



# OUR COAST

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## **Bundaberg Coastal Hazard Adaptation Strategy**

## Foreword

Bundaberg Region is at the forefront of innovation in natural hazard resilience and adaptation, borne from experience in dealing with a range of challenging events in recent years. The Bundaberg community is also becoming more aware of its natural hazard risk in the wake of these events. Council has a strong focus on natural hazard management and resilience with several programs underway, including the Bundaberg 10 Year Action Plan through the Department of Local Government, Racing and Multicultural Affairs; the Woodgate Shoreline Erosion Management Plan (SEMP); and the Coastal Hazard Adaptation Strategy (CHAS).

In response to coastal change, the State Government and Local Government Association of Queensland (LGAQ) provided funding to Queensland coastal Councils to develop a strategic approach to managing coastal hazards.

The Strategy presents an opportunity to set a new benchmark for how coastal adaptation planning is undertaken in Queensland, through the integration of traditional adaptation planning techniques, stakeholder engagement and adaptation pathways analysis. The Strategy has been driven by and for the affected communities, utilising a co-design approach, with stakeholder engagement being fully embedded within each phase of the project.

There is a range of adaptation options relevant to each coastal community that have been prioritised based on criteria such as risk, community expectation and feasibility. To give the community ownership, these options have been discussed with stakeholders to assist in understanding future response options. Implementation by Council, the community and other partners should be based on the principle of adaptive capacity and capability building over time.

The Our Coast Bundaberg Coastal Hazard Adaptation Strategy enables us to be better prepared to address the impacts of coastal hazards on our communities, environment, cultural values, infrastructure, liveability and services.





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# Our coastal story



*We want to nurture  
the places we love,  
even when things  
might change.*





**Our coastal places are special to all of us in the Bundaberg Region. Whether we live on the coast, work in the coastal towns and villages, or escape to the beautiful beaches and water for a break; our coast is part of who we are.**

Our coast is dynamic. It changes one day to the next. Sand moves with the currents and tides, creating different landforms every day. Flora and fauna move with it, thriving in new habitats over time. New businesses open, new residents arrive. The community shares and values our coast creating endless coastal lifestyle meanings as our community stories evolve.

*As sure as the tide rises and falls, our coast will be slightly different tomorrow than it was today.*

Each part of our coast is different. We love different parts of it for different reasons. Bargara is the bustling commercial and tourist centre. Burnett Heads links us to the export market. Coral Cove and Innes Park are great places to raise a family. Moore Park Beach and Woodgate are little towns full of character. Coonarr, Winfield and Buxton, and the smaller coastal villages provide the quiet life just as it ever was.

We want to make sure we can maintain what we love about our coast, in the face of change from natural hazards like erosion, storm tide inundation, and sea level rise. Understanding and anticipating change means we can plan for it and even prosper despite it.

## Bundaberg community coastal values

You have told us what the coast means to you, and we have listened. The Bundaberg community coastal values are a cycle that drives us, and it drives this strategy.



## People-centred coastal adaptation

People are at the heart of the Coastal Hazard Adaptation Strategy (the Strategy). The community has been part of its development at every step. Successful implementation is dependent on further involvement by individuals, families, businesses, government, and community organisations who share and value our coast.

*Look out for these speech bubbles that express the community's values of the coast*

*"We have a great community spirit here"*

*"Our grandchildren's futures are dependent on the groundwork we apply now. "*



### CASE STUDY

#### Mon Repos Turtle Centre

The new \$22 million Loggerhead Turtle centre at Mon Repos officially opened in early November 2019.

The centre offers a state-of-the-art experience with touchscreen televisions and vivid displays. The centre is now a year-round tourist destination operated by Queensland Parks and Wildlife Service.

The highlight of the centre is the immersive theatre room, where you slip off your shoes and step onto sand as the turtle nesting experience is recreated. Mon Repos supports the largest population of nesting marine loggerhead turtles in the South Pacific and is critical to the survival of this endangered turtle.

No matter what season you arrive you will feel like you're on the beach witnessing these beautiful creatures come home to lay their eggs or watching the babies hatch and make their first journey out to sea. The centre has something for everyone with digital and virtual educational games for kids to teach the life cycle of turtles and conservation efforts.

The Gidarjil Language Centre has developed the interpretive signage to welcome Turtle Centre visitors to the country of the First Nation tribes of the Gooreng Gooreng, Gurang, Taribelang Bunda and Bailai peoples in the Port Curtis Coral Coast Region.

The Mon Repos Turtle Centre is a standout example of nature-based tourism and the new immersive experience is a fabulous addition to the existing nightly turtle encounter tours. Turtle season is a reason to celebrate across the Bundaberg Region and is integral to our coastal values.



# Understanding coastal change



*The dynamic nature of our coast is driven mostly by natural processes that have been happening for hundreds of thousands of years, if not longer.*

