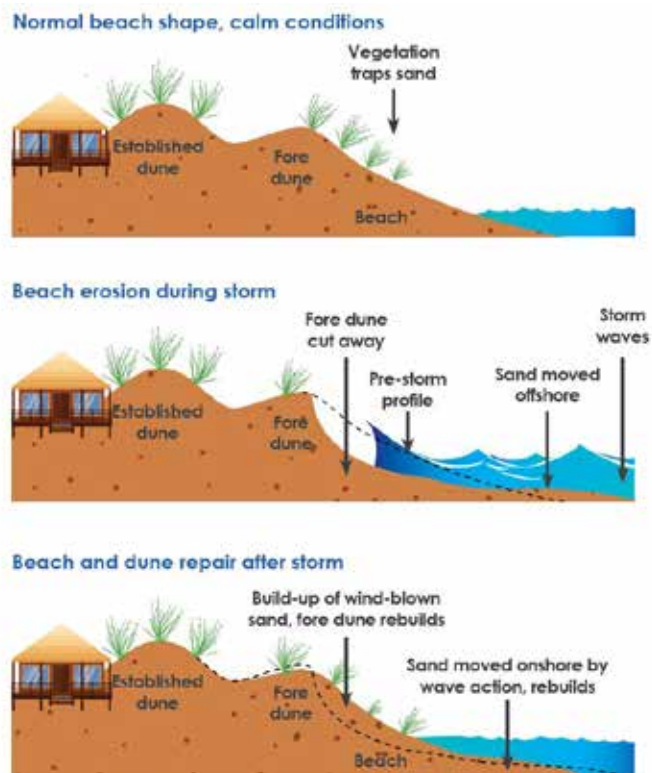


Figure 7. Natural short-term erosion and dune rebuilding process

Long-term erosion

In other cases, due to changing sediment supply or climate conditions, the beach may not be able to rebuild between storm events. Without intervention, long-term erosion (termed recession) may occur, which is the landward movement of the shoreline over a longer timeframe (decades).

Both short-term and long-term erosion processes may impact on coastal assets, depending on how close to the shoreline assets are located.

3.3 Tidal inundation due to sea level rise

Tidal inundation is regular flooding from the tidal cycle, including up to the Highest Astronomical Tide (HAT). Very high tides, also called king tides, can impact low lying areas. This can lead to increased damage especially if a king tide coincides with a cyclone or other storm. Areas of low-lying coastal land will experience increasing tidal inundation with sea level rise. A 0.8 m sea level rise by 2100 is currently planned for by the Queensland State Government.

Erosion

Erosion is when coastal forces such as waves, winds, tides and currents remove sand from the beach and move it offshore. This can cause the shoreline position to move landwards. Big erosion events can threaten buildings, roads and important cultural areas.



Tidal inundation

Tidal inundation is when normal astronomical tides cause flooding of low-lying coastal land. Areas exposed to tidal inundation are expected to periodically flood. With global average sea levels expected to rise, areas effected by tidal inundation are also expected to increase.

3. What are coastal hazards?

3.4 A history of coastal hazards and coastal protection

The Yarrabah community has experiences of coastal hazards stretching back into the Dreamtime. Stories tell of the Great Barrier Reef as the original coastline of the country before sea levels rose to where they are today. The Great Barrier Reef used to extend all the way into Mission Bay, as shown by the layers of coral that are now covered by sand and silt.

“... That’s telling me that something has changed in the past” (Vincent Schrieber)

Another story tells of a small tsunami that came from the north and made Yarrabah what it is today. Yarrabah has three mountain ranges that lie in parallel, the easternmost of which is the Murray Prior Range. The low-lying areas, such as along what is now Back Beach Road, were once inundated. Not many people lived in the flat areas of Yarrabah during these times, as there was more saltwater coming through the land than freshwater. Water would also come in from the southern end of Back Beach Road. Middens have been found along the Murray Prior Range and up on the ridge near the new Djenghi subdivision on this road – some 3.5 - 4km from the current coastline. There are swamp lands that run through the middle of Yarrabah now.

“To find middens [there], that’s telling me that my grandparents never used to walk or live down anywhere in the places that houses are built on.” (Vincent Schrieber)

Sharks and crocodiles used to travel through these low-lying areas, they could come from the northern side, or the southern side, or the eastern side. It was like a moat, with water surrounding the mountains.

The shipwreck of the Anglican Mission “Elam” sunk in Mission Bay during a storm in 1934. This wreck is currently situated about 89 m from the beach near St. Alban’s Anglican Church. There is also a second wreck 206 m offshore from the coastline near the new Walba Nguymbi jetty.

Shipwrecks can protect from coastal hazards in numerous ways, such as by trapping sand to prevent it from being moved offshore by waves and currents, and by acting as a breakwater to reduce the force of waves before they reach the shoreline. How these structures perform in protecting from coastal hazards can be quite unpredictable. Based on aerial photography dating back to the 1960s, the coastlines adjacent to both wrecks have eroded and receded. Further to the east, on the other hand, the shoreline has accreted with the colonisation of mangroves.

Shipwrecks can also act as an artificial reef – providing habitat and refuge for many marine species such as rays, fish, shellfish, crustaceans, sea cucumbers, sponges, corals, and many more.

In 1986-89, the community started a protection project to save the old cemetery. Tidal surges and heavy rain had eroded the beach nearby. The land beneath was becoming undermined, with sand and soil being sucked out to sea, making the cemetery and coffins unstable. The community made baskets to hold rocks to protect the cemetery, where many of their Elders are.

“Mother Nature has a way of putting things back to where it was. It’s a scary thought, but she has the first and last say. There’s nothing we can do but prepare for it ... as best we can.” (Vincent Schrieber)

Wreck in front of St Alban’s Anglican Church



3.5 Current and future exposure

Updated mapping

The Yarrabah coastline occasionally experiences cyclone and storm events which can cause erosion and inundation. King tides associated with storm and cyclone events also cause flooding. Coastal hazard impacts are predicted to increase with a changing climate and rising sea levels.

As part of the Our People – Our Place – Our Coast Strategy, the existing mapping for Erosion Prone Areas and predicted storm tide and tidal inundation zones have been updated for the coastline in front of the Yarrabah township. Storm tide and tidal inundation mapping has also been updated for the rest of the coastline. These updates are based on the best available technical data, and have included:

- new modelling of open coast erosion³
- application of the Queensland Government approach to defining Erosion Prone Areas, tailored to Yarrabah in consultation with State and LGAQ⁴.

Based on the state-wide approach to mapping, the Erosion Prone Area includes components of:

- **Open coast erosion:** A calculated component of open coast erosion potential, informed by erosion modelling
- **Tidal areas:** the combined area inundated by the Highest Astronomical Tide plus a defined horizontal buffer, plus any additional area inundated due to sea level rise.

As required by the Queensland Government, a projected sea level rise of 0.8 m by 2100 has been adopted for the Our People – Our Place – Our Coast Strategy (with 0.4 m by 2060).

Planning horizons

Mapping for both erosion and storm tide inundation includes multiple planning timeframes or horizons and event likelihoods⁵ (Table 1).

Likelihoods

Likelihoods are words to describe how common or rare an event is. Likely events are expected to happen regularly and multiple times within the average lifespan. Possible events are expected to happen every so often and a few times in the average lifespan. Rare events are unusual and might occur once or twice in the average lifespan.

AEP

Annual Exceedance Probability, or AEP, is the likelihood that certain conditions will occur in a given year. AEP values are based on computational modelling that considers measured coastal data and multiple thousands of simulated scenarios.

Planning horizons

Planning horizons are points in the future for which strategic decisions are made. This Strategy considers planning horizons of present day (2021), 2060, and 2100.

Table 1. Likelihood of occurrence scenarios

Likelihood of occurrence	Hazard AEP	Planning horizons
Likely	2%	Present day, 2060, 2100
Possible	1 %	Present day, 2060, 2100
Rare	0.2 %	Present day, 2060, 2100

Maps of the 2100 1 % AEP are provided in Supplement B to the Strategy.

Erosion Prone Areas and storm tide inundation zones do not represent a predicted loss of coastal land. The maps provide an indication of areas that may be exposed to erosion or inundation processes (now or in the future), and in many cases the impacts can be avoided, minimised or managed through adaptation planning.

Additional detail on the mapped components and the approach is provided in the Phase 3 summary report (YASC 2021b).

³ Refer Phase 3 summary report (YASC 2021b)

⁴ Refer Phase 3 summary report (YASC 2021b)

⁵ Likelihoods are defined by Annual Exceedance Probabilities (AEPs) which indicate the probability that an event will occur in any given year.

3. What are coastal hazards?

FUTURE IMPACTS

Projected sea level rise and an increase in cyclone intensity for the Queensland coastline is anticipated to increase the extent and impact of coastal hazards.



Coastal erosion:

- Increased water levels will accelerate coastal erosion
- Sediment transport patterns may be altered by shifts in wave direction, triggering changes to the form and location of shorelines
- Low-lying land may be permanently inundated
- Increased cyclone and storm activity will escalate the severity of coastal erosion events

Storm tide inundation:

- Sea level rise will increase the apparent severity and frequency of storm tide inundation and will cause inundation to occur further inland
- Increased cyclone and storm intensity will add to the magnitude of storm tide events and the extent of inundation.

Source: Coastal Hazard Technical Guideline (DEHP 2013)

3.6 Potential impacts on the Yarrabah Shire

How we identified potential impacts

Coastal hazards have the potential to negatively impact Yarrabah communities, infrastructure, essential community services such as water supply, and our lifestyle today and long into the future.

As part of the Our People – Our Place – Our Coast Strategy, technical assessments have been used to determine the coastal hazard risk for a range of assets that exist in the communities. Risk is the possibility of loss, damage, or injury. In a coastal context, risk arises from exposure to coastal hazards such as storm tide inundation, and erosion. Risk can be measured by considering both the likelihood and consequence of loss, damage, or injury. The risk assessment has included analysis of:

- data on infrastructure assets (drainage, sewerage, electricity, telecommunications, stormwater, water supply, and roads)
- information on homes and other buildings
- coastal protection structures such as sea walls and other beach and foreshore assets such as boat ramps

- cultural heritage sites and sites of cultural and historical significance
- the YASC Planning Scheme and Master Plan, as well as areas of future master planning

Risk is assessed based on the likelihood of an asset being exposed to a coastal hazard, combined with the consequence of that exposure (Table 2).

A tailored approach to assessing consequence was developed, based on community feedback on the important elements for the coastal zone (lifestyle, coastal access, public safety, environmental values, cultural landscapes, property and infrastructure, and economy and growth) (Table 3).

To complete the risk assessment:

- The likelihood of exposure (likely, possible, rare) was determined for each asset / land parcel, separately for erosion and inundation
- The consequence of exposure (insignificant, minor, moderate, major, catastrophic) was determined for each asset / land parcel, separately for erosion and inundation
- Coastal hazard risk was assessed (low, moderate, high, extreme), based on the likelihood and consequence for each asset / land parcel, separately for erosion and inundation.

Table 2. Risk matrix

			Consequence				
			Negligible	Minor	Moderate	Major	Catastrophic
Likelihood	HAT	Almost certain	Moderate	High	High	Extreme	Extreme
	2% AEP	Likely	Moderate	Moderate	High	Extreme	Extreme
	1 % AEP	Possible	Low	Low	Moderate	High	High
	0.2 % AEP	Rare	Low	Low	Low	Moderate	High



3. What are coastal hazards?

Table 3. Consequence categories (modified from LGAQ and DEHP (2016), and Council's Asset Management Plan (YASC 2015)

Consequence	Community and lifestyle		
	Lifestyle	Access	Public safety
	Considers elements of modern and traditional lifestyle, such as community services, cultural connection, recreational and social activities and day-to-day business activities.	Considers access for activities such as boating and fishing, as well as access to areas used for hunting, gathering and cultural / ceremonial sites.	Considers threats to human health and safety, such as injury, disease, mental and physical wellbeing.
Catastrophic	Widespread semi-permanent impact (~1 year) to highly utilised community services, wellbeing, or culture of the community with no suitable alternatives. General and widespread displacement for extended duration.	Widespread and permanent impact on access to key sites and activities. Community unable to function without significant support. Recovery unlikely.	Large number of severe injuries. Extended and large numbers requiring hospitalisation.
Major	Major widespread long-term (~1 month) disruption to well-utilised services, wellbeing or culture of the community with very few alternatives available. Community only partially functioning, some services unavailable.	Severe and semi-permanent impact on access to key sites and activities. Significant damage that requires external resources for community support. Full recovery may take many years.	In some circumstances, extensive injuries could occur, requiring hospitalisation.
Moderate	Minor medium to long-term (~1 week) or major short-term disruption to moderately utilised services, wellbeing or culture of the community with limited alternatives. Normal community function with some inconvenience. Community support satisfied through local arrangements.	Substantial impact on access to key sites and activities requiring significant works to repair or restore access. Localised damage that is rectified by routine arrangements. Full recovery may take less than 1 year.	Isolated serious injuries / illnesses and/or multiple minor injuries / illnesses requiring medical treatment.
Minor	Small to medium short-term disruption (~1 day) to moderately utilised services, wellbeing, finances, or culture of the community with some alternatives available, or more lengthy disruption of infrequently utilised services.	Small to medium short-term disruption of access to key sites and activities which may require some works to repair or restore access.	Minor and isolated injuries and illnesses, and first aid treatment may be required.
Negligible	Very small short-term disruption (~1 hour) to services, wellbeing, finances or culture of the community with numerous alternatives available.	Very little to no impact on access to key sites and activities.	Negligible injuries or illnesses.

Environment	Place and planning		
Environmental values	Cultural landscapes	Property and infrastructure	Economy and growth
Considers elements such as ecological values, ecosystem services, and cultural and traditional uses.	Specific consideration of traditional cultural values and the ability to maintain and pass on traditional knowledge and practices to future generations.	Considers the threat of damage to built assets and any inter-dependencies such as regional access and ability to deliver critical services.	Includes existing business and potential economic growth opportunities, especially for locally owned and operated enterprises.
Severe and widespread, permanent impact on multiple regionally or nationally significant environmental values of the region. Recovery unlikely.	Severe and widespread, permanent impact on multiple sites of cultural significance, including loss of land, connection to land, and ability to continue traditional practices. Recovery unlikely.	Widespread major damage or loss of property or infrastructure with total value >\$5 million. Full recovery/repair may take many years.	Regional economic decline, widespread business failure and impacts on state economy.
Severe and widespread semi-permanent impact on one or more regionally or nationally significant environmental values of the region. Full recovery may take many years.	Severe and widespread semi-permanent impact on one or more sites of cultural significance, including loss of land, connection to land, and ability to continue traditional practices. Full recovery may take many years.	Major damage or loss of property or infrastructure with total value >\$1 million. Full recovery/repair may take several years.	Significant financial loss. Lasting downturn of local economy with isolated business failures and major impacts on regional economy. Some financial assistance required.
Substantial impact on one or more locally significant environmental values of the region. Full recovery may take several years.	Substantial impact on one or more sites of local cultural significance. Full recovery may take several years.	Moderate to major damage to property or infrastructure with total value >\$250,000. Full recovery may take less than 1 year.	Significant impacts on local economy and minor impacts on regional economy.
Small, contained and reversible short-term impact on isolated ecosystem services and natural features of the region. Full recovery may take less than 1 year.	Small, contained and reversible short-term impact on sites of cultural significance. Full recovery may take less than 1 year.	Minor damage to properties or infrastructure with total value >\$100,000.	Individually significant but isolated impacts on local economy.
Little to no environmental impact.	Little to no impact to sites of cultural significance.	Minimal damage to properties or infrastructure with total value >\$25,000.	Minor short-term impact on local economy.

4. How can we adapt to future coastal hazards?

4.1 Framework for adaptation

A strategic approach

Across Australia and internationally, coastal land managers are taking a strategic approach to managing the risk of coastal hazards and enhancing the resilience of our coastal zones.

Common elements of this strategic approach include:

- Identifying **adaptation objectives** that align and support community values, goals and aspirations.
- Assigning a strategic **adaptation response** to different localities, to guide decision making with a pathways approach across present day, intermediate and 2100 planning horizons.
- Assessing the range of **adaptation options** suitable in different locations to help avoid, mitigate, and manage the risk of coastal hazards.
- Developing a **Strategy** (this document) for coastal adaptation, with prioritised actions over a 5–10 year timeframe.

A tailored approach has been developed to guide decision making on adaptation response and options across the Yarrabah coastal zone.

Adaption

Adaptation is adjusting to actual or expected conditions and events. Adaptation can have good or bad outcomes and should be guided by understanding the desired state of being. Good adaptation to coastal hazards means taking action to reduce risk and increase resilience.

Adaptation objectives

The purpose of clarifying adaptation objectives is to help guide an appropriate adaptation response, and to screen adaptation options, across different localities.

Objectives for the Our People – Our Place – Our Coast Strategy include:

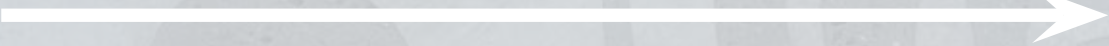
- Clean healthy beaches
- Beaches and coastal habitats protected including for wildlife nesting, refuge and feeding
- Waterways, wetlands and ocean support healthy fisheries and aquatic wildlife
- Sites of cultural significance are recorded and protected
- Cemeteries and burial sites (marked and unmarked) are protected
- Continual connection and access to places of spiritual and cultural significance
- Access for boating, traditional hunting and fishing sites
- Access to beaches for camping and fishing
- Homes are built strong and can withstand natural disasters
- Access to safe refuge and emergency services during natural disasters
- Protection of natural resources and local environments to ensure sustainable fishing and food supply
- Support for a growing eco- and cultural-tourism industry and local economy
- Genuine collaboration regarding the management of natural resources, community infrastructure and services.

These objectives provide a reference for considering the suitability of different coastal hazard adaptation options across the Yarrabah Shire.

Adaptation response

The tailored framework for the Our People – Our Place – Our Coast Strategy includes four adaptation responses – **Avoid (and maintain), Monitor (look and learn), Actively manage, and Transition and change** (Table 4). A general adaptation response was determined for each Yarrabah Aboriginal Shire community and for each time frame (planning horizon) (Table 5). This helps to determine the appropriate approach for each community.