# Understanding our coast



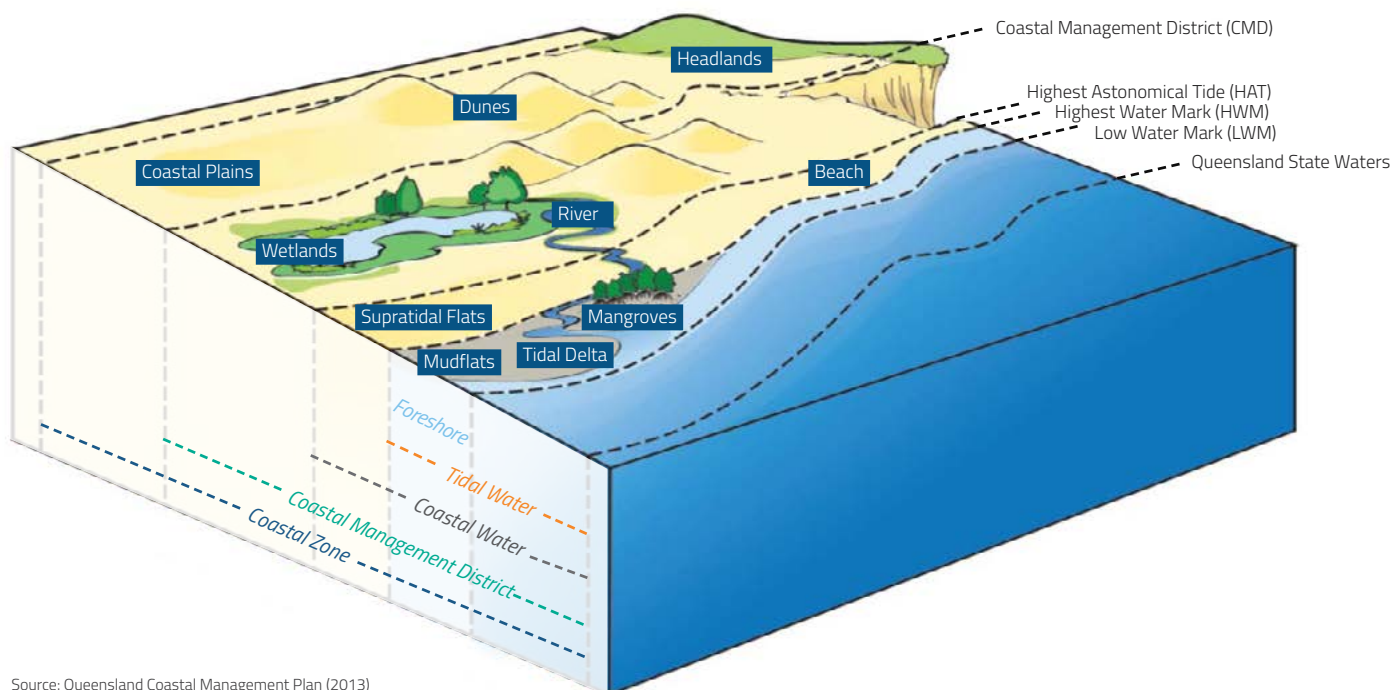
The Bundaberg Region's coastline sweeps gently from the north with long sandy beaches and dune systems backed by extensive mangrove wetlands such as in Moore Park Beach. Rocky foreshores of basalt dominate the coastal landscape between Burnett Heads and Elliott Heads. Further south the coastal plain becomes very wide comprising of beach ridges and dune barriers that typify Coonarr and Woodgate Beach.

The diagram below illustrates the 'coastal zone' and shows areas of interest that relate specifically to this Strategy.

The coastal zone collectively describes all the natural coastal ecosystems and landforms between the coastal plains and the extent of Queensland State controlled waters.

Coastal ecosystems, such as mangrove wetlands, play an important role by increasing the resilience of coastal environments to coastal hazard impacts. Well vegetated dunes, riverbanks, creeks and mangrove systems contribute to the natural buffering of coastal processes such as storm tide inundation, permanent sea water intrusion and coastal erosion. Furthermore, dunes, stabilised by vegetation that thrives in the harsh coastal conditions, help to regulate freshwater wetlands and improve water quality.

## The coastal zone



Source: Queensland Coastal Management Plan (2013)

# How will our coast change?

Coastal ecosystems are vulnerable to the changing climate. The implications of climate induced sea level rise and the potential increase in tropical cyclone intensity for Queensland's coast are likely to lead to progressive coastal change, as the coast naturally adapts to new climate patterns. Changes to coastal processes will be observable.

*"Ensure there is a strong communication of decisions made, so people don't draw their own conclusions."*

Natural disasters, like those previously experienced along the Queensland coast, cause significant economic costs and societal impacts, and will continue to be a primary driver of change.

Projections for Queensland's coastline by 2100 indicate:

- » Sea level rise of 0.8 metres; and
- » Tropical cyclones will become less frequent and those which do occur are expected to be more intense and may track further south

But other changes will be slower – almost impossible to see changing day to day. The types of changes that you might see happening over a very long time include:

- » **Rising groundwater** – permanent moisture and change in vegetation which are already happening in places like Moore Park Beach and Woodgate Beach.
- » **Sewer & stormwater backing up** – as groundwater levels rise, this impacts utilities like the sewerage and stormwater systems.
- » **Natural environment adaptation** – emergence of salt tolerant vegetation types growing in new places, while bats and birds might change their nesting habitats.
- » **Permanent inundation** – as sea levels rise, some low-lying land that flooded only periodically (perhaps at king tide) or never before will be covered in sea water all the time.

As a result there are several natural coastal changes occurring which require settlements and communities to adapt:



**Sea-Level Rise** – resulting in permanent inundation of property and infrastructure by sea water



**Coastal Erosion** – is the loss of coastal lands due to the net removal of sediment or bedrock from the shoreline. Coastal erosion can be caused by winds, wave and other natural forces. Beach erosion occurs when waves and currents remove sand from the beach system



**Storm tide inundation** – caused by elevation of the sea level over expected tide levels which may result in flooding of sea water into property and infrastructure



**Accretion** – sand restoration to eroded areas or building up in places it hasn't in the past



**This is why Bundaberg Regional Council is working proactively with the community to understand, prepare and adapt to this foreseeable change in our places.**

For some places, facing coastal change may result in damage to, or loss of homes, public and private assets and facilities with community-wide impacts. For ecosystems, sea level rise may lead to loss of habitat, and salinisation of soils may cause changes to the distribution of plants and animals.