Table 4. Adaptation responses for YASC

	Coastal hazard adaptation			
				
Adaptation response	Avoid (and maintain) 	Monitor (look and learn) 	Actively manage 	Transition and change 
How do we respond and adapt to coastal hazards?	Prevent new risks from occurring and avoid placing new development or assets in coastal hazard areas.	Monitor the risk of coastal hazards. Monitor until local trigger levels are reached to initiate mitigation.	Proactively manage or mitigate the risk of coastal hazards through a range of adaptation options. Mitigate until management options are no longer socially, culturally or economically feasible or local trigger levels are reached to initiate transition.	A strategic decision to transition or change a specific land use (or location) to an alternative land use. Active management or mitigation may be part of the transition process.
Adaptation options What can we do?	- Apply land use and development planning controls. - Protect natural landscapes and beaches from harm. - Maintain assets in good condition.	- Watch for any changes to the coast that might indicate a change in the risk. - Collect and record information about important cultural sites and places.	- Create community custodians & educate people about coastal hazards and how to care for our coasts. - Plan for possible natural disasters. - Use nature-based solutions to create healthy dunes and coasts. - Upgrade infrastructure and sites to be more resilient. - Relocate infrastructure to safer locations. - Change how we use the land.	

4. How can we adapt to future coastal hazards?



Avoid (and maintain)

The general first principle is to avoid placing new development or built assets in coastal hazard areas.

The preference is to develop (or transition over time) land use in coastal hazard areas to locations with lower risk of coastal hazard impacts, while allowing for uses that maximise economic, cultural, social and environmental value to the region. Any new development or infrastructure in coastal hazard areas must be in accord with local and State Planning Policy and approvals requirements and include necessary mitigation measures.

It is also important to avoid creating new risks or increasing existing ones. Maintaining infrastructure in good condition and protecting coastal areas from future harm will increase the natural resilience and help to avoid or delay the need for more active management.



Monitor (look and learn)

At localities where the coastal hazard risk profile is low, the adaptation response is to monitor risk by observing changes and regularly reviewing what these changes mean in terms of changing risk – look and learn. Best practice is to undertake maintenance/asset management activities and continue active stewardship of the coastal zone. Where these observations suggest an increased risk (as indicated by local trigger levels), then the adaptation response may change to active management.

Continuing to collect and record data on culturally significant sites and places, and places of high environmental value will help to grow knowledge and inform future decisions.



Actively manage

At localities where coastal hazard risks have been identified, the adaptation response is to proactively manage the risk through implementing a range of adaptation options. Adaptation options will be tailored to each locality, incorporating site-specific processes, community input, and statutory planning considerations. If, over time, the risk profile is observed to increase (as indicated by local trigger levels), and active management becomes infeasible (due to economic or other factors), then the adaptation response may shift to transition requiring a change in land use or relocation of assets.



Transition and change

In some specific areas within a community, if the coastal hazard risk profile is very high, and active management becomes infeasible (due to economic or other factors), a strategic decision may be made in consultation with the local community to transition to an alternative land use. Transition is likely to be a gradual process over time, where mitigating hazards for a period is part of the transition process. A range of adaptation options will be part of the transition process.

Table 5. Adaptation response by reporting region and community (all coastal hazards)

Reporting region	Present day	2060	2100	Comment
Yarrabah township	Monitor (Look and learn) 	Actively manage 	Actively manage 	The risk from open coast erosion and tidal inundation is currently low, however, storm tide risk is presently medium. The risk from these coastal hazards is expected to increase by 2100.
Wungu	Avoid (and maintain) 	Avoid (and maintain) 	Monitor (Look and learn) 	Open coast erosion risk to assets and the coast at Wungu increases by 2100. The risk to assets from storm tide inundation is low at Wungu in the present day and remains low through 2100.
Jilgi	Avoid (and maintain) 	Monitor (Look and learn) 	Actively manage 	The risk to assets and the coastline is low at Jilgi in the present day. The risk from all coastal hazards increases by 2060. Open coast erosion risk to assets and the coast at Jilgi increases by 2100.
Ganyjira	Avoid (and maintain) 	Avoid (and maintain) 	Actively manage 	The risk from storm tide inundation remains low from present day to 2100. Open coast erosion risk increases substantially by 2060 through to 2100. Tidal inundation poses less risk but is expected to increase by 2100.
Buddabadoo	Avoid (and maintain) 	Avoid (and maintain) 	Monitor (Look and learn) 	The risk from coastal hazards remains low through present day to 2060. Tidal inundation is expected to pose a greater risk to assets and the coastline at Buddabadoo by 2100.
Rest of the Yarrabah Shire	Avoid (and maintain) 	Monitor (Look and learn) 	Actively manage 	Generally, the remainder of the Yarrabah Shire coastline is at low risk from coastal hazards in the present day. The risk slightly increases by 2060 and by 2100, a more active approach to management should be taken.

4. How can we adapt to future coastal hazards?

Adaptation options

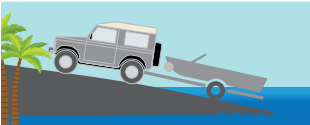
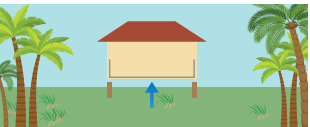
Six themes of adaptation options have been defined for the Our People – Our Place – Our Coast Strategy, with a range of options that relate to avoiding, mitigating and managing the risk of coastal hazards. The themes are:

1. Shire-wide initiatives to enhance community custodianship
2. Planning updates
3. Maintaining and improving infrastructure
4. Nature-based coastal management
5. Coastal engineering and nature-based
6. Coastal engineering.

The range of common adaptation options across these themes are described in Table 6. More detailed descriptions of the options are provided in Supplement C to the Strategy, along with preliminary screening of the relevance of options to different localities.

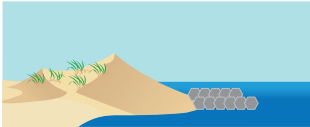
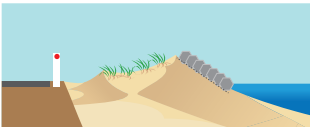
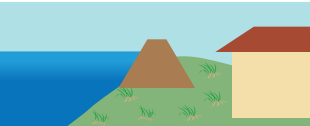


Table 6. Adaptation options by theme

Theme	Adaptation options	Description	Supplement C summary sheet number
Council-wide initiatives to enhance custodianship	Community custodianship	Developing programs and partnerships to enhance stewardship of the coastline	Sheet 1
	Education and knowledge sharing 	Facilitating knowledge sharing and education on coastal values, hazards and adaptation	Sheet 2
	Monitoring 	Monitoring changes in coastal hazard risk and effectiveness of adaptation.	Sheet 3
Planning updates	Land use planning 	Informing statutory planning and strategic plans such as the Yarrabah Master Plan Includes consideration of land purchase or land swap/ relocation	Sheet 4
	Disaster management	Updating emergency response planning	
Maintaining and improving infrastructure	Increase infrastructure resilience  	Modifying critical infrastructure (e.g. raising floor levels) Modifying drainage networks Building resilient homes	Sheet 5
	Relocate infrastructure 	Relocating critical infrastructure	

4. How can we adapt to future coastal hazards?

Table 6. Adaptation options by theme (continued)

Theme	Adaptation options	Description	Supplement C summary sheet number
Nature-based coastal management	Dune protection and maintenance 	Minimising dune disturbance, maintaining vegetation	Sheet 6
Coastal engineering and nature-based	Beach nourishment 	Providing additional sand to the beach	Sheet 7
Coastal engineering	Structures to assist with sand retention  	Using structures (groynes, sand fencing) to help retain sand	Sheet 8
	Structures to dissipate wave energy	Constructing offshore breakwaters or artificial reefs to dissipate wave energy (submerged or exposed)	Sheet 9
	Last line of defence structures 	Constructing seawalls / revetments	Sheet 10
	Structures to minimise inundation 	Constructing levees / dykes	Sheet 11

4.2 Determining adaptation actions

A range of adaptation actions have been identified to enable a strategic approach to coastal hazard adaptation across the Yarrabah coast and to ensure we achieve the goals and aspirations of the community (Section 2.3). A suite of priority actions across the six themes (Table 6) have been defined at a regional and community scale as part of the adaptation response pathway.

The following sections (Sections 5-10) provide an overview of the Shire-wide actions, as well as the actions for each

community. The locality summaries identify exposure and risk to coastal hazards. Actions identified for present day should be considered a priority with the aim to be implemented in the next 5 – 10 years.

The program of priority actions for each community has been informed by a suite of decision-making processes and tools. The decision-making process for determining recommended adaptation options for the Our People – Our Place – Our Coast Strategy is illustrated in Figure 8.

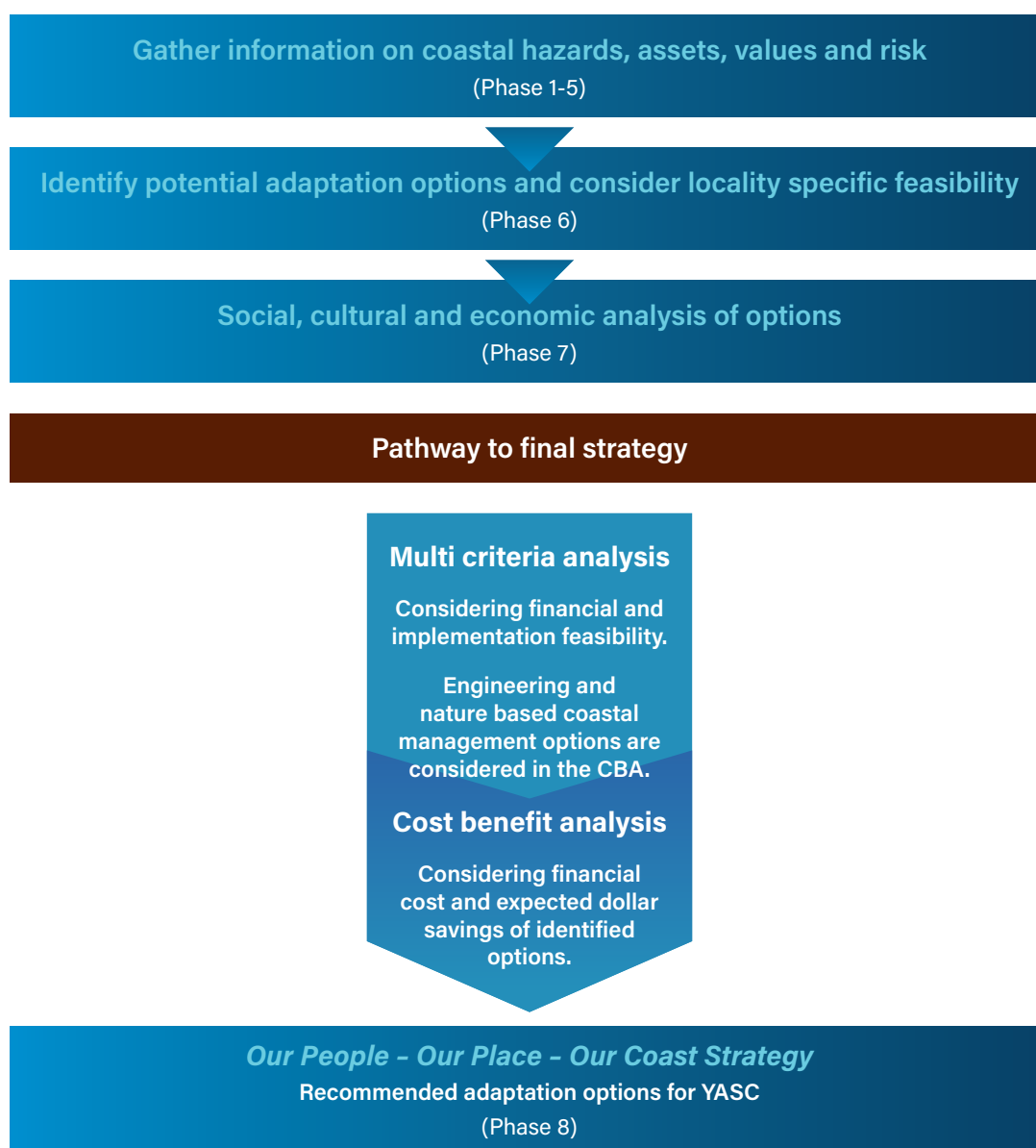


Figure 8. Decision making process for the identification of final adaptation options for Yarrabah.

4. How can we adapt to future coastal hazards?

Multi Criteria Analysis

A Multi Criteria Analysis (MCA) considered the effectiveness of each action in achieving the adaptation objectives as well as general feasibility for the Yarrabah region. This process enabled the identification of some actions that were subject to further economic analysis. It also shows that some actions if implemented would provide good value to the Yarrabah community and help to achieve the adaptation objectives.

Cost Benefit Analysis

A Cost Benefit Analysis (CBA) compared the costs of building and maintaining certain nature-based coastal management and engineering options against the benefits in avoiding damage that each option provided. This analysis provided a purely financial perspective on the feasibility of certain options.

Supporting case studies

Two case studies were also used to consider in more detail the importance of certain assets in achieving the adaptation objectives. Information from these case studies helps to justify certain adaptation options that might not have been financially feasible.



CASE STUDY: Housing and hazards

The first case study examined the forecasted increasing frequency and intensity of coastal hazards that are likely to exacerbate the housing issues in Yarrabah. The 2016 Census estimated occupancy rates in Yarrabah to be approximately 4.8 people per household, based on a population of about 2,900 residents, far above the Queensland average of 2.6. This is important when considering the overcrowding issues that are apparent in the area, as population estimates from local council have put resident numbers closer to 4,000.

This is important to understand as there is a wide range of impacts that can result from overcrowding. Crowded conditions in Indigenous communities can result in poor physical and mental health. More specifically, the social stress resulting from crowded conditions can lead to increased rates of domestic violence, and furthermore that crowding may contribute to increased risk of injury and death from house fires.

Support may be required from State or Federal government to invest in resilient housing. Consideration of other options will still be required, and resilient housing may become one of a package of adaptation initiatives that can be implemented in Yarrabah to avoid exacerbating the impacts of overcrowding.



Combining these decision-making tools

These tools were used together to determine a recommended program of actions that meets the needs of the YASC communities and aim to effectively accomplish the adaptation objectives of the Strategy.

Actions across capacity building, land use planning and modifying infrastructure are the core focus for most localities, combined with some site-specific targeted investigations to inform future updates to the adaptation pathways.

Baseline actions of dune protection and maintenance will be critical for enhancing resilience.

Currently, there is not a strong financial case for structural (engineering) adaptation options in the present day, however, some structural options are expected to become economically viable over time as the risk continues to increase.

Importantly however, there are other drivers that influence the suitability of these options and willingness to invest in the short-term. This includes broader strategic initiatives to maintain access and cultural values.

Results of the economic analysis may also change over time and should be the subject of future Strategy reviews and updates.

CASE STUDY: Nature based solutions providing social and economic outcomes

The second case study examined nature-based solutions in the coastal space and refers to adaptation options that protect from coastal hazards by establishing or restoring natural ecosystems (e.g. establishing a mangrove forest). These solutions often provide additional benefits beyond the pure coastal protection value. These come in the form of ecosystem services such as water quality improvements, habitat provision, and spiritual values, to name a few.

A portion of the economic benefits (i.e. employment) that are derived from this approach are likely to be captured in neighbouring areas (as opposed to within the Yarrabah community). Another approach is to establish a nursery, where the necessary tube stock is grown locally. Employment from this approach could be very beneficial for Yarrabah, where the unemployment rate is close to 50%, much higher than that of Cairns or Queensland as a whole.

The potential benefits of nature-based solutions are diverse, particularly when efforts are made to capture the full economic benefits in the local community. It is possible that setting up a local nursery to provide stock for revegetation activities would help Yarrabah to do this, and therefore this should be considered going forward if nature-based solutions are to be part of Yarrabah's long-term strategy.

5. Shire-wide adaptation actions

The priority actions for the Strategy across the Shire include a range of actions relevant to the six themes identified for the plan:

1. Shire-wide initiatives to enhance custodianship
2. Planning updates
3. Maintaining and improving infrastructure
4. Nature-based coastal management
5. Coastal engineering and nature-based
6. Coastal engineering.

Priority 5 – 10 year actions for each of these themes are summarised in the tables below, with some additional information available in Supplement C. Adaptation response and actions specific to each locality are provided in the location summaries.

Table 7. Shire-wide initiatives

Adaptation actions	2022 Priority strategic actions (completed within 5 – 10 years) * denotes collaboration with other organisations and agencies required for implementation
1. Shire-wide initiatives to enhance custodianship	
1.1. Community stewardship	1.1.1 Establish and implement a dune protection and maintenance program, including establishing a nursery (refer to 1.1.4) that is coordinated by and/or encourages participation by Traditional Owners, Elders, Indigenous Land and Sea Rangers and schools.*
	1.1.2 Seek co-funding/resources for further initiatives through grants and stakeholder partnerships.
	1.1.3 Promote coastal custodianship in the youth and future generations with community dune and coast care events.*
	1.1.4 Investigate opportunity to establish a community nursery linked to market gardens and dune and foreshore revegetation (refer to 4.1.2).
1.2. Knowledge sharing	1.2.1 Establish a coastal working group with key stakeholders (Traditional Owners, Elders, Indigenous Land and Sea Rangers, Council, research agencies and community) to report on monitoring initiatives, collaborate and advise on the management of the Yarrabah coastline, including culturally significant sites.*
	1.2.2 Enhance community adaptive capacity to respond to coastal hazards, including awareness of increasing coastal hazard exposure and risk, and ways to improve individual preparedness and adaptive capacity through training, education and events.*
	1.2.3 Continue to advance partnerships and collaboration with Traditional Owners and Elders to further consider needs and aspirations for Aboriginal and Torres Strait Islander People in coastal hazard adaptation.*
	1.2.4 Promote cross-sector partnerships and initiatives to enhance resilience and strategic adaptation for transport infrastructure, including boating infrastructure.*
	1.2.5 Provide community education and awareness around beach access and impacts on dunes, including responsible pedestrian, 4WD and vessel access (e.g. boat launching).