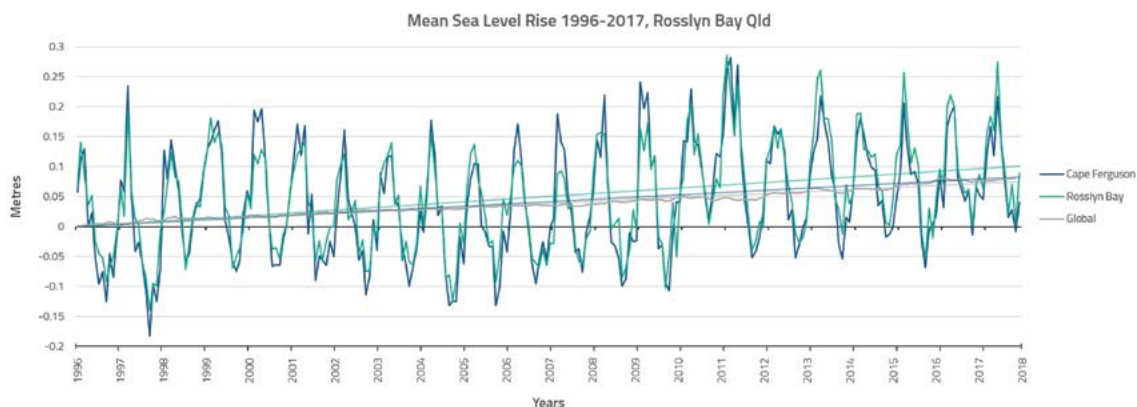
Our coast is a natural place, and we like it like that. As do the multitudes of flora and fauna species that have made the coast home for longer than we have. The tides and currents cause both erosion and accretion of sand that influence change in dune systems and other natural areas along the coast. Natural processes create unique and perfect habitats for flora and fauna to thrive.

Natural processes will change over time too. Some will recede while others will intensify which will influence our ability to manage them or adapt. Flora and fauna habitats might look different than they do today, if we can allow them to change through good environmental protection.

Other influences of change are brought by us that can make the coast and the people and places within it more vulnerable to changes over time. Like increasing population which puts pressure on business continuity, insurance affordability and emergency response.

With the coast changing so much, our environmental protections and stewardship of the coast must be forefront in nurturing the places we love.

*Did you know?*



## SEA LEVEL RISE

**The Australian and Queensland Governments are monitoring sea level rise across the nation.**

The Bureau of Meteorology maintains an array of SEAFRAME stations which measure sea level very accurately and record meteorological parameters. The array consists of 16 stations. Locally, tide gauges at Rosslyn Bay (near Yeppoon) is part of that network and is managed to accurately record sea level change and sea level trends as part of the Australian Baseline Sea Level Monitoring Project. These stations indicate a sea level rise trend about the same

or slightly higher than the global mean sea level rise trend of 3.4mm per year. Baseline sea level monitoring at Rosslyn Bay for the period 1996 to October 2017, compared to the global mean sea level rise from the CSIRO historical sea level changes is shown above. Vertical stability of the gauges is surveyed by State organisations. The survey data is archived by Geoscience Australia. This data will be used as the sea level rise evidence base for the Bundaberg region.

# Project Approach

The program known as QCoast2100 enables councils to advance coastal adaptation planning, understand the risk and to set a pathway for the future. The program can better position Bundaberg to reduce impacts to the community, environment, cultural values, infrastructure and services.

The program has eight set phases to ensure a rigorous risk assessment process, which can be broadly categorised into **three themes**:



1

## Commit and Get Ready

is about understanding the place and community, defining the study area and setting the program steps. Risk identification and assessment and conversion to tolerability for the communities in the study area.

2

**Identify and Assess** is the technical work of identifying all the property at risk, the level of expected impacts and arriving at a risk level for the settlements and various study areas.

3

## Plan, Respond and Embed

involves determining the adaptation options and applying them to local risk to create adaptation pathways. The outcomes enable risk-informed decision making at a local level.



The Strategy has robustly identified the risk and vulnerability of our settlements to coastal hazards using the most up to date tools available. The modelling indicates the level of risk at our coastal places considering:

- » the existing place characteristics such as the potential for growth, quantity and type of existing infrastructure and services;
- » the location of those characteristics in relation to the risks; and
- » the coastal change expected and how that may expose our places to coastal hazards.

The examination of the potential change, the exposure and vulnerability, to arrive at a risk level is to ensure that the community understands the risk faced. With this understanding we can develop adaptation pathways for the future.

**Importantly, a people-centred strategy focusses on providing Bundaberg residents with the information they need about predicted natural change over time to make decisions about risk and adaptation to private property.**

## Work is happening every day in our coastal zone to address foreseeable natural coastal change:

- » beach and dune nourishment or sand restoration;
- » actions of beach management plans
- » parkland care and improvements such as revegetation;
- » sea wall maintenance;
- » dune maintenance and restoration; and
- » infrastructure maintenance and upgrades such as tide gates

Bundaberg Regional Council has pro-actively developed a unique local response to the changing coast. Through a local perspective on the concepts, approaches and challenges involved in building resilience we can better undertake adaptive activities.



The Strategy was delivered through eight phases, under the three themes which are described below:



### Commit and get ready

*Phase 1-2 is about understanding the community and designing a project that is suitable for Bundaberg.*

- 1 Plan for life-of-project stakeholder communication and engagement
- 2 Scope coastal hazard issues

### Identify and assess

*Phase 3-5 involved the technical work of identifying all the property at risk, the level of expected impacts and arriving at a risk level for the settlements and various study areas.*

- 3 Identify areas exposed to current and future coastal hazards
- 4 Identify key assets potentially impacted
- 5 Risk assessment of key assets in coastal areas

### Plan, respond and embed

*The final phases involve translating the risk assessment into strategies for adaptation. Weighing up the options for efficacy, acceptability, cost and benefits to arrive at the chosen pathways for adaptation.*

- 6 Identify potential adaptation actions
- 7 Socio-economic appraisals of adaptation options
- 8 Strategy development, implementation and review

# Adaptation principles

Throughout the project, the community and stakeholders were consulted on core values and principles for an adaptation strategy. The consultation sought to uncover the adaptation principles.

*What are the essential outcomes of an adaptation strategy?*

*What are the non-negotiable aspects of an adaptation strategy?*

*What are the community values which must shine through the strategy?*

The first principles are developed across four societal themes: People, Settlements, Economy and Environment.