Adaptation actions	2022 Priority strategic actions (completed within 5 - 10 years) * denotes collaboration with other organisations and agencies required for implementation
1. Shire-wide initiatives to enhance custodianship	
1.3 Monitoring	1.3.1 Establish a system of photo monitoring points (CoastSnap, Fluker Post or similar) at beaches in the area or provide training (see 1.2.2) for Indigenous Land and Sea Rangers in drone monitoring techniques for coastal areas.*
	1.3.2 Establish a water quality monitoring program to understand changes in salinity and saltwater intrusion in the coastal aquifer.
	1.3.3 Create a platform/process for data monitoring and management, identifying synergies and collaboration opportunities with existing monitoring programs and research.
	1.3.4 Establish a monitoring program for sites of cultural significance that measures indicators such as spiritual/social value, archaeological value, physical condition, and protection of sites.*
2. Planning updates	
2.1 Land use planning	2.1.1 Submit updated Erosion Prone Area layers to State Government for formal update to the existing State-wide mapping.
	2.1.2 Use the updated Erosion Prone Area and storm tide mapping and outcomes of the Strategy in current and future Planning Scheme and Master Plan updates to inform decisions on development areas and strategic land use planning.
	2.1.3 Consider implications (within Council) of the Strategy for future development approvals and conditions, including: ▪ Approval conditions for lots of undeveloped land ▪ Implications for future development approvals and conditions.
2.2 Disaster management	2.2.1 Use the updated Erosion Prone Area and storm tide mapping, risk assessment and economic implications to update the Yarrabah Aboriginal Shire Council Local Disaster Management Plan.*
	2.2.2 Review the long-term adequacy of evacuation facilities and evacuation routes, including evacuation by land and sea.*

5. Shire-wide adaptation actions

Adaptation actions	2022 Priority strategic actions (completed within 5 - 10 years) * denotes collaboration with other organisations and agencies required for implementation
3. Maintaining and improving infrastructure	
3.1 Increasing infrastructure resilience	3.1.1 Review at-risk infrastructure (from Strategy data outputs) and embed risks into current asset management plans, Master Plan, and current and future works programs (this could include 'betterment' at critical asset refurbishment/renewals points).
	3.1.2 Review access road renewals and upgrades (prioritisation), and upgrade design requirements and timing of upgrades.
	3.1.3 Promote resilient homes within the community (link in with knowledge sharing initiatives).* - Insist on climate resilient housing when negotiating new housing or housing upgrade programs - Identify and embed operational triggers for simple retrofits, e.g. raising electrical points, hot water systems - Advocate for a State-wide approach to supporting resilient community housing, potentially supported by the Coastal and Estuarine Risk Mitigation Program.
	3.1.4 Consult with utility providers on future services and upgrades, and implications of coastal hazard areas, including the findings of the water quality monitoring program (see 1.3.2).*
	3.1.5 Conduct a community-wide flood and drainage study (linked to 3.1.1).
3.2 Relocate infrastructure	3.2.1 Consider relocating/rebuilding at-risk temporary structures away from fragile and eroding foredunes and rehabilitate sand dunes.
4. Nature-based coastal management	
4.1 Dune and vegetation protection and maintenance	4.1.1 Work with the existing Ranger programs to establish a targeted dune and riparian protection and maintenance program.*
	4.1.2 Revegetate the dunes and foreshore as part of the foreshore precinct plan with native plants and fruit trees along the shoreline where vegetation has been cleared, including educational signage highlighting plant names and their role in coastal protection (linked to 1.2.3 and 1.2.5).*
	4.1.3 Consider areas where fencing can be used to protect native dune vegetation.*
	4.1.4 Establish formal access paths and roads to the shore.*
	4.1.5 Extend the dune protection and maintenance program to include protecting mangroves and marine plants

Adaptation actions	2022 Priority strategic actions (completed within 5 - 10 years) * denotes collaboration with other organisations and agencies required for implementation
5. Coastal engineering and nature-based	
5.1 Beach nourishment	5.1.1 Scope for potential future works, in accordance with adaptation pathway planning.
	5.1.2 Investigate cost-effectiveness and environmental soundness of sand sources for beach nourishment.
	5.1.3 Identify key areas for long term ongoing beach nourishment.
6. Coastal engineering	
6.1 Coastal hazard reduction	6.1.1 Investigate opportunities to further examine the sediment dynamics and coastal processes around YASC communities and the shoreline including: ▪ Geomorphic assessment ▪ Hydrodynamic modelling ▪ Shoreline Erosion Management Plan.
	6.1.2 Investigate suitability of formalising boat ramps and decommissioning existing boat ramps that are impacting foredunes (in conjunction with 4.1.4).
6.2 Coastal hazard protection works	6.2.1 Investigate protection options for key roads at potential risk of being cut due to extreme events. (Point Road to Walba Nguymbi Jetty & Back Beach Road)

6. Yarrabah township

6.1 Coastal landscape

Yarrabah township is the main community within the Yarrabah Shire. The township is north-facing and bordered by False Cape and Cape Grafton. The main settlement is located at the western end of the Yarrabah Beach and the eastern side grades into mangroves. Yarrabah Beach is 3.3 km long and consists of a narrow, low energy high tide strip of sand fronted by tidal flats up to 1 km wide. Offshore from Yarrabah Beach sits the Elam Yarrabah shipwreck, which sunk during a storm in 1934.

Key local values

The coastal zone at Yarrabah township is highly valued by local residents and residents within the Yarrabah Aboriginal Shire region. The coastline holds cultural, social and economic significance. There are culturally significant sites along the foreshore, including the white sand of the beach, sacred sites, Dreaming tracks and two cemeteries on the western and eastern sides of Yarrabah Beach. St Alban's Anglican Church is also a culturally and spiritually important place for the Yarrabah community.

The Yarrabah foreshore is an important source of food, including seafood, fruits and nuts. Boat ramp access for fishing, hunting, and camping adjacent to the sea and beaches is also important for continuing cultural practices and maintaining traditional connections to the coast.



Figure 9. Map of Yarrabah township locality

6.2 Potential impacts from coastal hazards

The Yarrabah township community already observes and experiences the impacts of coastal hazards. Inundation, mostly from tides, impacts the Yarrabah coastline. Anecdotal reports suggest tidal waters come close to Yarrabah State School during annual king tide events. This is caused by dune breaching along small sections on the middle and western side of Yarrabah Beach.

Yarrabah Beach is also susceptible to coastal erosion. Under sea level rise scenarios, coastal erosion is predicted to increase.

Exposure

Yarrabah township already experiences inundation from big tidal events and storm tide in the present day. Low-lying areas around the middle and western side of Yarrabah Beach are most vulnerable. Exposure is likely to increase by 2100, increasing the area of exposure along the entire length of coastline.

Key buildings such as Yarrabah State School and St. Alban's Anglican Church are presently exposed to open coast erosion. Many temporary structures such as beach shacks, tents and humpies are located close to the shoreline and are at risk from coastal hazards.

Risk

Inundation and erosion both pose a risk to assets along the coastline at Yarrabah township. Inundation hazard risk is moderate at present day and increases substantially for low-lying areas by 2100. The current erosion risk is low to moderate but is likely to increase by 2100.

Overview of assets at risk

A small number of buildings are likely to be at low to moderate risk from open coast erosion at the present day. Notable buildings at low risk in the present day include two Yarrabah State School buildings. By 2100, all Yarrabah State School buildings are at low to high risk from erosion. St. Alban's Anglican Church is at extreme risk of impact from open coast erosion by 2060. A small number of houses in Yarrabah township are at risk from erosion from present day to 2100. The level of risk to these houses increases by 2100.

There are few buildings at risk from tidal inundation from present day to 2100. The 'other buildings' at risk increases from 1.6 % to 4.85 % between 2060 and 2100. Yarrabah State School grounds is at moderate risk by 2100, however none of the buildings are expected to become inundated by tidal waters.

There are a number of buildings at moderate risk of storm tide inundation in the present day, including 50 % of the primary school buildings. By 2060, it is expected that St.



6. Yarrabah township

Alban's Church will be at high risk of storm tide inundation. An additional two Yarrabah State School buildings will also be at risk. Some houses in the Yarrabah township are also at low to moderate risk of storm tide inundation. By 2100, all Yarrabah State School buildings are expected to be at risk from storm tide inundation. The number of houses at risk is also likely to increase.

A small number of utilities infrastructure including electrical, telecommunications and water assets are mostly low risk at present day, but the exposure risk and length of these assets are likely to increase by 2100.

YASC 2019 Master Plan

While the Master Plan areas are not yet developed, some of the zones described in the Master Plan are within coastal hazard areas and therefore are considered at risk should development proceed. Zones classified as cultural heritage, infrastructure, sporting facilities, foreshore master plan and

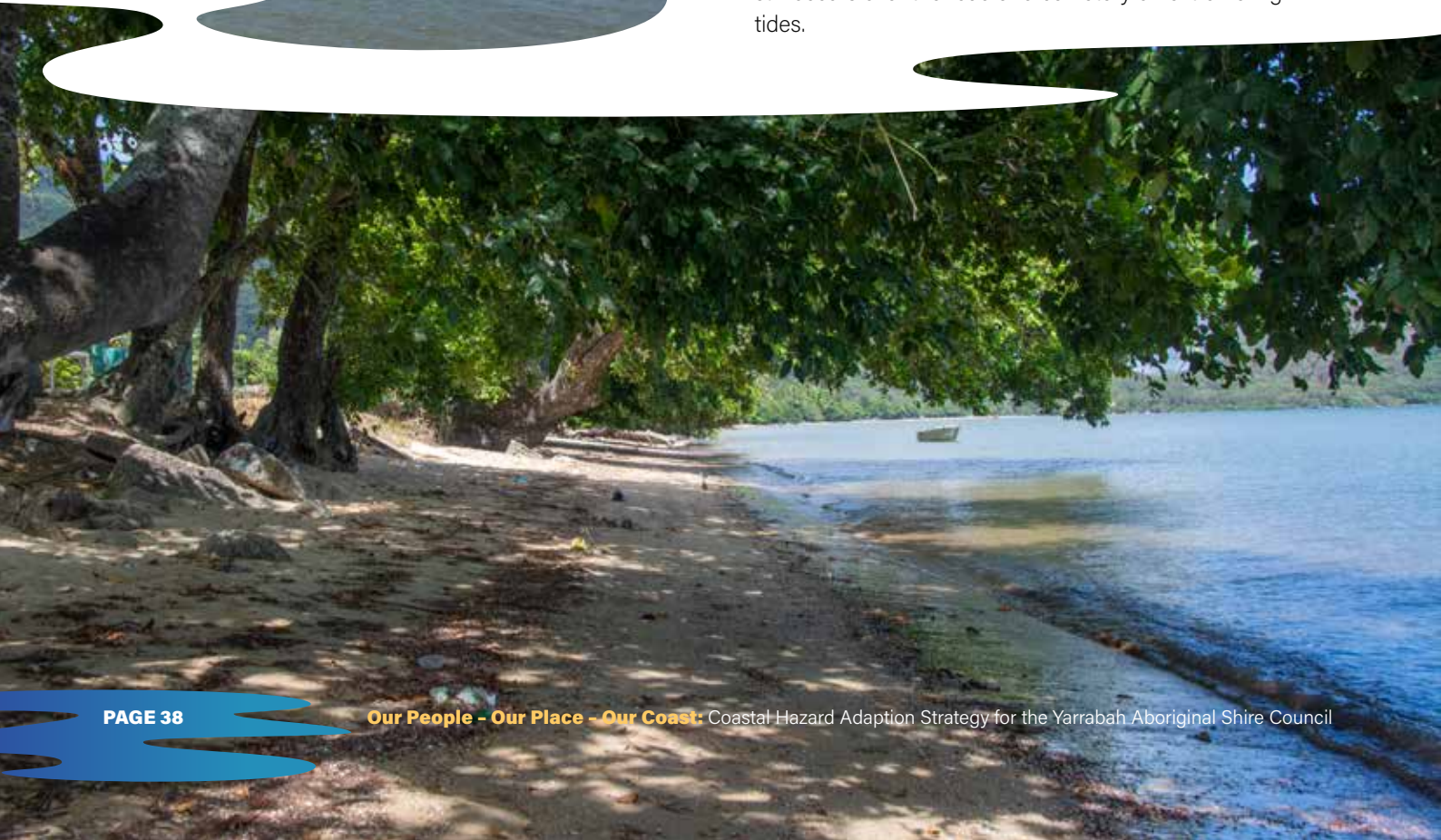
residential areas are within the coastal hazard areas by 2100. For zones such as the foreshore master plan, locating them within coastal hazard areas is unavoidable. Therefore, they should be designed with consideration to withstand natural coastal processes. However, for other future assets, careful consideration should be given as to whether they need to be located within the coastal hazard area or could be relocated away from hazards.

Walba Nguymbi Jetty

The 165 m long Walba Nguymbi jetty at Gribble Point in Mission Bay has recently been completed on a new \$11.5 million project (Queensland Government 2020). This jetty is envisioned to enhance the accessibility of future tourism ventures within Yarrabah, with its infrastructure critically located on a coastal environment. Therefore, coastal hazards affecting this site would have major impacts on both the structure's longevity as well as future visitation numbers.

The old cemetery

Located on the western side of Yarrabah Beach, the old cemetery holds significant cultural and spiritual value. Many of the community's Elders are laid to rest here. This site has been impacted by inundation and significant erosion of the adjacent beach in the past which began to expose some buried coffins. At the time, Council installed gravel bags and wire baskets along the shoreline which has so far protected the site from further serious damage. However, inundation still occurs over the road and cemetery on extreme high tides.



6.3 Coastal hazard adaptation

There are a number of priority actions relevant to the six themes identified for the Plan:

1. Shire-wide initiatives to enhance custodianship
2. Planning updates
3. Maintaining and improving infrastructure
4. Nature-based coastal management
5. Coastal engineering and nature-based
6. Coastal engineering.

Recommended adaptation actions for the Yarrabah township locality are summarised in Table 8.

Table 8. Adaptation pathway for Yarrabah township coastline

	Present day	2060	2100
Adaptation response	Monitor (look and learn) 	Actively manage 	Actively manage 
Adaptation Actions			
1. Council-wide initiatives to enhance custodianship	As per Shire-wide actions, including:		
1.3 Monitoring	Establish a water quality monitoring program to understand changes in salinity and saltwater intrusion in the coastal aquifer. Establish a monitoring program for sites of cultural significance that measures indicators such as spiritual/ social value, archaeological value, physical condition, and protection of sites.		
2. Planning updates	As per Shire-wide actions		
3. Maintaining and improving infrastructure	As per Shire-wide actions, including:		
3.1 Increasing infrastructure resilience	Conduct a community-wide flood and drainage study, and investigate immediate works in the vicinity of the old cemetery.	Consider relocating/rebuilding at risk temporary structures away from fragile and eroding foredunes and rehabilitate sand dunes.	
3.2 Relocate infrastructure			
4. Nature based coastal management	As per Shire-wide actions		
5. Coastal engineering and nature-based	As per Shire-wide actions, including:		
5.1 Beach nourishment	Scope potential future works, in accordance with adaptation planning, including sand sourcing study and approvals for beach nourishment at Yarrabah Beach, to protect sites of cultural significance and important buildings and infrastructure.	Create a long-term program for beach nourishment and maintenance. Continue beach nourishment program at key locations.	
6. Coastal engineering	As per Shire-wide actions, including:		
6.1 Coastal hazard reduction	Investigate opportunities to further examine the sediment dynamics and coastal processes around Yarrabah Beach to protect and enhance the white sand. Investigate suitability of formalising boat ramps and decommissioning existing boat ramps that are impacting foredunes along Yarrabah Beach.		
6.2 Coastal hazard protection works			If beach nourishment is not providing adequate protection, trigger the investigation of last line of defence structures (e.g. seawall, revetment).

7. Wungu (Sound of Corroboree Dance)

7.1 Coastal landscape

Wungu is located towards the southern end of the GPBC area in the northern half of the Yarrabah Shire. It is located about 7.5 km southeast of Yarrabah township and it is connected by Wungu Road.

Wungu beach is bounded by a rocky headland at the northern end and extends 4.5 km to meet Jilgi beach. The beach faces southeast and has relatively fine sand. Due to the smaller sand grain size and mild wave conditions, the beach is lower and wider. Locals commonly use this beach for swimming, fishing and launching boats using two informal boat ramps. A sand / gravel road runs behind the beach, with a couple of community buildings (toilet block and concrete meeting shed) as well as temporary structures and tents along the foreshore. A small lake also sits behind the dunes and connects to the ocean at the rocky headland. Wungu Road is classified as a key access route and is likely to experience occasional inundation and landslides from tidal and rainfall events.

Key local values

The coastline is highly valued by the Wungu community, it is the Country of Yarrabah's Traditional Owner group. There is a toilet block and a meeting shed close to the shore where family and community gatherings frequently occur. There is high scenic amenity from the beach with views of Fitzroy Island nearby, however foreshore vegetation is currently being impacted by invasive weed species and the formation of multiple access points to the beach.



Figure 10. Map of Wungu locality



Sandy road along Wungu foreshore and extent of invasive weed species (e.g. Singapore daisy)

7.2 Potential impacts from coastal hazards

This community is isolated and has very few built assets at risk of coastal hazards. However, there is a major personal safety risk to members of the Wungu community living in temporary structures and tents.

Erosion primarily occurs from vehicles driving on a sandy road along the foreshore and using the beach to launch boats. Other erosion concerns stem from heavy rainfall which erodes the beach as runoff flows to the ocean.

Exposure

Coastal erosion is the main coastal hazard impacting the shoreline at Wungu. The entire width of the beach is likely to be impacted by erosion and the exposure is expected to increase in the future. Storm tide and tidal inundation do not currently have as much of an impact on the coastline as erosion however exposure to inundation is expected to increase by 2100.

Risk

The level of risk to open coast erosion is currently medium and is expected to increase to high by 2100. Storm tide and tidal inundation pose less risk currently and are expected to remain low through 2100.