## RESILIENT PEOPLE

- » connectivity of people and place
- » overcoming fear of loss and taking charge of the future
- » be aware of the frequency of events into the future – more catastrophic events will happen quicker
- » overcoming perception with knowledge and education on risk
- » communicating the 'real' situations during disaster events
- » a connected community drives success
- » have confidence in our area



## RESILIENT ECONOMY

- » stronger relationships with the media, generate positive stories on the economy before and after events across multiple channels
- » incentivising tourism activities outside the hazard areas
- » avoid changing economic dynamics too quickly
- » economic vitality notwithstanding the risks



## RESILIENT SETTLEMENTS

- » commercial centres resilient to coastal hazards
- » infrastructure is sensitively located and designed
- » adjust new development to risk – build smarter
- » multiple ways in and out from key locations
- » staging interventions over time
- » no 'one size fits all' approach
- » resilient building design is critical
- » clear identification of risk areas



## RESILIENT ENVIRONMENT

- » let natural processes happen as much as possible
- » communicate accurate sea level rise information using the Rosslyn Bay data
- » maximise the ability of the coast to be dynamic
- » maximise the use of healthy, mature, resilient wetlands to buffer communities
- » strengthen what we have and reinforce it
- » protection of cultural sites, e.g. shell middens
- » recognise partnerships for mutual benefit





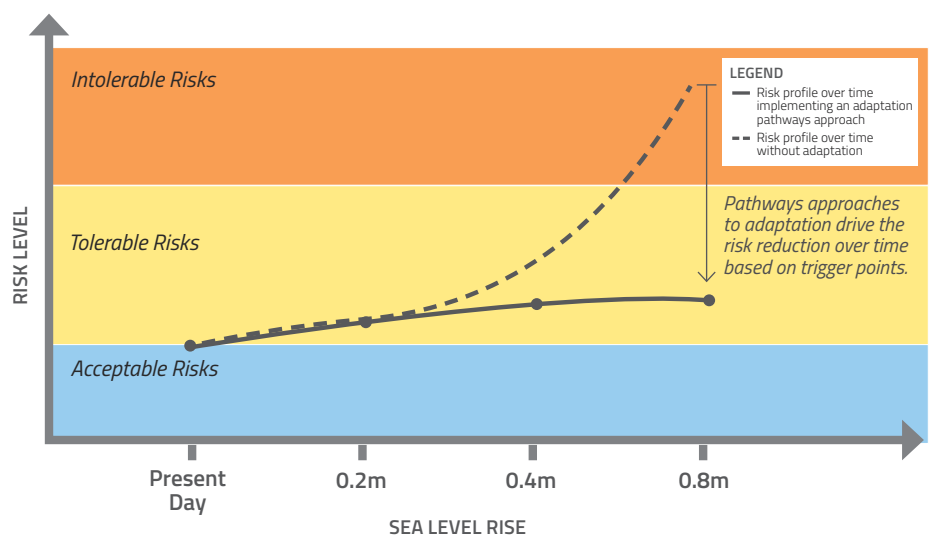
## What does coastal risk mean for me?

**Risk combines an understanding of the likelihood of a hazardous event, in this case sea level rise, storm tide inundation and coastal erosion, with an understanding of the consequences upon the built, social and natural environments.**

We have considered risks that range from low to extreme depending on a combination of coastal hazard events and sea level rise scenarios.

The risk assessment identifies the likely level of risk to the coastal settlements collectively, in other words the risk presented does not apply to individual properties or assets.

The objective of the Strategy is to identify adaptation options to reduce or maintain the level of risk to a tolerable or acceptable level. This can be illustrated by bringing the 'unmitigated risk' profile down, as shown below.



# Coastal Hazard Risk Assessment

There is a range of sea level scenarios considered in this risk assessment to identify and achieve an acceptable or tolerable level of risk for personal safety and property in coastal hazard areas.

This map is a preliminary guide to show where and when coastal hazard risk has been determined to become intolerable.

The key assets to each place are also shown by each settlement.



## Miara, Winfield & Norval Park

Risk of coastal erosion remains **tolerable** with all scenarios.

Risk of storm tide inundation remains **tolerable** with all scenarios.

Potential for major damages to buildings and infrastructure. Regular inundation of key access routes.



## Burnett Heads

Risk of coastal erosion remains **tolerable** with all scenarios.

Risk of storm tide inundation becomes **intolerable** with a 0.8m sea level rise scenario.

Potential for catastrophic damages to buildings and infrastructure.



## Innes Park & Coral Cove

Risk of coastal erosion becomes **intolerable** with a 0.8m sea level rise scenario.

Risk of storm tide inundation is **tolerable** with all scenarios.

Potential for catastrophic damages to buildings and infrastructure.



## Elliott Heads

Risk of coastal erosion is **tolerable** with all scenarios.

Risk of storm tide inundation is **tolerable** with all scenarios.

Potential for major damages to buildings and infrastructure.



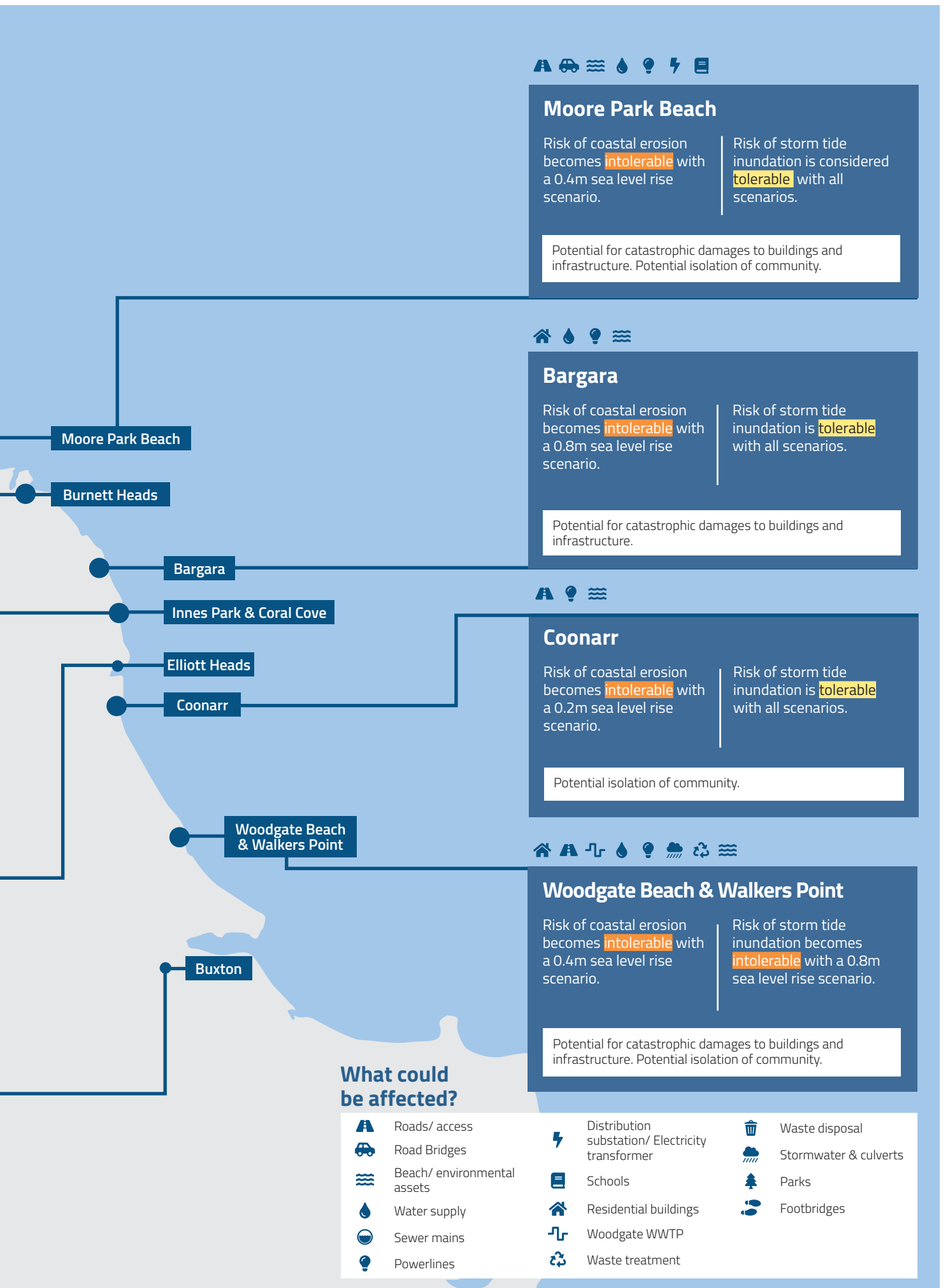
## Buxton

Risk of coastal erosion remains **tolerable** with all scenarios.

Risk of storm tide inundation is **tolerable** with all scenarios.

Potential for major damages to buildings and infrastructure.

| Risk profile | Action required                                                  |
|--------------|------------------------------------------------------------------|
| Intolerable  | Immediate action required to avoid or reduce the risk            |
| Tolerable    | Short to medium term action required to avoid or reduce the risk |
| Acceptable   | Accept risk - take no action                                     |



3

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# Adapting to change



## Strategy into Action

**The actions identified in the Strategy to adapt to coastal change are based on adaptation pathways that maintain, modify or transform our settlements.**

The Strategy considers local community values, identifies risks through scientific modelling, weighs technical options, and analyses adaptation methods using the maintain, modify and transform spectrum to develop a risk profile for each place.

A responsive, flexible and long-term implementation plan considers all possible adaptation options along with the effectiveness, acceptability and consequences of any option.

The analysis revealed that natural coastal processes are not successfully mitigated without considerable physical intervention –itself not a panacea – which may permanently impact coastal morphology and environmental systems.

In addition, the costs of maintaining coastal form will likely become either inefficient in the face of natural change or prohibitively expensive in the future.

Thus, pathways to adaptation enable the community to transition with natural processes. This will allow risk-aware decision making for foreseeable coastal change to our community, property, environment and valued areas.

Long term benefits from a risk aware and responsive adaptation plan:

- » certainty for development and growth in private and public sectors;
- » cost effective actions to implement early;
- » time to prepare and plan physically and financially for higher cost options;
- » leadership and community cohesion;
- » identified opportunities for innovation and renewal;
- » risk-aware emergency response and disaster management;
- » long-term reduction of asset damage costs; and
- » long term reduction of business disruption and recovery costs

The Strategy aims for an action plan which is simple to understand. It spells out what to do and when to do it. We must be able to learn from it over time and constantly update our adaptation knowledge as events occur and pathways are travelled. The actions must integrate responses across community organisations, private and public asset owners, Council, business and residents to respond with a coordinated approach.

# Our place vision

**We already have a clear view of the future for our coastal towns, villages, and places through documents like our community plan and our planning scheme.**

To understand the possible impact of change along the coast, our coastal places were grouped by common characteristics. While each settlement is unique, they have some common characteristics that we can use to explain their form and function, especially in the vision for the future. There are four groups:



## *Destination coastal growth hub*

Bargara reflecting its primacy in the coastal urban growth plan;



## *Coastal townships*

Moore Park Beach, Woodgate Beach and Walkers Point reflecting small amounts of local centre and community use zones with services sufficient to support residences and modest growth visions;



## *Coastal growth centres*

Burnett Heads, Innes Park, Coral Cove and Elliott Heads reflecting their role in providing residential growth and supported by services at Bargara;



## *Coastal character villages and localities*

Buxton, Winfield, Miara and Coonarr reflect the visions for limited growth and services.

The Strategy outcome is to understand whether coastal change affects the ability of each of these places to reach their future in the ways envisaged.





Winfield

Norval Park

Miara

Moore Park Beach

Burnett Heads

Bargara

Innes Park &  
Coral Cove

Elliott Heads

Coonarr

Woodgate Beach  
& Walkers Point

Buxton

QUEENSLAND

## A pathways approach

**Our challenge with a changing coast is anticipating what action we might need to take and when to ensure we can create the future we envisage.**

Communicating meanings of coastal adaptation can be challenging. It's important to realise that change need not be immediate unless there is a very real risk of loss of life or property. This Strategy adopts a scenario-based philosophy of considered change over time that allows for constant monitoring and adaptive decision-making, rather than immediate change.

It employs a 'maintain', 'modify', and 'transform' pathways approach so that we can take smaller steps now (or indeed, maintain what we have been doing), and then modify or transform our approaches over time as we see the projected risks occurring in our coastal areas.