Overview of assets at risk

Assets currently at risk from coastal erosion include the toilet block, meeting shed, unsealed roads, and boat ramp. The assets impacted by storm tide and tidal erosion are minimal.

7.3 Coastal hazard adaptation

There are a number of priority actions relevant to the six themes identified for the Plan:

1. Shire-wide initiatives to enhance custodianship
2. Planning updates
3. Maintaining and improving infrastructure
4. Nature-based coastal management
5. Coastal engineering and nature-based
6. Coastal engineering.

Recommended adaptation actions for the Wungu locality are summarised in Table 9.

Table 9. Adaptation pathway for Wungu coastline

	Present day	2060	2100
Adaptation response	Avoid (and maintain) 	Avoid (and maintain) 	Monitor (look and learn) 
Adaptation Actions			
1. Council-wide initiatives to enhance custodianship	As per Shire-wide actions		
2. Planning updates	As per Shire-wide actions		
3. Maintaining and improving infrastructure	As per Shire-wide actions		
4. Nature based coastal management	As per Shire-wide actions		
5. Coastal engineering and nature-based	N/A		
6. Coastal engineering	N/A		
6.1 Coastal hazard reduction	Investigate suitability of formalising boat ramps		

8. Jilgi (Puffer Fish)

8.1 Coastal landscape

Jilgi is part of the GMYPPBC area in the southern half of the Yarrabah Shire. It is located 9 km south of Yarrabah township and it is connected by an unsealed gravel road.

Jilgi beach is bounded by low rocky outcrops at each end and in the centre of the beach. The beach is 1 km long, faces east and has relatively fine sand. Due to the smaller sand grain size and mild wave conditions, the beach is lower and wider. Back Beach Road reaches the southern end and runs along the right side of the coast. The road runs behind the beach, with temporary structures and tents along the foreshore.

Key local values

Locals commonly use Jilgi beach for swimming and fishing. This community is isolated and has very few built assets and infrastructure.

8.2 Potential impacts from coastal hazards

This community is isolated and has very few built assets at risk of coastal hazards. The potential isolation of the community due to coastal inundation and landslide of the key access road must be considered in future planning.

Additionally, there is a major personal safety risk to members of the Jilgi community living in temporary structures and tents.

Exposure

Back Beach Road is classified as a key access route and is likely to experience occasional inundation and landslides from tidal and rainfall events.

Risk

The Jilgi community is currently considered low risk from coastal hazards. The risk is expected to increase from present day to 2100, particularly with regard to exposure to open coast erosion. The main access roads may be at risk from tidal and storm tide inundation by 2060.



Figure 11. Map of Jilgi locality

Overview of assets at risk

There are some built structures and temporary housing that are located in close proximity to the shoreline and are at risk of exposure to open coast erosion and the risk of exposure increases by 2100.

Back Beach Road is at risk from storm tide inundation by 2060 to 2100. A greater number and extent of assets are also likely to become impacted by coastal hazards by 2100.

Jilgi beach

8.3 Coastal hazard adaptation

There are several priority actions relevant to the six themes identified for the Plan:

1. Shire-wide initiatives to enhance custodianship
2. Planning updates
3. Maintaining and improving infrastructure
4. Nature-based coastal management
5. Coastal engineering and nature-based
6. Coastal engineering.

Recommended adaptation actions for the Jilgi locality are summarised in Table 10.

Table 10. Adaptation pathway for Jilgi coastline

	Present day	2060	2100
Adaptation response	Avoid (and maintain) 	Monitor (look and learn) 	Actively manage 
Adaptation Actions			
1. Council-wide initiatives to enhance custodianship	As per Shire-wide actions, including:		
1.3 Monitoring		Establish a water quality monitoring program to understand changes in salinity and saltwater intrusion in the coastal aquifer.	
2. Planning updates	As per Shire-wide actions		
3. Maintaining and improving infrastructure	As per Shire-wide actions, including:		
3.2 Relocate infrastructure		Consider relocating/rebuilding at risk temporary structures away from fragile and eroding foredunes and rehabilitate sand dunes.	
4. Nature based coastal management	As per Shire-wide actions		
5. Coastal engineering and nature-based	As per Shire-wide actions		
6. Coastal engineering	As per Shire-wide actions, including:		
6.2 Coastal hazard protection works		Scope potential future works, in accordance with adaptation pathway planning, including concept options for a Geotextile Sand Container seawall and rock revetment, to manage increasing coastal hazards along Back Beach Road.	

9. Ganyjira (Crab)

9.1 Coastal landscape

Ganyjira is part of the GMYPPBC area in the southern half of the Yarrabah Shire. It is located directly south of the Jilgi community and connected by Back Beach Road. Ganyjira beach is bounded by rocky outcrops at each end. The beach is 100 m wide and flat at low tide, with very fine sand.

There are some houses at the foreshore as well as tents and shacks tucked away in the dense vegetation. Back Beach Road follows the shoreline very closely. It then transitions into a 4WD track to the mouth of Saltwater Creek (Buddabadoo).

Key local values

Ganyjira beach is a relatively untouched stretch of coastline, it is commonly used by locals for swimming and fishing.

9.2 Potential impacts from coastal hazards

This community is isolated and has very few built assets and infrastructure at risk from coastal hazards. The potential isolation of the community due to landslides and coastal inundation of the key access road must be considered in future planning.

Additionally, there is a major personal safety risk to members of the Ganyjira community living in temporary or informal structures and tents.

Exposure

There are built structures and temporary housing that are exposed to open coast erosion from present day to 2100. Back Beach Road and the 4WD track to the mouth of Saltwater Creek (Buddabadoo) are classified as key access routes and are likely to experience occasional inundation and landslides from tidal and rainfall events.

Risk

The Ganyjira community is currently considered low risk from coastal hazards. The open coast erosion risk is expected to increase in 2060 to 2100. Sections of Back Beach Road are exposed to tidal inundation by 2100. There is limited risk to assets posed by storm tide inundation in the present day.

Overview of assets at risk

The Ganyjira community is currently considered low risk from coastal hazards. The risk to open coast erosion increases from present day to 2100, particularly to some built structures and temporary housing that are located close to the shoreline. Sections of Back Beach Road are also at risk from exposure to open coast erosion and tidal inundation by 2100. This may affect access to the communities, particularly during emergencies.



Figure 12. Map of Ganyjira locality

9.3 Coastal hazard adaptation

There are a number of priority actions relevant to the six themes identified for the Plan:

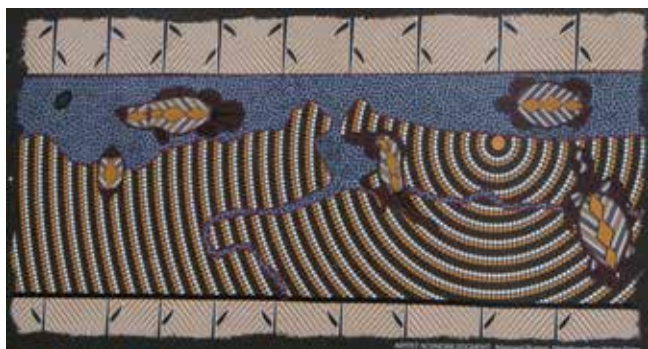
1. Shire-wide initiatives to enhance custodianship
2. Planning updates
3. Maintaining and improving infrastructure
4. Nature-based coastal management
5. Coastal engineering and nature-based
6. Coastal engineering.

Recommended adaptation actions for the Ganyjira locality are summarised in Table 11.

Table 11. Adaptation pathway for Ganyjira coastline

	Present day	2060	2100
Adaptation response	Avoid (and maintain) 	Avoid (and maintain) 	Actively manage 
Adaptation Actions			
1. Council-wide initiatives to enhance custodianship	As per Shire-wide actions		
2. Planning updates	As per Shire-wide actions		
3. Maintaining and improving infrastructure	As per Shire-wide actions, including:		
3.2 Relocate infrastructure			Consider relocating/ rebuilding at risk temporary structures away from fragile and eroding foredunes and rehabilitate sand dunes.
4. Nature based coastal management	As per Shire-wide actions		
5. Coastal engineering and nature-based	As per Shire-wide actions		
6. Coastal engineering	As per Shire-wide actions, including:		
6.2 Coastal hazard protection works		Scope potential future works, in accordance with adaptation pathway planning, including concept options for a Geotextile Sand Container seawall and rock revetment, to manage increasing coastal hazards along Back Beach Road and the 4WD track.	

10. Buddabadoo (Saltwater Creek)



Artist acknowledgement: Maynard Bulmer, Mandingalbay Yidinji Elder

10.1 Coastal landscape

Buddabadoo is part of the GMYPPBC area in the southern half of the Yarrabah Shire. The beach is located southwest of the Yarrabah township, and it is a 6 km long, east-facing beach that remains undeveloped. The beach starts from the low rocky section north of the Saltwater Creek entrance to the low rocky section at the southern end. The beach is steep and narrow with average 0.5 m waves during high wave conditions. During low tide, the beach is fronted by a 50 m wide bar offshore. The beach is backed by densely vegetated and low sand ridges, and it transitions inland to wetland areas and the steep slopes of the Malbon Thompson Range.

Key local values

Most of Buddabadoo remains untouched by development, and it is only accessible by Back Beach Road with no other access roads to the beach. The Buddabadoo community is tucked away in the densely vegetated sand ridges in temporary housing structures.

10.2 Potential impacts from coastal hazards

This area is isolated and has very little in terms of built assets and infrastructure at risk from coastal hazards. However, there is a major personal safety risk to the Buddabadoo community living in temporary housing structures.

Exposure

The southern side of Buddabadoo is accessible via a road that easily becomes inundated during large events and sea level rise. There is also an old timber bridge that is not suitable for transiting. The potential isolation of community due to poor existing infrastructure that is crucial to access must be considered in future.



Figure 13. Map of Buddabadoo locality

Risk

The Buddabadoo community is currently considered to be at low risk from coastal hazards as large sections of the coastline are rocky shores. There are also limited assets within the coastal zone. However, Back Beach Road, the main accessway to the communities in the southern section of the Yarrabah Shire, is at risk of exposure to open coast erosion and tidal and storm tide inundation by 2100. Stormwater runoff resulting from extreme rainfall events may exacerbate risks to the community.

Overview of assets at risk

Assets that may be at risk include roads and other built infrastructure, specifically Back Beach Road, an old timber bridge at a creek crossing, and boat ramp access points close to Buddabadoo mouth. A greater number and extent of assets are also likely to become impacted by coastal hazards in the future.

10.3 Coastal hazard adaptation

There are a number of priority actions relevant to the six themes identified for the Plan:

1. Shire-wide initiatives to enhance custodianship
2. Planning updates
3. Maintaining and improving infrastructure
4. Nature-based coastal management
5. Coastal engineering and nature-based
6. Coastal engineering.

Recommended adaptation actions for the Buddabadoo locality are summarised in Table 12.

Table 12. Adaptation pathway for Buddabadoo coastline

	Present day	2060	2100
Adaptation response	Avoid (and maintain) 	Avoid (and maintain) 	Actively manage 
Adaptation Actions			
1. Council-wide initiatives to enhance custodianship	As per Shire-wide actions		
2. Planning updates	As per Shire-wide actions, including:		
2.2 Disaster management	Review the long-term adequacy of evacuation facilities and evacuation routes, including evacuation by land for the community after bridge upgrade.		
3. Maintaining and improving infrastructure	As per Shire-wide actions		
4. Nature based coastal management	As per Shire-wide actions		
5. Coastal engineering and nature-based	As per Shire-wide actions		
6. Coastal engineering	As per Shire-wide actions, including:		
6.2 Coastal hazard protection works		Scope potential future works, in accordance with adaptation pathway planning, including concept options for a Geotextile Sand Container seawall and rock revetment, to manage increasing coastal hazards along Back Beach Road on the northern side of Buddabadoo.	

Tidal inlet and wetlands in the Wet Tropics Management area at Buddabadoo mouth.

11. Implementation

11.1 Working together

Yarrabah Aboriginal Shire Council recognises a shared responsibility is required for the successful management of coastal hazard risk in the region.

Successful implementation will require continual collaboration and careful coordination between a large number of agencies and organisations as well as a commitment by the local community to protect and look after these fragile environments. Key organisations and their key roles and responsibilities are outlined in Table 13.

Table 13. Key organisations with shared roles and responsibilities for adaptation

Organisation	Key roles and responsibilities in relation to coastal hazard adaptation
Yarrabah Shire Aboriginal Council (YASC)	Council will provide oversight and lead the coordination for the Our People – Our Place – Our Coast Strategy implementation. Council's primary responsibility is the maintenance and protection of Council land and assets, and to inform statutory land use planning. Council will implement the Our People – Our Place – Our Coast Strategy through a range of mechanisms including: • embedding outcomes and actions from the Strategy into existing Council process and activities; and • implementing new initiatives from the Strategy Council's role in adapting to climate change and coastal hazards varies depending on the type and ownership of different assets. Council's role includes to: • Inform the community and all stakeholders the outcomes of relevant Council-led investigations on coastal hazard risk, planning and adaptation options. • Observe and monitor coastal hazard risk for Council-managed land and assets. For land and assets owned or managed by others, YASC may, as part of everyday activities, observe a risk from coastal hazards and will notify the relevant landowner/manager. • Proactively plan and implement strategic planning measures to reduce the risk of coastal hazard impacts on Council managed land and assets, inform appropriate land use and master planning across the region and work together with other agencies and organisations to manage their own risks • Act by implementing strategic planning measures and actions to reduce the risk of coastal hazard impacts on Council managed land and assets, and to inform appropriate land use planning across the region.
Gunggandji-Mandingalbay Yidinji Peoples Prescribed Body Corporate (GMYPPBC)	GMYPPBC holds Native Title over land and waters on the southern half of Yarrabah Shire. It is also the trustee owner of this Aboriginal land. The Gunggandji Mandingalbay-Yidinji Rangers (GMY Rangers) operate in this area.
Gunggandji Prescribed Body Corporate (GPBC)	GPBC holds Native Title over land and waters on the northern half of Yarrabah Shire. It is also the trustee owner of this Aboriginal land. The Gunggandji Land and Sea Rangers operate in this area.

Yarrabah Local Disaster Management Group (LDMG)	LDMGs are established by local governments to support and coordinate disaster management activities for their respective LGAs. In addition to a large number of legislated responsibilities, the LDMG regularly reviews different risks to the community including those associated with coastal hazards. The information in the Our People – Our Place – Our Coast Strategy and associated technical reports should be used to update and inform future risk assessments, planning and response initiatives.
Yarrabah Leaders Forum (YLF)	Yarrabah Leaders Forum may play an advocacy role to support Council and other key organisations.
State agencies	DATSIP is now Department of Seniors, Disability Services and Aboriginal and Torres Strait Islander Partnerships. One of their many roles is to provide whole-of-government leadership in Aboriginal and Torres Strait Islander policy, coordination and monitoring, and the delivery of services in relation to the Our People – Our Place – Our Coast Strategy. Department of Environment and Science (DES) have a role in providing scientific and technical support to YASC to monitor coastal conditions, implement further studies, and designing coastal engineering adaptation options. Department of Communities, Housing and Digital Economy (DCHDE) have a role in community-building through connecting people to services and delivering housing support services. Similarly, QBuild provide building and maintenance works for government-owned assets such as schools, social housing, police stations, and health facilities. Transport and Main Roads (TMR) are responsible for access assets such as roads, boat ramps and the Walba Nguymbi jetty. Wet Tropics Management Authority (WTMA) is responsible for managing the Wet Tropics World Heritage Area within Yarrabah Shire.
Local business and private asset owners	Fact Sheet 3 'Resilient homes' provides some basic information on how buildings can adapt to coastal hazards and become more resilient.

11.2 Summary of priority actions across the Yarrabah region

To guide implementation, a detailed action plan will be developed that includes additional detail on:

- Timeframes for actions
- Costing for priority 5 – 10 year actions
- Instruments, plans and processes (existing, modified, new) required to deliver adaptation options
- Potential funding sources
- Monitoring and evaluation
- Barriers to implementation and change management actions
- Partnership opportunities with stakeholders.

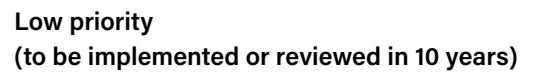
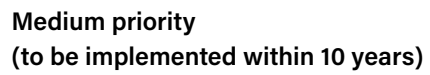
A summary of the priority actions by locality and recommended timeframe for implementation is provided in Table 14.