The pathways approach to adaptation is designed to schedule adaptation decisions. The approach provides the support for Council to be strategic, flexible and structured when implementing decisions relating to adaptation and allow for planning, prioritisation and budgeting for actions.

Each of our settlements will have its own adaptation pathway and Action Plan based on the risk profile developed in the early phases of the Strategy. These will be developed, implemented and monitored by Council.





1

## **'Maintain'**

*Continue to use the land and maintain the current risk level. These options include the constant work in the areas of disaster management, land use planning, asset planning and maintenance, and community education and awareness programs. These activities do not remove the risk or the hazard.*

2

## **'Modify'**

*Use of physical interventions that modify our settlements where the risk becomes intolerable. These include soft solutions such as beach nourishment and physical options such as raising key access roads to mitigate isolation risks; seawalls or storm surge barriers to protect the land from the sea.*

3

## **'Transform'**

*Relocate or withdraw assets that are exposed to intolerable risks, options in this category include tenure transition and land swap. Land Use and Tenure Transition is complex due to high capitalisation of coastal land and is generally only appropriate in certain circumstances when the land value becomes a true reflection of the risk level.*

# Adaptation options

1

## 'Maintain'

There are a range of options available in this category that seek to maintain the current risk profile.

### LAND USE PLANNING

Land use planning responses such as zoning, development controls and risk mapping are employed to avoid the risks for new development in a strategic and future sense. The visions for each settlement must align with coastal change to ensure projected in-fill development is appropriate and a risk-based approach to planning is in place.

### EDUCATION AND AWARENESS CAMPAIGNS

Council provides extensive resources as part of their disaster management activities for community awareness. The information is valid for all hazards and assists the community in the lead up to potential natural hazard events. The resources provided include a household

emergency plan guide, an emergency kit guide, an evacuation plan template, preparing pets information; and relevant emergency contact numbers.

Including specific information to enhance understanding of coastal processes, adaptation options and impacts of coastal changes can build resilience in the community through communication and messaging.

### RESILIENT INFRASTRUCTURE

Building or replacing infrastructure assets that are resilient to coastal hazards increases the service to the community and is necessary for the ongoing function of a settlement.

This approach also minimises interruptions to services such as drainage, roads, water

supply and electricity during and after coastal hazard events. Using the evidence and supporting data available to asset owners, future infrastructure and asset planning decisions can build in resilience based on an understanding of coastal hazards.

### DISASTER MANAGEMENT

Council, the State Emergency Service, volunteer and local disaster management groups play an important role in keeping the community safe. The local disaster management plan outlines activities within the key stages of prevention, preparedness, response and recovery. Disaster management strengthens community disaster preparedness and coordinates systematic responses to potential coastal hazard events.

## “Modify”

There are a range of options in the Modify category that form physical alterations to protect people and property from the impacts of climate change, sea level rise, coastal erosion, permanent inundation or storm tide inundation.

### RAISING KEY ACCESS ROADS

Raising the level of key access routes reduces the frequency of inundation and mitigates the risk of isolation to affected communities. Raising the road level or construction of a causeway over a crossing which may experience inundation ensures a key access road remains available as an evacuation route, allows emergency services access and improve logistics during recovery.

### STORM SURGE BARRIER AND EARTH DYKE

Barriers and dykes are an artificially constructed wall designed to avoid inundation from storm tides. Barriers and dykes are hard engineered structures usually made from earth and rock covered with vegetation, grass or esplanade to maintain a public amenity value.

### GROYNES

Groynes are structures built perpendicular to the shoreline that trap sand moving along the coast, causing sand build up on the downdrift side. A variant of a groyne is an artificial headland which acts in the same manner but has a larger footprint. They can be effective in controlling coastal erosion and longshore transport.

### SEAWALLS

A wall or embankment structure put in place to stop tidal inundation or coastal erosion. Seawalls are often constructed in combination with beach nourishment and dune revegetation to provide a last line of defence under the coastal dune, reducing the risks of erosion and floods.

### BEACH NOURISHMENT

Beach nourishment is the artificial addition of sand to a beach system, increasing the buffer against erosion or preventing further loss of sand. This option reduces the risk of storm tide inundation when combined with dune creation and vegetation.

A long-term beach nourishment strategy requires continuous monitoring of shoreline changes to identify timing of renourishment campaigns.



## ‘Transform’

There are a couple of options available in this category that seek to transform the current risk profile.

### LAND USE AND TENURE TRANSITION

Land Use and Tenure Transition should be considered in areas where it may be appropriate to cease occupation of the property in order to free occupants from dangerous situations and intolerable risks.

### LAND-SWAP

Land swap may be applied to assets or buildings that are impacted by intolerable risks. The land swap activity is dependent on availability of an alternative site but is fully effective in removing risk to life and property.

## A collective action plan

The Strategy Action Plan uses a planning technique which can be universally applied. Anyone with a role to play can apply the planning steps to their situation at home, at work, in business, in government. It has common steps at any scale.

An initial task for Council and community for the Action Plan is to create templates and guidance material for the community and business to prepare their own adaptation strategy based on the same methodology. The diagram in this section illustrates the universal steps for a risk aware, pathways approach Action Plan.



## A role for everyone

Council will be the facilitator and leader in the Action Plan but not necessarily responsible for implementation. There are practical roles for residents, business, community organisations, state agencies, and disaster management. An ambitious aim of the collective Action Plan is that every part of the community in the coastal area: private land or business owner, surf club, school, retirement village, local motel or sports club should know and understand their own risks and create a suitable Action Plan for assets, premises, and members.

Every time Queenslanders experience natural disasters, we are amazed at the community

spirit of endurance and mateship that binds us together in these times of need.

The Strategy aims to go a step further and build understanding before natural events and create a risk-aware and prepared community.

Decisions one organisation or landowner will make will not be appropriate for other organisations, property or locations. Being risk aware and prepared to adapt is an intensely individual experience. Everyone's risk exposure is different. Individual understanding of risk and personal strategy development is the first step to a more resilient coastal community.

## Council's Role

As the facilitator and leader in the Action Plan, Council will provide tools, templates, guidance, in kind assistance and alert the community to any appropriate funding streams among Council-specific actions and a plethora of possible small-scale actions across all Council programs.

The major task for Council internally is to ensure the strategy actions are embedded across all Council programs for risk-aware decisions as business as usual. The Bundaberg Coastal Hazard Adaptation Strategy works in tandem with many other aspects of Council business and community values and will be embedded into:

- » land use planning and community visioning
- » building regulations
- » community facilities and support programs
- » asset management processes
- » infrastructure planning and cost-benefit analysis tasks
- » parks and environmental protection
- » emergency management and disaster recovery; and
- » monitoring and reporting systems

## Monitoring and review

**Actions require careful and ongoing monitoring to ensure today's solutions remain valid in the future and that the adaptation efforts are achieving results.**

Just as the coastline evolves, so too should the adaptation responses. Each place with an adaptation pathway will have a monitoring and review program. This is crucial, as risks arising from coastal hazards rarely remain static, especially as the understanding of coastal processes may improve with time. Changed timeframes mean that clear pathways cannot be accurately forecast today.

Monitoring and reviewing the Action Plan ensures that the adaptation pathways remain suitable, effective, timely and cost appropriate. Common indicators to measure success or change of the Action Plan will be required for regular measurement of success.



### CASE STUDY

#### **Woodgate Shoreline Erosion Management Plan (SEMP)**

**The Woodgate Beach SEMP will enable Bundaberg Regional Council and the local community to proactively plan for erosion management in vulnerable areas such as in the vicinity of the boat ramp.**

The study identified that the shoreline most at risk over the next 20 years is located in a 700-metre stretch of beach 400 metres north and 300 metres south of the main boat ramp.

The Woodgate SEMP has recommended a range of options to address erosion over a 20 year timeframe, including beach nourishment and a buried seawall.



### Erosion indicators

- » Event records of frequency, time, tide, event circumstances including photos from uniform locations over time
- » Dune morphology records
- » Number of properties impacted by event
- » Records of infrastructure impacted by event
- » Beach access lost or damaged
- » Vegetation buffer loss or damage

Over time, if erosion issues at specific locations are identified these may be managed by implementation of a Shoreline Erosion Management Plan. This plan will address priority erosion issues and recommend management options. Council is currently progressing the Woodgate shoreline erosion management plan.



### Sea level rise indicators

- » Data review from the Bureau of Meteorology SEAFRAME station at Rosslyn Bay
- » Photos from uniform locations over time
- » Tidal ingress
- » Number of properties impacted
- » Permanent loss of infrastructure road damage



### Inundation indicators

- » Photos from uniform locations over time
- » Tidal ingress frequency and length of event
- » Number of properties impacted
- » Permanent loss of infrastructure
- » Road damage, sea water intrusion locations and frequency
- » Soil structure and sodicity
- » Vegetation loss and system shift and retreat or loss through salinity

# Our coastal adaptation pathways



Each of our places will have its own adaptation pathway and Action Plan based on the risk profile developed in the early phases of the Strategy. These will be developed, implemented and monitored by Council. The community should use the pathways approach, risk profiles and tools presented to understand personal risk and the planning techniques to create strategies for private property, homes, clubs, and business.

1 Winfield

2 Norval Park

3 Miara

4 Moore Park Beach

5 Burnett Heads

6 Bargara

7 Innes Park & Coral Cove

8 Elliott Heads

9 Coonarr

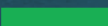
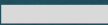
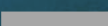
10 Woodgate Beach & Walkers Point

11 Buxton

#### Place Vision Legend

-  Destination coastal growth hub
-  Coastal townships
-  Coastal growth centres
-  Coastal character villages and localities

## How to read the pathways map

| Symbol                                                                              | Interpretation                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | Circles indicate decision points, that is, points in time when a decision needs to be made between alternate adaptation options. The timing of decision points has been set to coincide with present day conditions (now) and sea level rise scenarios of 0.2m, 0.4m and 0.8m. |
|  | Planning or investigation commences for adaptation option                                                                                                                                                                                                                      |
|  | Indicates when a non-preferred adaptation option would likely be implemented                                                                                                                                                                                                   |
|  | Preferred adaptation option indicating the preferred pathway for adaptation                                                                                                                                                                                                    |
|  | Ruled out option, however this pathway indicates when planning or investigation would likely commence IF the option is reconsidered                                                                                                                                            |
|  | Ruled out option, however this pathway indicates when implementation would likely commence IF the option is reconsidered                                                                                                                                                       |

# Miara, Winfield and Norval Park

**Miara, Winfield and Norval Park are coastal character villages which will retain current form, preserving the distinctive character that reflects their connection with the landscape and the history of the region.**



## Miara, Winfield & Norval Park

Risk of coastal erosion remains **tolerable** with all scenarios.

Risk of storm tide inundation remains **tolerable** with all scenarios.

Potential for major damages to buildings and infrastructure. Regular inundation of key access routes.

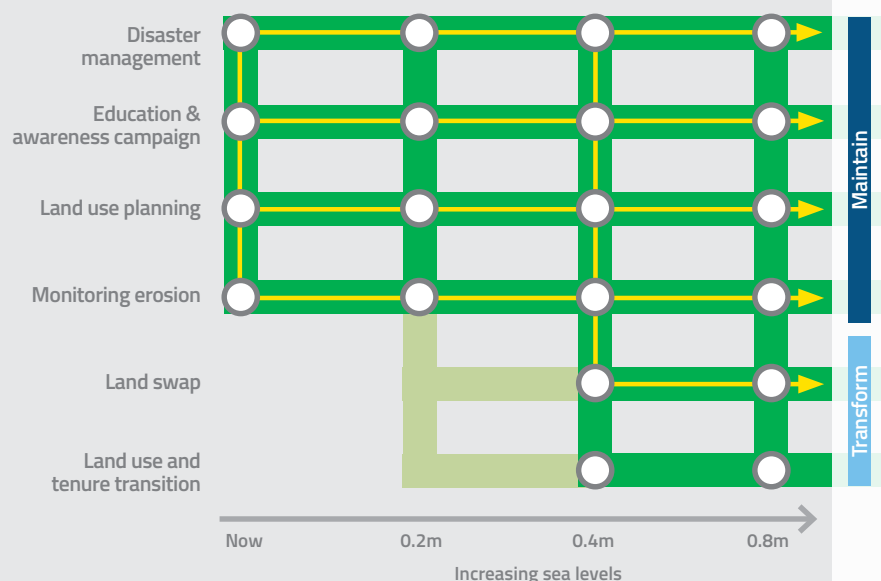
The risk profile for this settlement study area indicates that risk from both storm tide inundation and coastal erosion remains in the tolerable range under all sea level scenarios. Miara Road is likely to be frequently inundated in all scenarios and is considered a key access route to the Miara Holiday Park. The adaptation options for this location include a relocation of the holiday park where an alternative suitable location can be found.