11. Implementation

 **High priority**
(to be implemented within 5 years)

Table 14. Summary of adaptation actions by locality

Adaptation actions	2022 strategic adaptation actions <i>*denotes collaboration with other organisations and agencies required for implementation</i>
1. Council-wide initiatives to enhance custodianship	
1.1. Community stewardship	1.1.1 Establish and implement a dune protection and maintenance program, including establishing a nursery (refer to 1.1.4) that is coordinated by and/or encourages participation by Traditional Owners, Elders, Indigenous Land and Sea Rangers and schools.*
	1.1.2 Seek co-funding/resources for further initiatives through grants and stakeholder partnerships.
	1.1.3 Promote coastal custodianship in the youth and future generations with community dune and coast care events.*
	1.1.4 Investigate opportunity to establish a community nursery linked to market gardens and dune and foreshore revegetation (refer to 4.1.2).
1.2. Knowledge sharing	1.2.1 Establish a coastal working group with key stakeholders (Traditional Owners, Elders, Indigenous Land and Sea Rangers, Council, research agencies and community) to report on monitoring initiatives, collaborate and advise on the management of the Yarrabah coastline, including culturally significant sites.*
	1.2.2 Enhance community adaptive capacity to respond to coastal hazards, including awareness of increasing coastal hazard exposure and risk, and ways to improve individual preparedness and adaptive capacity through training, education and events.*
	1.2.3 Continue to advance partnerships and collaboration with Traditional Owners and Elders to further consider needs and aspirations for Aboriginal and Torres Strait Islander People in coastal hazard adaptation.*
	1.2.4 Promote cross-sector partnerships and initiatives to enhance resilience and strategic adaptation for transport infrastructure, including boating infrastructure.*
	1.2.5 Provide community education and awareness around beach access and impacts on dunes, including responsible pedestrian, 4WD and vessel access (e.g. boat launching).
1.3. Monitoring	1.3.1 Establish a system of photo monitoring points (CoastSnap, Fluker Post or similar) at beaches in the area or provide training (see 1.2.2) for Indigenous Land and Sea Rangers in drone monitoring techniques for coastal areas.*
	1.3.2 Establish a water quality monitoring program to understand changes in salinity and saltwater intrusion in the coastal aquifer.
	1.3.3 Create a platform/process for data monitoring and management, identifying synergies and collaboration opportunities with existing monitoring programs and research.
	1.3.4 Establish a monitoring program for sites of cultural significance that measures indicators such as spiritual/social value, archaeological value, physical condition, and protection of sites.*



	Yarrabah township	Rest of Yarrabah Shire	Wungu	Jilgi	Gunyjira	Buddabadoo
	●	●	●	●	●	●
	●	●	●	●	●	●
	●	●	●	●	●	●
	●	●	●	●	●	●
	●	●	●	●	●	●
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	●	●	●	●	●	●
	●	●	●	●	●	●
	●	●	●	●	●	●
	●		●	●	●	●
	●			●		
	●	●	●	●	●	●
	●	●	●	●	●	●

11. Implementation

Adaptation actions	2022 strategic adaptation actions
2. Planning updates	
2.1. Land use planning	2.1.1 Submit updated Erosion Prone Area layers to State Government for formal update to the existing State-wide mapping.
	2.1.2 Use the updated Erosion Prone Area and storm tide mapping and outcomes of the Strategy in current and future Planning Scheme and Master Plan updates to inform decisions on development areas and strategic land use planning.
	2.1.3 Consider implications (within Council) of the Strategy for future development approvals and conditions, including: - Approval conditions for lots of undeveloped land - Implications for future development approvals and conditions.
2.2. Disaster management	2.2.1 Use the updated Erosion Prone Area and storm tide mapping, risk assessment and economic implications to update the Yarrabah Aboriginal Shire Council Local Disaster Management Plan.*
	2.2.2 Review the long-term adequacy of evacuation facilities and evacuation routes, including evacuation by land and sea.*
3. Maintaining and improving infrastructure	
3.1. Increasing infrastructure resilience	3.1.1 Review at-risk infrastructure (from Strategy data outputs) and embed risks into current asset management plans/Master Plan (this could include 'betterment' at critical asset refurbishment/renewals points).
	3.1.2 Review access road renewals and upgrades (prioritisation), and upgrade design requirements and timing of upgrades.
	3.1.3 Promote resilient homes within the community (link in with knowledge sharing initiatives).* - Insist on climate resilient housing when negotiating new housing or housing upgrade programs - Identify and embed operational triggers for simple retrofits, e.g. raising electrical points, hot water systems Advocate for a State-wide approach to supporting resilient community housing, potentially supported by the Coastal and Estuarine Risk Mitigation Program.
	3.1.4 Consult with utility providers on future services and upgrades, and implications of coastal hazard areas, including the findings of the water quality monitoring program (see 1.3.2).*
	3.1.5 Conduct a community-wide flood and drainage study (linked to 3.1.1).
3.2. Relocate infrastructure	3.2.1 Consider relocating/rebuilding at-risk temporary structures away from fragile and eroding foredunes and rehabilitate sand dunes.
4. Nature-based coastal management	
4.1. Dune and vegetation protection and maintenance	4.1.1 Work with the existing Ranger programs to establish a targeted dune and riparian protection and maintenance program.*
	4.1.2 Revegetate the dunes and foreshore as part of the foreshore precinct plan with native plants and fruit trees along the shoreline where vegetation has been cleared, including educational signage highlighting plant names and their role in coastal protection (linked to 1.2.3 and 1.2.5).*
	4.1.3 Consider areas where fencing can be used to protect native dune vegetation.*
	4.1.4 Establish formal access paths and roads to the shore.*
	4.1.5 Extend the dune protection and maintenance program to include protecting mangroves and marine plants.

	Yarrabah township	Rest of Yarrabah Shire	Wungu	Jilgi	Gunyjira	Buddabadoo
	●	●	●	●	●	●
	●		●	●	●	●
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11. Implementation

Adaptation actions	2022 strategic adaptation actions
5. Coastal engineering and nature-based	
5.1. Beach nourishment	5.1.1 Scope for potential future works, in accordance with adaptation pathway planning.
	5.1.2 Investigate cost-effectiveness and environmental soundness of sand sources for beach nourishment.
	5.1.3 Identify key areas for long term ongoing beach nourishment.
6. Coastal engineering	
6.1. Coastal hazard reduction	6.1.1 Investigate opportunities to further examine the sediment dynamics and coastal processes around YASC communities and the shoreline including: ▪ Geomorphic assessment ▪ Hydrodynamic modelling ▪ Shoreline Erosion Management Plan.
	6.1.2 Investigate suitability of formalising boat ramps and decommissioning existing boat ramps that are impacting foredunes (in conjunction with 4.1.4).
6.2. Coastal hazard protection works	6.2.1 Investigate protection options for key roads at potential risk of being cut due to extreme events.

11.3 Monitoring, evaluation, reporting and improvement

The Our People – Our Place – Our Coast Strategy will be reviewed every 10 years as a minimum. The next scheduled review of the Plan will be in 2032. The review should include consideration of:

- The degree to which the adaptation actions (planned or unplanned) have been implemented.
- Success of implementation of any adaption actions to date, considering:
 - Integration into Council and stakeholder plans and processes
 - Delivery of on-ground activities
 - Community perspectives
 - Reduction in coastal hazard risk.

Other triggers to update the Strategy including consideration of:

- Any changes in the policy environment (e.g. sea level risk predictions, approach to defining coastal hazard areas).
- Updated technical information or data that may become available.
- Any new development and landscape changes in the region.

	Yarrabah township	Rest of Yarrabah Shire	Wungu	Jilgi	Gunyjira	Buddabadoo
	●			●	●	● Northern beach only
	●			●	●	●
	●			●	●	●
	●	●	●	●	●	●
	●		●			
	● (Point Road to Walba Nguymbi jetty)			● (Back Beach Road)	● (Back Beach Road)	● (Back Beach Road)



12. References

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YASC (2022a). Yarrabah Aboriginal Shire Council Coastal Hazard Adaptation Strategy. Phase 7 Summary Report. Report by Alluvium for Yarrabah Aboriginal Shire Council.

13. Glossary

Term	Definition
Adaptation	Adaptation is adjusting to actual or expected conditions and events. Adaptation can have good or bad outcomes and should be guided by understanding the desired state of being. Good adaptation to coastal hazards means taking action to reduce risk and increase resilience.
Resilience	Resilience is the ability for something to withstand stress and continue to function and recover from damage. Resilience applies to the coastal environment as well as the community. Resilience happens when coastal ecosystems are clean and healthy, and when the community is prepared and safe for coastal hazards.
Coastal Hazards	Coastal hazards are when natural coastal processes threaten local values, properties, or our local way of life. Some coastal hazards include storm tide inundation, erosion, and tidal inundation.
Storm tide inundation	Storm tide inundation is when big storms cause temporarily higher water levels leading to flooding of normally dry land. Storm tide inundation is often accompanied by big waves and strong winds which together can cause widespread destruction.
Erosion	Erosion is when coastal forces such as waves, winds, tides and currents remove sand from the beach and move it offshore. This can cause the shoreline position to move landwards. Big erosion events can threaten buildings, roads and important cultural areas.
Tidal inundation	Tidal inundation is when normal astronomical tides cause flooding of low-lying coastal land. Areas exposed to tidal inundation are expected to periodically flood. With global average sea levels expected to rise, areas effected by tidal inundation are also expected to increase.
Likelihoods	Likelihoods are words to describe how common or rare an event is. Likely events are expected to happen regularly and multiple times within the average lifespan. Possible events are expected to happen every so often and a few times in the average lifespan. Rare events are unusual and might occur once or twice in the average lifespan.
AEP	Annual Exceedance Probability, or AEP, is the likelihood that certain conditions will occur in a given year. AEP values are based on computational modelling that considers measured coastal data and multiple thousands of simulated scenarios.
Planning horizons	Planning horizons are points in the future for which strategic decisions are made. This Strategy considers planning horizons of present day (2020), 2060, and 2100.
Risk	Risk is the possibility of loss, damage, or injury. In a coastal context, risk arises from exposure to coastal hazards such as storm tide inundation, and erosion. Risk can be measured by considering both the likelihood and consequence of loss, damage, or injury.
Avoid (and maintain)	Prevent new risks from occurring and avoid placing new development or assets in coastal hazard areas.
Monitor (look and learn)	Watch for any changes to the coast that might indicate a change in the risk; collect and record information about important cultural sites and places in a culturally appropriate manner.
Actively manage	Proactively manage or reduce the risk of coastal hazards through a range of adaptation options including custodianship, care for country, and in some cases, physical intervention
Transition and change	Gradually change what an area is used for. This might include relocating buildings or assets to an area that is safe from coastal hazards



Supplement A - Fact Sheets

What is a Coastal Hazard Adaptation Strategy

FACT SHEET #1



OUR COASTAL PARADISE

What is a Coastal Hazard Adaptation Strategy?

Council is developing a long-term strategy to help manage coastal erosion and flooding of low-lying areas by sea water (known as coastal hazards) over the next 80 years. This will assist us to understand current and future coastal hazard impacts on our coastline and communities.

The strategy looks at coastal hazards and the risk of harm to buildings and infrastructure like boat ramps, coastal plants and animals, and culturally significant places. It also looks at how we can protect and adapt to future climate-related changes.

This work will:

- Be inclusive of landholders and stakeholders, including Traditional Owners, residents, industry, tourism sector, community groups, and asset owners.



- Share knowledge on coastal hazards and risks to communities, stakeholders and businesses.
- Develop skills and knowledge to enable Council staff and other stakeholders to gain additional understanding on managing coastal hazards and building important partnerships.
- Focus funding on building long-term resilience rather than short-term recovery/reconstruction.

The Strategy development is funded by the Queensland Government and the Local Government Association of Queensland (LGAQ) through the QCoast2100 Program. We are one of over 30 Queensland coastal councils participating in the process.



What is a Coastal Hazard Adaptation Strategy

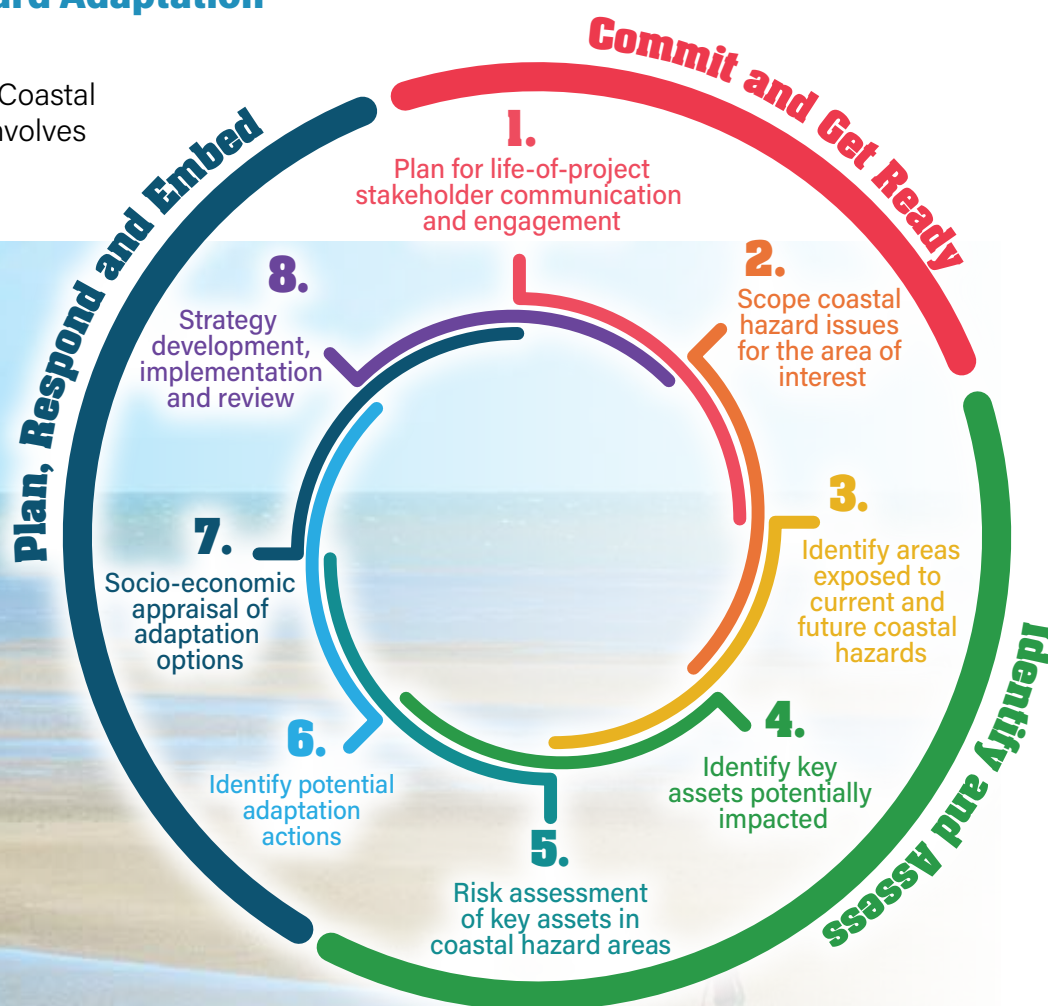
FACT SHEET #1



OUR COASTAL PARADISE

How is a Coastal Hazard Adaptation Strategy developed?

The process for developing a Coastal Hazard Adaptation Strategy involves 8 connected phases or steps.



More information about the process can be found at:

<http://www.qcoast2100.com.au>

Sand dunes

FACT SHEET #2

Council is developing a long-term strategy to help manage coastal erosion and flooding by sea water (known as coastal hazards). This will assist us to understand current and future coastal hazards and the impacts on our communities. One way you can do your bit is by protecting our sand dunes.

What are sand dunes?

Sand dunes can be very fragile and are an essential part of the coastline.

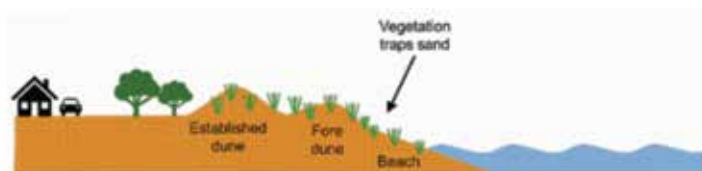
Sand dunes are created when sand is blown inland from the beach, forming small hills. These hills can become covered by different types of plants. Their roots work together to trap sand and keep the dune stable over time.

Why are sand dunes important?

Our coastlines and sand dunes are always changing as wind, tide and waves move the sand. Erosion and flooding can occur during storms and very big king tides.

In a large storm, sand dunes provide a protective barrier to the land behind. Sand is eroded from the dunes, but will re-build again afterwards. Native vines and grasses help to stabilise the dunes and larger trees help block big winds.

Sand dunes are also an important home for special plants and animals. Shorebirds feed and nest in the dunes and crabs bury into the sand. Sea turtles also lay their eggs in the sand dunes.



OUR COASTAL PARADISE



Why do we need to protect sand dunes?

Even though sand dunes act as a natural barrier, they are very sensitive to certain activities such as 4WDing, fires, weeds and pests. People trampling the sand dunes can also kill plants leaving the fragile dunes unstable and exposed. Once this happens, strong winds and waves can eat away the dunes and remove the sand from the beach. This can also make it harder for the dunes to rebuild.

Many important cultural sites of significance such as very old burial grounds and cemeteries are also located on the dunes and will be damaged forever if driven over with cars or used as camping areas.



Sand dunes

FACT SHEET #2

How can we care for sand dunes?

Sand dunes are critical for a healthy and safe beach, and they provide benefits to both us and the environment.

Some tips for caring for sand dunes:



Only access the beach using marked and dedicated tracks through the sand dunes instead of walking over dune vegetation.



Don't drive on the dunes. Keep cars on the hard sand below the high tide line or behind the dunes. Don't camp on the fore dunes. Stay behind the dunes and remove all rubbish when you go.

If we protect and look after our sand dunes, they will also protect us.



Only plant native or local plants on or around the dunes. These plants can out-compete native plants that help to keep the dune stable. Instead we can plant native dune grasses and tree seedlings.



Leave large pieces of dead wood on the dunes, do not remove to light fires. Fallen trees and driftwood also play a role in stabilising the sand dune and creating homes for small animals.

More information about the process can be found at:

<http://www.qcoast2100.com.au>



OUR COASTAL PARADISE

Resilient Homes

FACT SHEET #3



OUR COASTAL PARADISE

What does a resilient home look like?

In coastal areas, buildings may be exposed to impacts from coastal hazards, including flooding associated with big storms. Smart choices in the design of your home can reduce the impact of flooding. If rebuilding, renovating, or constructing a new building, it is worth considering these top tips to increase resilience.

Some of these changes may have higher costs right away, but provide a longer term benefit. Making these changes over time can reduce damage from future flooding, and help you get back to normal quicker after a flood event.

Top tips for a resilient home:



Living room

Raise TVs, speakers, WiFi modems and other electricals above waist height or mount on walls if possible to reduce damage during a flood



Kitchen and laundry

Raise fridges, freezers, kitchen appliances and cupboards on plinths or stands with removable kickboards to reduce damage and make cleaning up easier



If replacing electrical appliances think about appliances which can be lifted or placed in higher locations such as a front-loading washing machine on a shelf or plinth instead of a top loader on the ground.

Bedroom

Metal or raised bed frames and other furniture will be easier to clean up than divan or upholstered furniture

Outside

Place work benches along the inside of garage walls to help reinforce the walls and reduce damage from floodwaters and strong winds

Around the house

Raise electrical power outlets above waist height to reduce damage during a flood and allow power to be restored more quickly

Look at different floor and wall covering options. Tiles and waterproof grout are much easier to clean after a flood than wallpaper or carpet

Bathroom

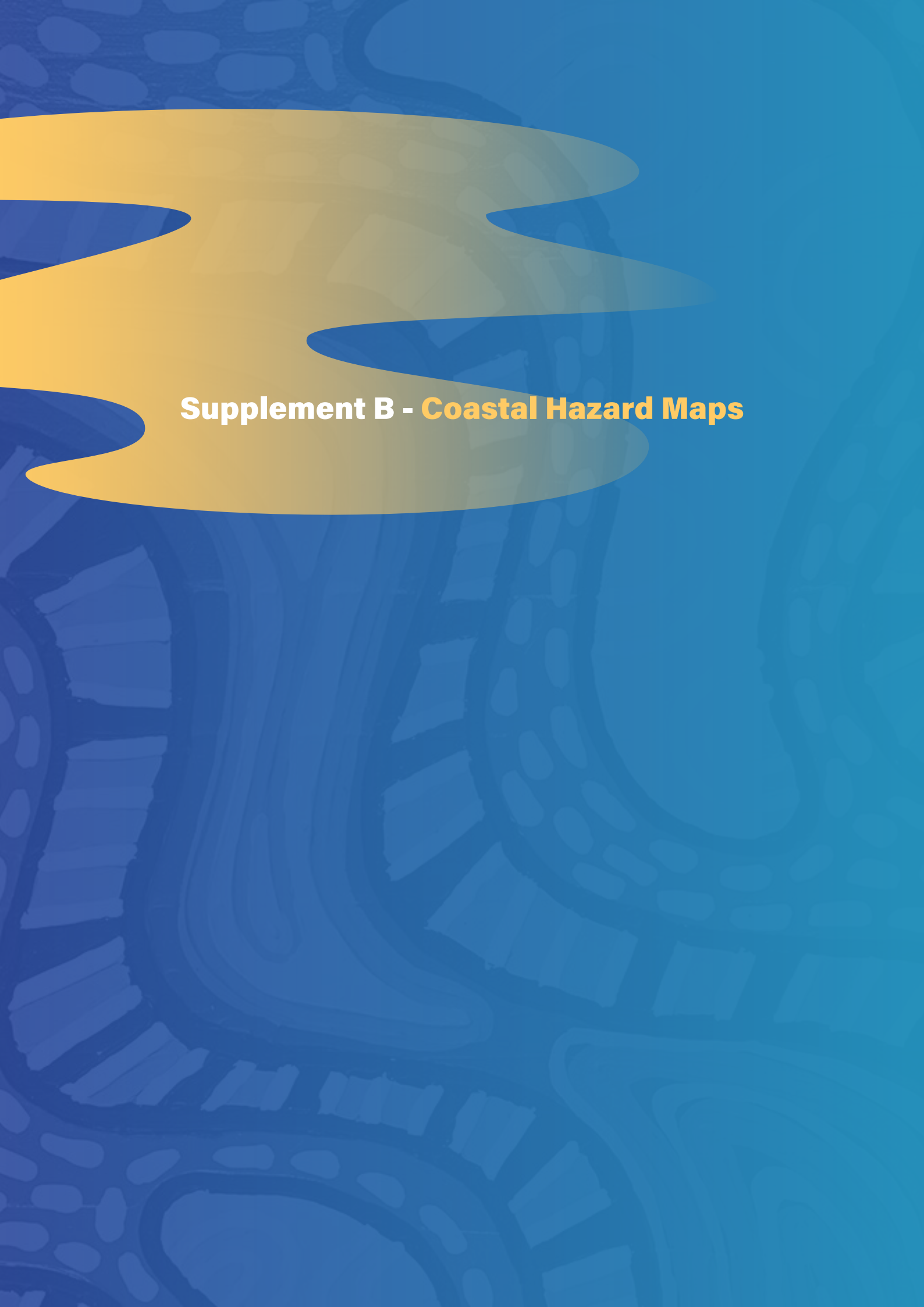
If fitting a new bathroom, think about a free-standing bath or shower that is easier to clean around after a flood rather than a fixed bath



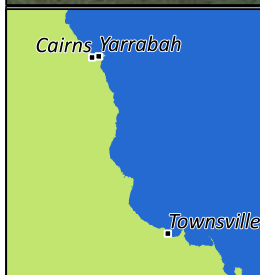
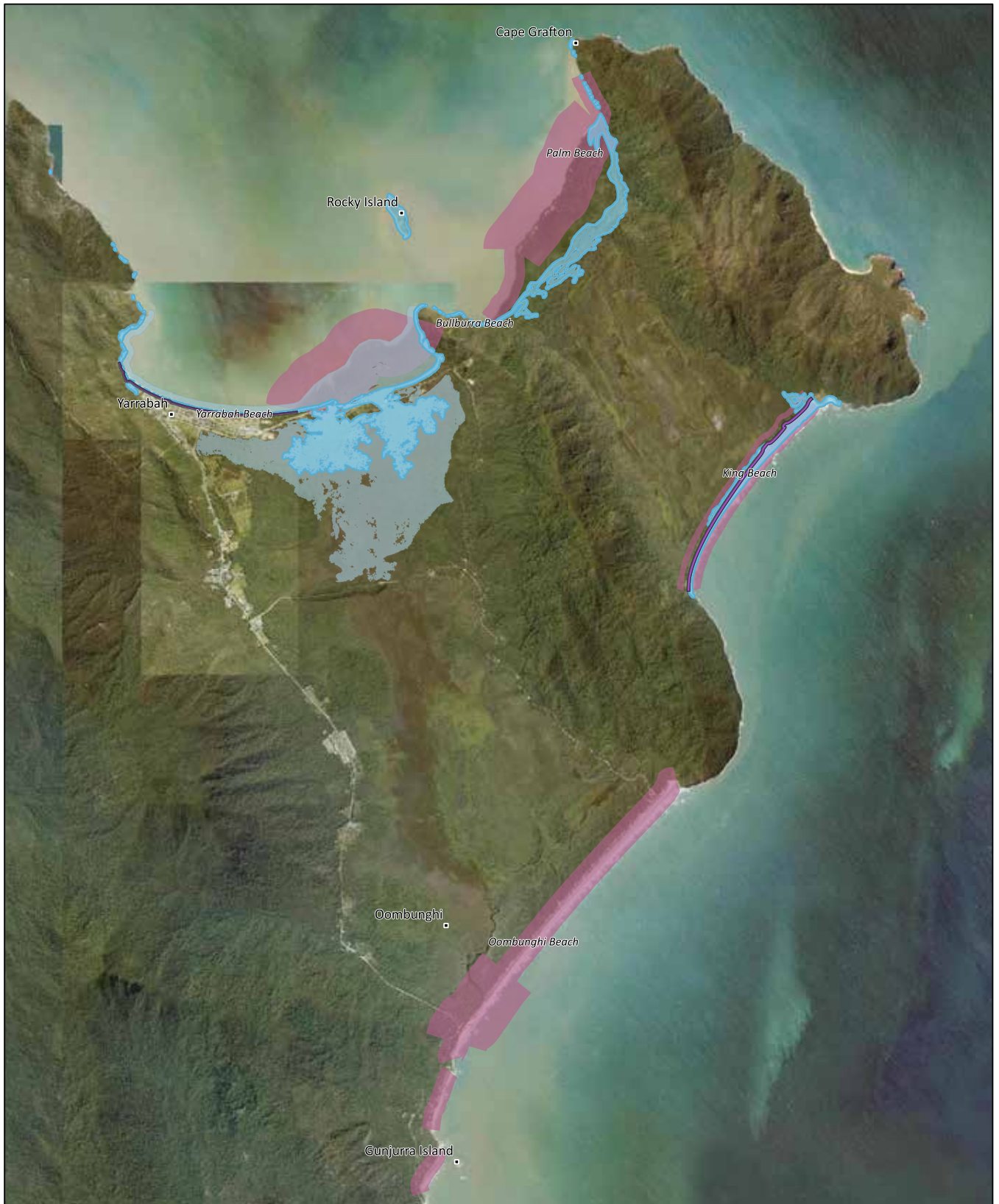
NOTE: Qualified tradespeople should be consulted as part of building modifications, especially for any structural and electrical alterations.

Further ideas for resilient homes can be found here:

- Flood Resilient Building Guidance for Queensland Homes - https://www.qra.qld.gov.au/sites/default/files/2019-04/flood_resilient_building_guidance_for_queensland_homes_-_april_2019.pdf
- Flood Resilient Homes Program - <https://www.citysmart.com.au/floodwise/>
- Flood-resilience strategies - <https://www.citysmart.com.au/wp-content/uploads/2018/07/FWHS-Floodresilience-Strategies.pdf>
- Rebuilding in storm tide prone areas - <https://therocknews.files.wordpress.com/2011/08/draft-part-1-lowres1.pdf>

The background of the page is a stylized map of coastal features. It includes a large, irregular yellow shape on the left side, which resembles a bay or a large body of water. The rest of the background is a blue-toned map showing various coastal features, including what appears to be a river delta or a complex network of waterways and land parcels. The map is rendered in a simplified, almost abstract style with different shades of blue and yellow.

Supplement B - Coastal Hazard Maps



Areas prone to coastal erosion processes

- Present-day Likely (2% AEP)*
- Present-day Possible (1% AEP)*
- Present-day Rare (0.2% AEP)*
- State calculated erosion distance
- Present-day Default erosion area (HAT +10m horizontal)
- Present-day HAT (with vegetation - modelled)*
- Present-day HAT (without vegetation - bathtub)**

* only mapped for Yarrabah Beach and King Beach

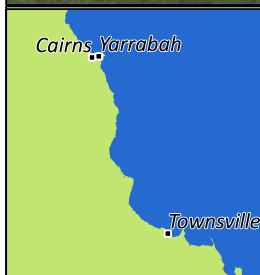
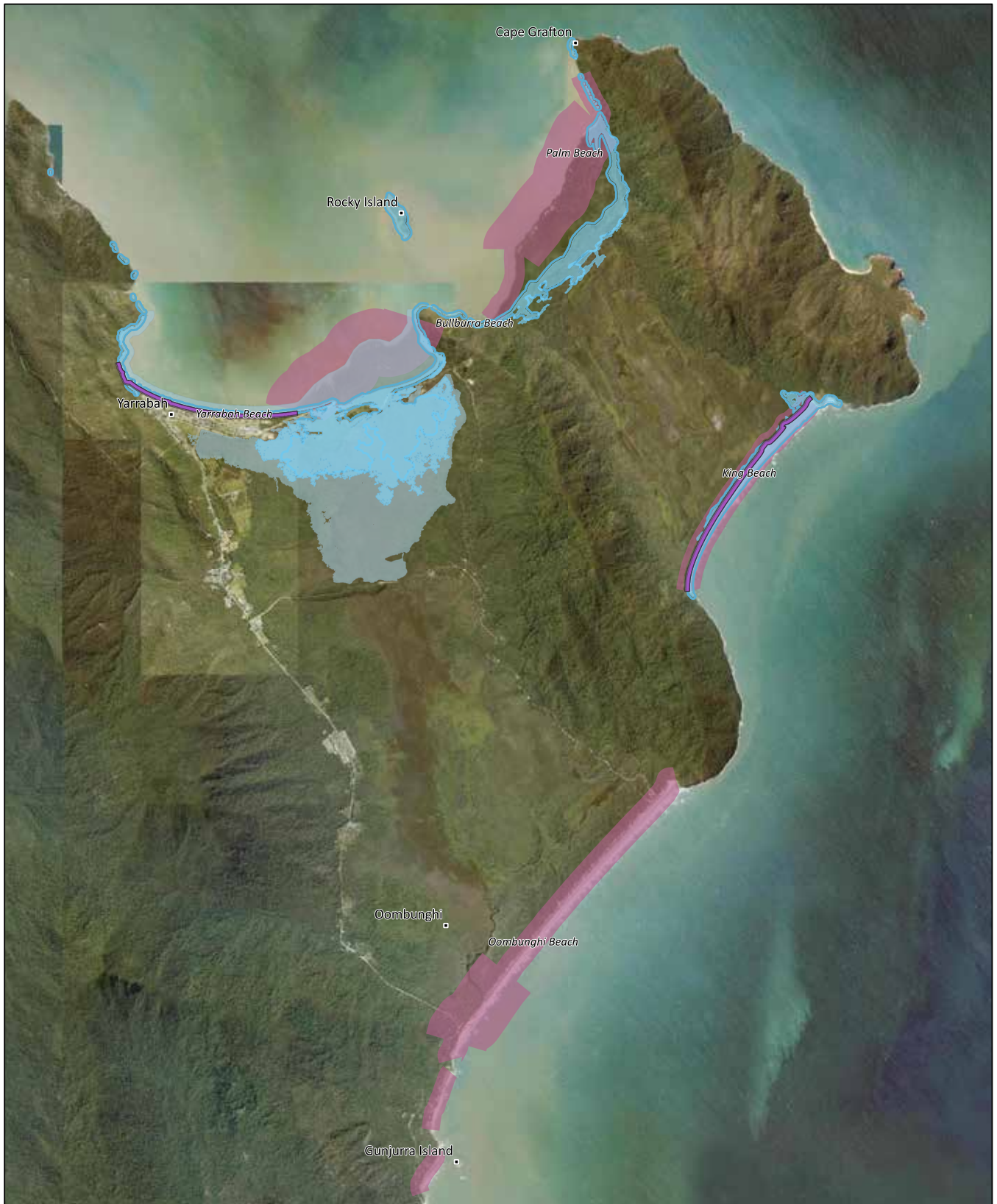
** only mapped for Yarrabah Beach, King Beach and Oombunghi Beach

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Areas prone to coastal erosion processes

- 2060 Likely (2% AEP)*
- 2060 Possible (1% AEP)*
- 2060 Rare (0.2% AEP)*
- State calculated erosion distance
- 2060 Default erosion area (HAT +25m horizontal)
- 2060 HAT (with vegetation - modelled)*
- 2060 HAT (without vegetation - bathtub)**

* only mapped for Yarrabah Beach and King Beach

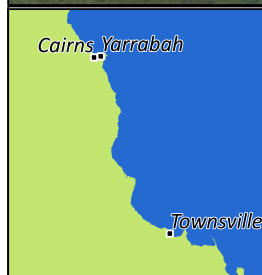
** only mapped for Yarrabah Beach, King Beach and Oombunghi Beach South

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Areas prone to coastal erosion processes

- 2100 Likely (2% AEP)*
- 2100 Possible (1% AEP)*
- 2100 Rare (0.2% AEP)*
- State calculated erosion distance
- 2100 Default erosion area (HAT +40m horizontal)
- 2100 HAT (with vegetation - modelled)*
- 2100 HAT (without vegetation - bathtub)**

* only mapped for Yarrabah Beach and King Beach

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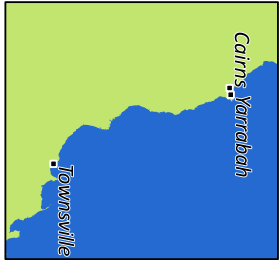
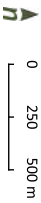
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Areas prone to coastal erosion processes

- Present-day Likely (2% AEP)*
- Present-day Possible (1% AEP)*
- Present-day Rare (0.2% AEP)*
- State calculated erosion distance (HAT +10m horizontal)
- Present-day HAT (with vegetation - modelled)*
- Present-day HAT (without vegetation - bathub)**

** only mapped for Yarrabah Beach, King Beach and Gumbungil Beach
* only mapped for Yarrabah Beach, King Beach and Gumbungil Beach



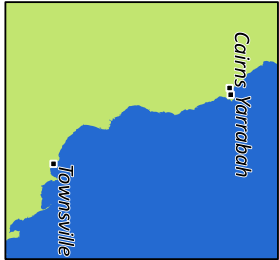
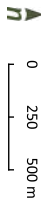
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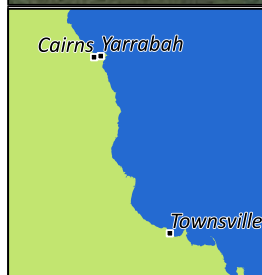
Areas prone to coastal erosion processes

- 2060 Likely (2% AEP)*
 - 2060 Possible (1% AEP)*
 - 2060 Rare (0.2% AEP)*
 - State calculated erosion distance
 - 2060 Default erosion area (HAT +25m horizontal)
 - 2060 HAT (with vegetation - modelled)*
 - 2060 HAT (without vegetation - bathtub)**
- * only mapped for Yarrabah Beach and King Beach
** only mapped for Yarrabah Beach, King Beach and Gumburgh Beach



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Present day storm tide inundation extents

- Likely (1% AEP with vegetation - modelled)*
- Possible (1% AEP without vegetation - bathtub)**
- Rare (0.2% AEP without vegetation - bathtub)**

* only mapped for Yarrabah Beach and King Beach

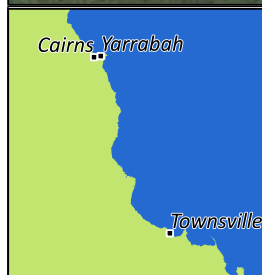
** only mapped for Yarrabah Beach, King Beach and Oombunghi Beach

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2060 storm tide inundation extents

- Likely (1% AEP with vegetation - modelled)*
- Possible (1% AEP without vegetation - bathtub)**
- Rare (0.2% AEP without vegetation - bathtub)**

* only mapped for Yarrabah Beach and King Beach

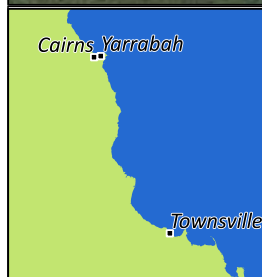
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0 500 1,000 m



2100 storm tide inundation extents

- Likely (1% AEP with vegetation - modelled)*
- Possible (1% AEP without vegetation - bathtub)**
- Rare (0.2% AEP without vegetation - bathtub)**
- State storm tide hazard

* only mapped for Yarrabah Beach and King Beach

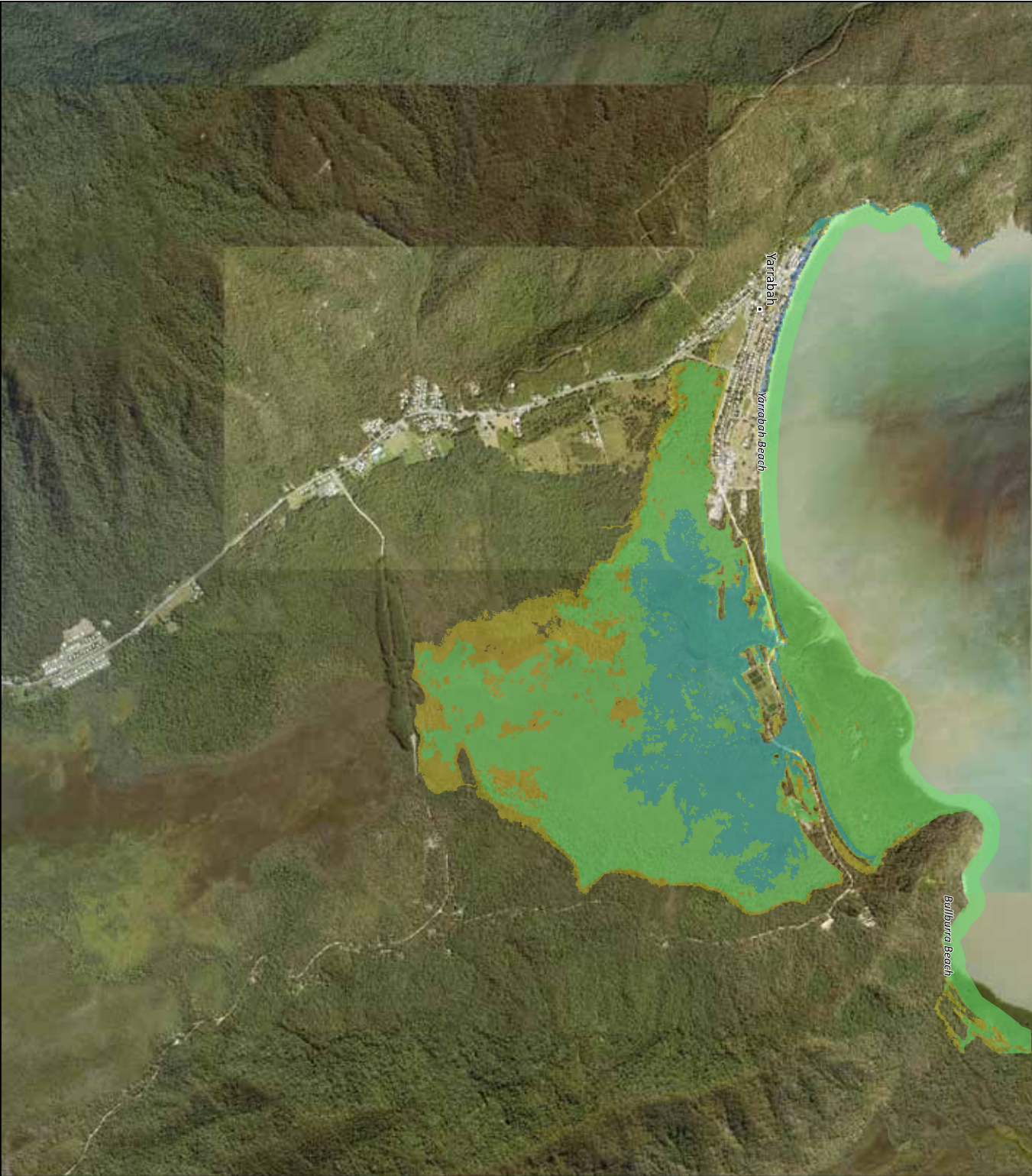
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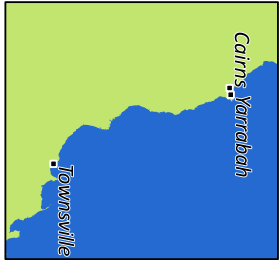
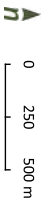
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Present day storm tide inundation extents

- Blue: Likely (1% AEP with vegetation - modelled)*
- Green: Possible (1% AEP without vegetation - bathub)*
- Yellow: Rare (0.2% AEP without vegetation - bathub)**

* only mapped for Yarrabah Beach and King Beach
** only mapped for Yarrabah Beach, King Beach and Camburgh Beach



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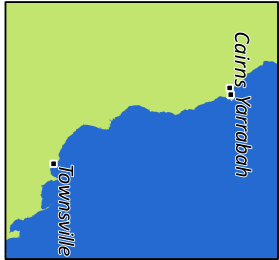
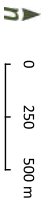
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2060 storm tide inundation extents

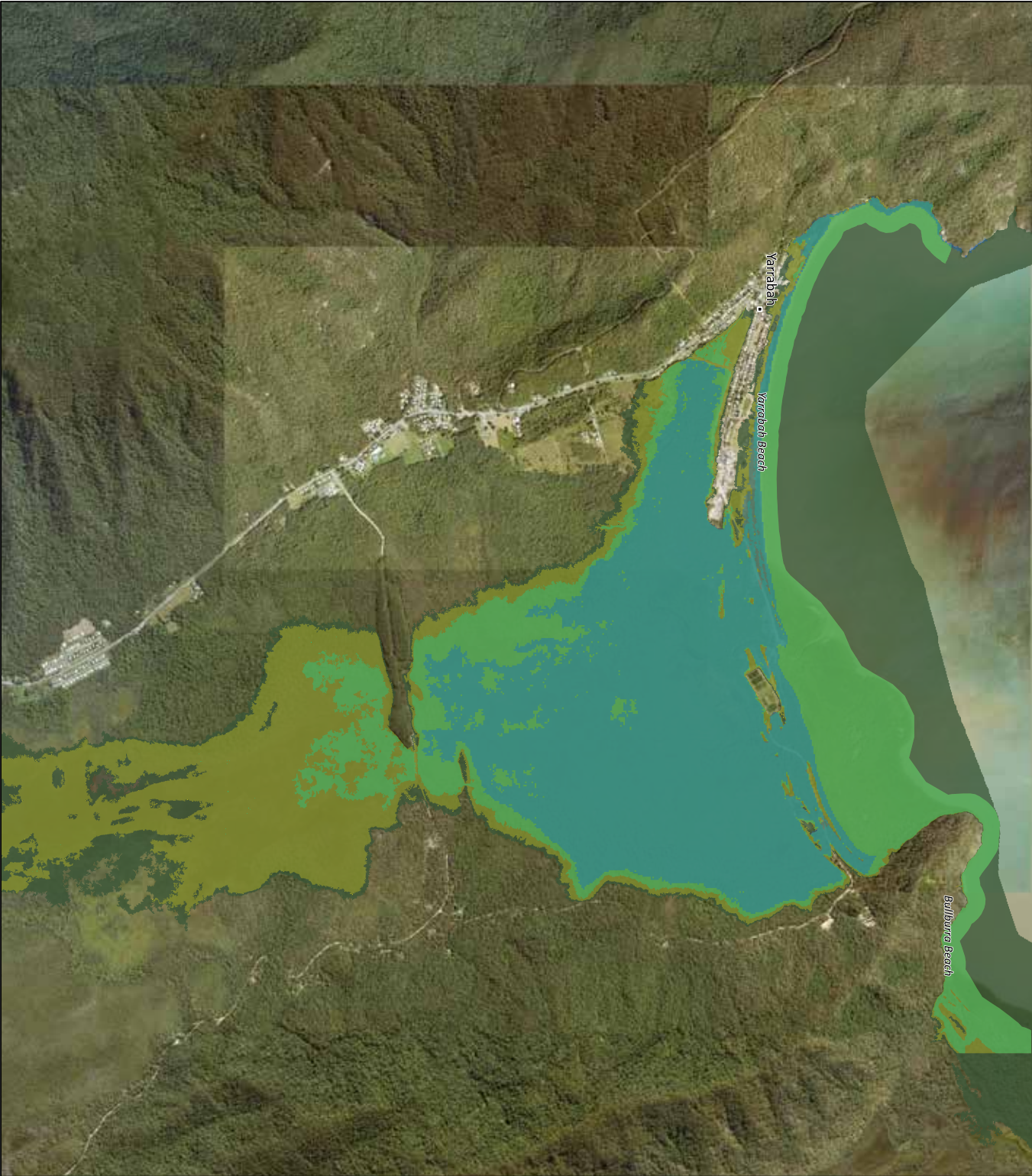
- Blue: Likely (1% AEP with vegetation - modelled)*
- Green: Possible (1% AEP without vegetation - bathub)**
- Yellow: Rare (0.2% AEP without vegetation - bathub)**

* only mapped for Yarrabah Beach and King Beach
** only mapped for Yarrabah Beach, King Beach and Dinnburgh Beach



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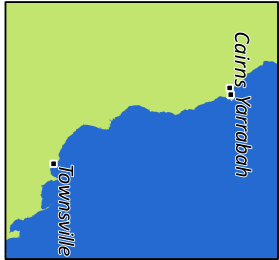
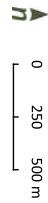
Produced by Alluvium Consulting Australia and Jeremy Benn Pacific.



2100 storm tide inundation extents

- Likely (1% AEP with vegetation - modelled)*
- Possible (1% AEP without vegetation - bathub)**
- Rare (0.2% AEP without vegetation - bathub)**

* only mapped for Yarrabah Beach and King Beach
** only mapped for Yarrabah Beach, King Beach and Gumburgh Beach



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Produced by Alluvium Consulting Australia and Jeremy Benn Pacific.



Supplement C - Adaption Options

SHEET 1 TO 3 – ADAPTATION ACTIONS – SHIRE-WIDE INITIATIVES TO ENHANCE CUSTODIANSHIP

SHEET 1 - COMMUNITY CUSTODIANSHIP

Active community custodianship of the coastline provides a strong foundation for long-term success in coastal management. Supporting the shared care of the Yarrabah coastline will maximise resilience and adaptive capacity.

Enhancing stewardship of the coastline

Community involvement in coastal management is important for enhancing the resilience of our beaches to coastal hazards.

Across the Yarrabah Shire, the coast is an essential part of community wellbeing and lifestyle. Access is important for a range of activities (e.g., boating, fishing). Maintaining access while promoting stewardship is key to achieving balanced management and adaptation.

A priority action for coastal hazard adaptation is the ongoing coordination and support of custodianship initiatives that will seek to further empower and equip Rangers and communities to:

- Contribute to on-ground dune protection and maintenance
- Manage access in a way that seeks to minimise dune disturbance
- Promote and advocate for the care and protection of dune systems
- Share knowledge on observed changes to the coast
- Contribute to monitoring and evaluation of the implementation and success of adaptation actions.



The full range of initiatives and activities that Council may undertake as part of the custodianship program include to:

- Confirm a dedicated role for a Council and/or Ranger officer
- Utilise new communication platforms (website, apps)
- Seek new funding and grant opportunities
- Coordinate and facilitate community events
- Provide support to community/volunteer groups
- Identify complementary activities and synergies
- Seek partnerships and collaboration opportunities
- Deliver education and training programs

- Promote use and development of innovative tools and products
- Encourage participation and awareness.



Dune protection and maintenance

As a priority, to provide best possible outcome for coastal hazard protection, community custodianship should have a strong focus on dune protection and maintenance. Community involvement may include:

- Fencing and creating designated walkways
- Pest, weed and litter control
- Native revegetation (where appropriate)
- Education and awareness (giving talks)
- Protecting cultural sites
- Surveys – coastal user groups, values, activities
- Contributing to the monitoring program – photo points and on-ground monitoring.

A suggested program that could meet many of these requirements and have added benefit of employment for the region would be a community nursey.

Relevant and priority areas

Delivery of community stewardship program initiatives is a priority across all localities.

Community stewardship		
Reporting region	Programs and partnerships to enhance stewardship of the coastline	Dune protection, maintenance and monitoring
Reporting region 1: Yarrabah township		
Reporting region 2: Rest of Yarrabah Shire		
Community 1: Wungu		
Community 2: Jilgi		
Community 3: Ganyjira		
Community 4: Buddabadoo		

	Relevant / feasible
	Priority
	Not applicable

SHEET 1 TO 3 – ADAPTATION ACTIONS – SHIRE-WIDE INITIATIVES TO ENHANCE CUSTODIANSHIP

SHEET 2 - KNOWLEDGE SHARING

An important element to growing adaptive capacity is knowledge sharing. Knowledge sharing includes initiatives to promote education and awareness of coastal hazards, what the adaptation options are, and how other agencies and individuals can meaningfully be involved / act to reduce the risk of coastal hazards.

Coordination of knowledge sharing initiatives will further empower and equip stakeholders to:

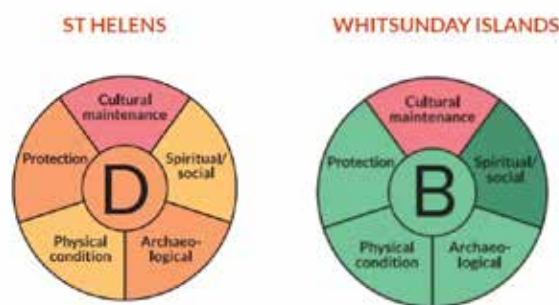
- Understand coastal hazard risk and adaptation options
- Contribute to community custodianship initiatives
- Be informed, empowered and equipped to manage risk to private assets
- Be informed of implementation progress of adaptation actions
- Contribute to monitoring

Initiatives and activities that Council may undertake as part of coordinating a knowledge sharing program include to:

- Establishing a collaborative partnership with Traditional Owners
- Promote collaborative action across stakeholder groups (host meetings, facilitate cross-agency communication)
- Generate communications materials to raise awareness of coastal hazard risk and the adaptation options being implemented
- Seek to manage perceptions on:
 - Levels of risk and tolerance
 - Shared responsibilities in the management of coastal hazard risks
- Communicate the need for adaptive management
- Deliver / facilitate training programs and workshops (and link in with community custodianship education initiatives)
- Coordinate information sharing across agencies (data, maps, monitoring data).

Monitoring of cultural sites of significance

An example knowledge sharing initiative, such as the Cultural Heritage Assessment Report Cards currently in practice in the Mackay-Whitsunday-Isaac region, can help monitor significant sites and provide detailed information on the specific threats impacting them.



Source: <https://healthyriverstoreef.org.au/report-card/cultural-heritage-assessments/>

Indicators such as Spiritual/Social Value, Archaeological Value, Physical Condition, Protection of Sites, and Cultural Maintenance can be assessed regularly by the community.

This can foster a stronger connection and sense of responsibility to these important cultural locations.



Relevant and priority areas

Delivery of knowledge sharing initiatives is a priority action across all localities.

Knowledge sharing		
Reporting region	Facilitating knowledge sharing and education on hazards and adaptation	Other
Reporting region 1: Yarrabah township		
Reporting region 2: Rest of Yarrabah Shire		
Community 1: Wungu		
Community 2: Jilgi		
Community 3: Ganyjira		
Community 4: Buddabadoo		

	Relevant / feasible
	Priority
	Not applicable

SHEET 1 TO 3 – ADAPTATION ACTIONS – SHIRE-WIDE INITIATIVES TO ENHANCE CUSTODIANSHIP

SHEET 3 - MONITORING

Targeted monitoring provides a means to assess how the coastal environment is changing over time, and the effectiveness of adaptation options in mitigating the risk of coastal hazards.

The development and implementation of a targeted monitoring program to inform adaptive management is an important component of all adaptation strategies.

A useful approach to monitoring coastal environments may include:

- Simple and frequent photo point monitoring and on-ground observations suitable for community participation
- Event based monitoring (beach profile elevations)
- More detailed surveys (on-ground or aerial) every 5 – 10 years.

Monitoring observations may include:

- Dune movement
- Erosion extent
- Sand characteristics (colour, grain-size, composition)
- Sand coverage / beach shape
- Vegetation coverage, type, density and health
- High water mark
- Flood extent
- Exposure of rock
- Exposure of structures (i.e., footings, foundations)



Initiatives and activities that Council may undertake as part of a coastal monitoring program include to:

- Establish a photo point monitoring system
- Confirm a program of monitoring actions
- Create a platform and process for data management
- Tailor the monitoring program to align with / inform a 5 - 10 year review of adaptation response and options

Photo point monitoring

Photo posts with a defined outlook/viewpoint can be installed to enable photos to be captured from the same perspective each time. Systems use an email address or online app to help collect and collate photos, creating a photo record over time. This approach provides a simple way for community members and visitors to contribute to monitoring of the beach. Formal or informal versions of this system can be established for any section of coast.



Periodic aerial imagery / drone survey can be added to provide an aerial perspective of shoreline changes over time. The drone surveys can also provide elevation data that can be analysed to quantify changes in the beach profile over time (i.e., dune width, slope, toe position, berm height). Elevation surveys can also be undertaken with on-ground equipment (survey stations and GPS).

Relevant and priority areas

Targeted monitoring is a priority action across all localities.

Monitoring		
Reporting region	Monitoring changes in coastal hazard risk and effectiveness of adaptation	Photo point monitoring
Reporting region 1: Yarrabah township		
Reporting region 2: Rest of Yarrabah Shire		
Community 1: Wungu		
Community 2: Jilgi		
Community 3: Ganyjira		
Community 4: Buddabadoo		

	Relevant / feasible
	Priority
	Not applicable



SHEET 4 – ADAPTATION ACTIONS - PLANNING UPDATES

Planning instruments can assist to mitigate the risk (likelihood and consequence) of coastal hazards, including erosion and storm tide inundation.



Statutory planning / planning scheme

Updated Erosion Prone Area mapping produced as part of Council's adaptation strategy for Yarrabah township can be adopted by State Government and Council. State Government mapping also applies for all other areas of Yarrabah. Council will have reference to the Erosion Prone Areas for planning overlays and controls. These do not trigger immediate updates to Planning Scheme zones or a Planning Scheme review, rather they provide Council with additional information to review the existing zones more comprehensively. The Erosion Prone Areas, together with the Council's adaptation initiatives, will enable Council to:

- Ensure coastal hazards and risks are identified and considered
- Avoid development in high-risk inundation or erosion prone areas, including the current and future Planning Schemes and the proposed Master Plan
- Enable Council to manage and control / condition development and statutory approvals
- Incorporate flexibility and adaptability (i.e., triggers)
- Maintain values that are integral to the community
- Promote/encourage appropriate design and mitigation as part of new developments (resilience opportunities)
- Protect areas of environmental significance
- Plan ahead for required mitigation / transition actions
- Rezone areas unsuitable for new development in long-term.

Other strategic planning

Adaptation response and actions also informs other planning related to infrastructure, open space, foreshore master plans and asset management. The Yarrabah Master Plan is an example.

Integrating an up-to-date understanding of coastal hazards and appropriate mitigation options into existing and new relevant strategies will assist to mitigate risk, enhance resilience, and achieve multiple benefits from adaptation (e.g., aesthetic and recreation benefits combined with risk mitigation). As part of strategic planning, Council may look to consider options of land purchase / swap / relocation for limited areas where coastal hazard risk becomes very high and a long-term transition response is required.

Disaster management

A review and update of emergency response planning based on outcomes of adaptation planning will allow Council to plan accordingly with an aim to minimise the consequence of coastal hazard impacts during extreme events.

Up-to-date understanding of coastal hazard prone areas, likely event magnitudes and extents, and possible access and infrastructure constraints, will improve planning and preparation as well as response and recovery efforts.

Relevant and priority areas

Planning updates are relevant across all localities.

Planning updates			
Reporting region	Statutory planning / planning scheme updates	Other strategic planning – including land purchase / swap / relocation	Update emergency response planning
Reporting region 1: Yarrabah township			
Reporting region 2: Rest of Yarrabah Shire			
Community 1: Wungu			
Community 2: Jilgi			
Community 3: Ganyjira			
Community 4: Buddabadoo			

	Relevant / feasible
	Priority
	Not applicable



SHEET 5 – ADAPTATION ACTIONS – MAINTAINING AND IMPROVING INFRASTRUCTURE

Maintaining and improving infrastructure is a practical way to mitigate the risk (likelihood and consequence) of coastal hazards, including erosion and storm tide inundation.

Upgrading infrastructure

Upgrades can be made to critical infrastructure that cannot be readily relocated out of a coastal hazard zone. Typical upgrades include raising floor levels to reduce inundation risk and changing infrastructure design and materials to be more flood tolerant (reduce the consequence of inundation).



For efficiency, upgrades would typically coincide with upgrades and renewals scheduled in an asset management / maintenance program. Updated coastal hazards zones, identified risks to infrastructure assets, and recommendations from adaptation planning will inform updates to asset management plans.

Relocating infrastructure

Where it is feasible to do so, critical infrastructure can be relocated out of the high-risk coastal hazard zone. This often requires long-term planning as the location of critical infrastructure is driven by demand, and the need to support surrounding settlements and services. Long-term planning is built into asset management plans.

Improving drainage networks

Improving drainage networks in the areas immediately surrounding infrastructure and in the main settlement areas can reduce the duration and consequence of coastal inundation. This should be considered as part of the adaptation strategy and asset management plan for a locality.



Building resilient homes

In coastal areas, public buildings and private dwellings may be exposed to impacts from coastal hazards, including inundation and erosion.

Smart choices in the design of homes can reduce the impact of inundation. This is applicable for rebuilding, renovating, or building a new dwelling. Some of these changes may have higher initial upfront costs but provide a longer term benefit. Making these changes over time can reduce damage from future inundation, and help residents get back to normal quicker after a flood event.

For new buildings it is also possible to design resilient or relocatable housing to reduce the risk from other hazards that the region experiences, including inundation and erosion. These designs may include a lightweight dwelling on piled or pier footings. The design should be undertaken in consultation with the PBCs to understand the community needs.



Relevant and priority areas

Modifying infrastructure is a relevant option to all localities, and a higher priority for areas with higher tidal and storm tide inundation risk.

Modifying infrastructure				
Reporting region	Upgrading infrastructure	Relocating infrastructure	Improving drainage networks	Resilient buildings
Reporting region 1: Yarrabah township				
Reporting region 2: Rest of Yarrabah Shire				
Community 1: Wungu				
Community 2: Jilgi				
Community 3: Ganyjira				
Community 4: Buddabadoo				

	Relevant / feasible
	Priority
	Not applicable

SHEET 6 – ADAPTATION ACTIONS – NATURE-BASED COASTAL MANAGEMENT

SHEET 6 - DUNE PROTECTION AND MAINTENANCE

The dune system is the primary natural defence from coastal hazards. The foredunes dissipate wave energy and protect the land behind from impacts of erosion and storm tide inundation.



Dune protection and maintenance is important to encourage sand to accumulate across the dunes and be stabilised by vegetation. In most cases a well vegetated, stable dune system can be achieved through actively reducing disturbance and facilitating native vegetation establishment.

Native vegetation has an important role in dune development and stabilisation. Native vegetation actively captures wind-blown sand, which accelerates the build-up of dune volume and height, which in turn provides increased protection from coastal hazards to the land behind.

The Yarrabah coastline has extensive coastal dune systems that provide protection from erosion and inundation to many assets. Active protection and enhancement of these dune systems is an ongoing priority action across the region.

Reduce disturbance

Reducing disturbance to the dune system can be achieved and balanced with access needs through fencing, signage, and providing defined / formalised access points and walkways / boardwalks at the most appropriate locations. Minimising through-traffic across the dune system is important to allow native vegetation to establish and contribute to building the dune system. Importantly it can also reduce 4WD access into unwanted areas that can be particularly destructive.

Weed removal and native vegetation regeneration

Native vegetation is best adapted to the role of enhancing dune development and stability in different localities. Exotic / weed species can inhibit native vegetation establishment, and therefore controlled weed removal is an important part of dune protection and maintenance. In most locations, controlled weed removal, combined with reduced disturbance, will be sufficient to allow native vegetation to regenerate from existing seed banks.



Revegetation (if required)

In some cases, if the native vegetation seed bank has been diminished due to clearing or other disturbance, revegetation with local species may be required as part of dune protection and maintenance. Vegetation plans can be tailored to consider suitable species, access, views and other site-specific needs. Matting (geo-fabric) can be used to stabilise dunes while new vegetation establishes.



Relevant and priority areas

Dune protection and maintenance is a priority action for the sandy open coast localities.

Dune protection and maintenance			
Reporting region	Reduce disturbance (fencing)	Weed removal and encourage native regeneration	Native revegetation if required
Reporting region 1: Yarrabah township			
Reporting region 2: Rest of Yarrabah Shire			
Community 1: Wungu			
Community 2: Jilgi			
Community 3: Ganyjira			
Community 4: Buddabadoo			

	Relevant / feasible
	Priority
	Not applicable

SHEET 7 – ADAPTATION ACTIONS – COASTAL ENGINEERING AND NATURE-BASED SOLUTION

SHEET 7 - BEACH NOURISHMENT

Beach nourishment involves providing additional sand to increase the volume of sand on the upper beach.

Sand can be sourced from quarries, offshore (if appropriate) or other sources. Beach nourishment is typically combined with dune maintenance and protection to enhance resilience to coastal hazards.



Beach nourishment has the benefit of providing increased protection from coastal hazards while maintaining the natural values and aesthetics of the beach and coastline. Beach nourishment is typically achieved through sand scraping or importing sand.



Importing sand

Importing sand to nourish the beach involves sourcing and distributing sand to increase sand volume and build up the dune system. Sand can be placed through a variety of methods, including pumping via a pipeline, sand rainbowing from offshore, or direct profile nourishment and dune nourishment with excavators.



Beach nourishment volumes can be designed to mitigate coastal hazards at specific sites for a number of years. A routine beach nourishment program can often be a more cost-effective adaptation option (with added recreational / aesthetic benefits) for mitigating coastal hazards than last line of defence structures (seawalls).

Sand scraping

Whilst not beach nourishment as new sand is not being introduced to the system, sand scraping can offer protection through the use of natural sand. Sand scraping involves mechanically moving sand from the intertidal zone to the dune or upper beach zone, mimicking the natural beach recovery processes (at an accelerated rate). The overall sediment budget of the beach remains the same.



Relevant and priority areas

A detailed beach nourishment assessment is required wherever major beach nourishment is pursued, to evaluate site specific issues including:

- Potential sources of sediment and longevity of sediment supply
- Characteristics of desired sediment (e.g., colour, grain size, material)
- Volume of material required over the short and long term.

Beach nourishment is relevant to sandy open coast localities.

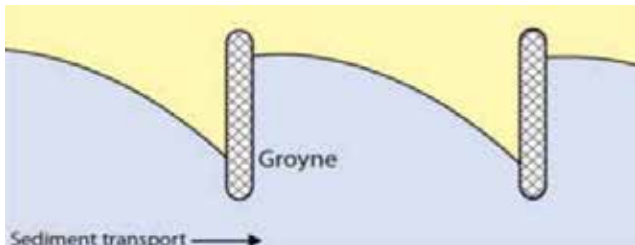
Beach nourishment		
Reporting region	Sand scraping	Import sand to nourish the beach
Reporting region 1: Yarrabah township		
Reporting region 2: Rest of Yarrabah Shire		
Community 1: Wungu		
Community 2: Jilgi		
Community 3: Ganyjira		
Community 4: Buddabadoo		

	Relevant / feasible
	Priority
	Not applicable

SHEET 8 TO 11 – ADAPTATION ACTIONS – COASTAL ENGINEERING

SHEET 8 - STRUCTURES TO ASSIST WITH SAND RETENTION

Structures can be installed to assist with retaining sand in a specific area of the shoreline. Groynes are the most common structure used for this purpose, extending perpendicular to beach. Groynes are typically combined with beach nourishment to provide the most enduring benefit to the beach.



Groynes intercept the longshore movement of sand and assist to retain sand on the beach between structures. Sand will accumulate to the side of the structure where sediment is moving towards. Some localised erosion can occur on the leeside. Permeable groynes allow water to flow through at reduced velocities, while impermeable groynes block or deflect the current.



Groynes can be constructed from a range of materials including rock, geotextile bags (geo-bags), and other materials (sheet piles, gabions, concrete). The design of rock or geo-bag groynes are most common in Australian marine environments, linked to the durability and availability of materials, suitability for design standards, and aesthetics.

Rock groynes

Groynes constructed of rock become relatively permanent features of the landscape. Rock groynes are typically used to assist with retaining large volumes of sand in a localised area on an ongoing basis.



Geo-bag groynes

Geo-bag groynes are becoming increasingly more favourable in coastal management. Groynes are constructed of large geo-textile containers (bags) filled with sand. These groynes will be periodically covered and exposed. Geo-bags have a shorter design life than rock, however they are more suited to adaptive management (can be removed or changed if the management approach changes).



Sand fencing

Sand fencing or brush matting can also be strategically located to encourage sand accumulation in a desired place, generally along the seaward side of existing or newly constructed dunes to promote dune growth. Although it should be noted that this is not a preferred option on its own and vegetation is preferred.

Relevant and priority areas

Groynes are a relevant action for beaches across all sandy beach localities with a dominant long-shore drift direction. The feasibility of groynes is assessed on a site by site basis. Feasibility may change with changing coastal hazard risk and adaptation objectives.

Reporting region	Rock groynes	Geo-bag groynes
Reporting region 1: Yarrabah township		
Reporting region 2: Rest of Yarrabah Shire		
Community 1: Wungu		
Community 2: Jilgi		
Community 3: Ganyjira		
Community 4: Buddabadoo		

	Relevant / feasible
	Priority
	Not applicable

SHEET 6 TO 11 – ADAPTATION ACTIONS – COASTAL ENGINEERING

SHEET 9 - STRUCTURES TO DISSIPATE WAVE ENERGY

Structures can be installed offshore to create a zone where wave energy will break and dissipate prior to reaching the beach. These structures include breakwaters and artificial reefs.

Breakwaters are erosion control structures most frequently placed parallel to the coast. Breakwaters are typically constructed using rock or geo-bags. **Exposed breakwaters** have a crest that rises above the surface of the water, whereas **submerged breakwaters** do not.



Artificial reefs can similarly be used to reduce wave energy and erosion of shorelines and are typically composed of base materials such as rock or geo-bags. They are submerged structures that function through wave dissipation and wave rotation, leading to salient growth in the lee of a reef. To a greater extent than breakwaters, artificial reefs can also be used to enhance marine biodiversity and recreational amenity.



Mangroves

Mangroves have an important role in providing natural dissipation of wave energy. The role of mangrove communities in providing coastal hazard protection is becoming increasingly recognised.

The protection, enhancement, and restoration of mangrove communities along shorelines is becoming a key focus of coastal hazard adaptation initiatives. Where extensive mangrove communities are established, these should be protected and encouraged to expand to provide additional protection for the shoreline from wave energy. This is typically an extension of dune protection and maintenance activities.



Relevant and priority areas

Protection and enhancement of mangroves is a priority across all localities where they are established / can be established.

Breakwaters and artificial reefs require careful design and construction to ensure they work effectively. This is often cost prohibitive for many locations. These options are also unlikely to be relevant to the Yarrabah Shire due to the presence of marine protected areas and the existing barrier reef providing wave attenuation.

Structures to dissipate energy offshore			
Reporting region	Breakwaters	Artificial reef	Mangrove protection and enhancement
Reporting region 1: Yarrabah township			
Reporting region 2: Rest of Yarrabah Shire			
Community 1: Wungu			
Community 2: Jilgi			
Community 3: Ganyjira			
Community 4: Buddabadoo			

	Relevant / feasible
	Priority
	Not applicable

SHEET 6 TO 11 – ADAPTATION ACTIONS – COASTAL ENGINEERING

SHEET 10 - LAST LINE OF DEFENCE STRUCTURES

Last line of defence structures can be used to protect critical assets from coastal hazards. These structures are typically in the form of a seawall that provides a barrier between the ocean and adjacent coastal land.

Seawalls can be vertical or sloped structures and are typically made of rock, concrete or geo-textile containers (geo-bags), and can be designed as buried revetments or exposed walls.

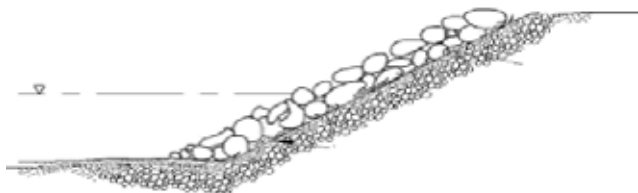


Figure adapted from USACE Coastal Engineering manual

Seawalls are normally very large structures designed to withstand extreme events. A seawall structure must be appropriately engineered to ensure the design (size, height, grade, layers, filters and material) meets the required standards to provide sufficient protection from the local wave climate.



Exposed seawall

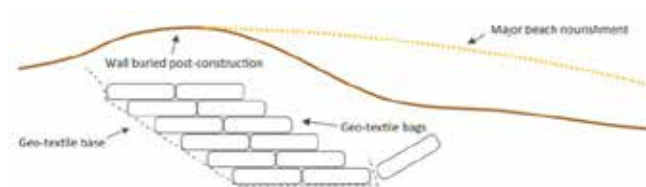
An exposed seawall is a hard barrier to wave energy. Unlike a dune system, a seawall has limited capacity to dissipate (spread out and absorb) energy when it hits the wall. Consequently, waves refract off the seawall and can scour sand from the base, resulting in a change in, or progressive loss of the sandy beach.



An exposed seawall will change the natural aesthetics of the beach and coastline. Exposed seawalls are typically used only as a last line of defence to protect critical assets (a last access road or other critical infrastructure) and in urbanised foreshore environments.

Buried seawall

In some cases, seawalls can be constructed as buried revetments. In these cases, the wall is buried and the dune system revegetated, and effort is made to ensure sufficient sand is retained to keep the wall buried (in all except extreme events).



A buried seawall provides protection from extreme events while maintaining natural beach aesthetics, however it may involve additional costs of periodic beach nourishment to ensure the wall remains buried.

Relevant and priority areas

A seawall in the form of a rock revetment structure along Yarrabah Beach may be feasible to protect existing infrastructure and buildings.



Last line of defence structures

Reporting region	Exposed seawall	Buried seawall
Reporting region 1: Yarrabah township		
Reporting region 2: Rest of Yarrabah Shire		
Community 1: Wungu		
Community 2: Jilgi		
Community 3: Ganyjira		
Community 4: Buddabadoo		

	Relevant / feasible
	Priority
	Not applicable

SHEET 6 TO 11 – ADAPTATION ACTIONS – COASTAL ENGINEERING

SHEET 11 - STRUCTURES TO MINIMISE FLOODING

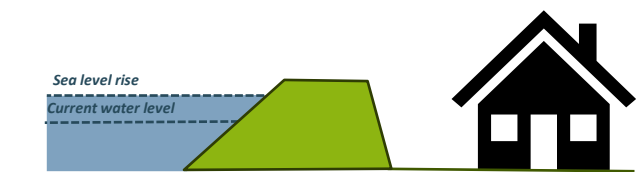
Structures such as dykes, levees and storm surge barriers can be used to protect low-lying coastal land from inundation.



Dykes and levees take the form of elevated mounds or walls that can be made of earth, rock, concrete, geo-fabric bags or other materials.

The terms dyke and levee are often used interchangeably to refer to a structure that prevents water from flooding a specific area. However, dykes more commonly refer to structures that prevent low-lying land from being permanently inundated (land that in the absence of the dyke would be under water).

Levees more commonly refer to structures that prevent land from being inundated from flood events (land that in the absence of the levee would only be occasionally inundated).



Storm surge barriers (tidal barrages or gates) are physical barriers that prevent storm surges travelling inland along rivers, lagoons, inlets or other waterways.



Storm surge barriers can generally be opened and closed and are most effectively implemented at narrow tidal inlets. They can vary in size from a flow valve on pipes and culverts to large scale barrages.



Relevant and priority areas
Structures to minimise inundation of low-lying land (levees and dykes) are relevant to inundation prone areas across all localities/zones.

Structures to minimise flooding			
Reporting region	Dykes	Levees	Storm surge barriers
Reporting region 1: Yarrabah township			
Reporting region 2: Rest of Yarrabah Shire			
Community 1: Wungu			
Community 2: Jilgi			
Community 3: Ganyjira			
Community 4: Buddabadoo			

	Relevant / feasible
	Priority
	Not applicable