Coastal erosion has been identified as a potential hazard in Colonial Cove, Winfield. Ongoing monitoring is required to provide evidence for any future modification response. Further site investigation will be required in the form of a Shoreline Erosion Management Plan for Colonial Cove.

Due to the risk level in this settlement, no constructed interventions are recommended.

## Adaptation pathway summary

- » Adaptation in Miara, Winfield and Norval Park will require a focus on disaster management, education and awareness campaigns, and land use planning to ensure limited growth in the settlement.
- » Council will continue to monitor the rate of erosion in Colonial Cove over time, which may lead to the implementation of a shoreline erosion management plan for this location.
- » Modification of operations at the Miara Caravan Holiday Park may be required to facilitate a relocation via a land swap in the longer term.



# Moore Park Beach

Moore Park Beach is a coastal township which will cater for modest growth reflecting and preserving character, identity and history of the relaxed coastal settlement. It supports facilities and services for local residents and visitors drawing its character and lifestyle from surrounding natural features.

Moore Park Beach has been identified as a priority settlement for adaptation responses to coastal hazards. Permanent inundation of low-lying areas in a 0.8m sea level rise scenario may lead to intolerable risk to the entire settlement caused by the effects of isolation.

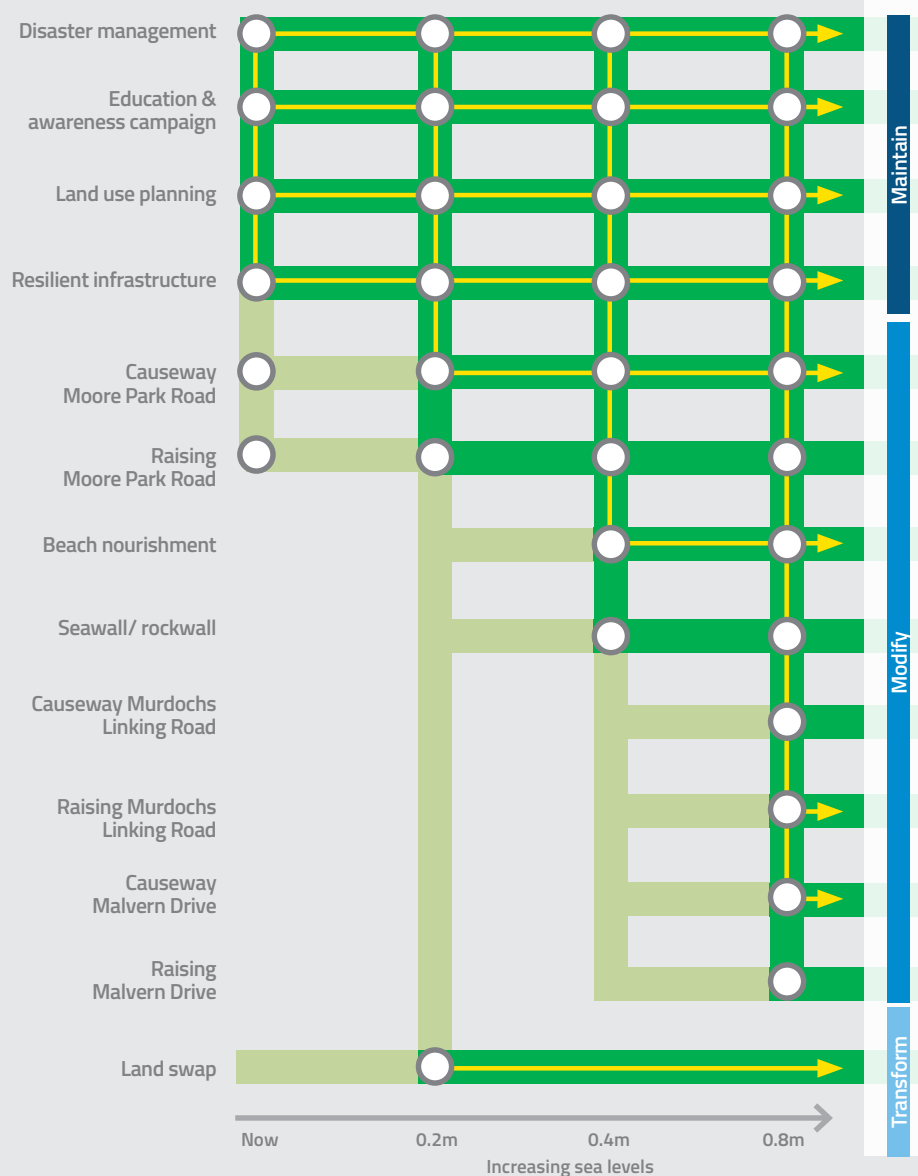
Key access routes to the settlement have been identified for adaptation to prevent the risks associated with isolation.

Overtopping of tidal gates occurs under present-day sea-level conditions and the risk becomes intolerable to the settlement under a 0.4m sea level rise scenario.

Areas specifically at risk include homes on the foreshore, the Moore Park Beach Surf Club and Holiday Park. On the foreshore the preferred adaptation pathway involves planning and investigating beach nourishment before a 0.4m sea level rise scenario.

## Adaptation pathway summary

- » In the short-term the preferred 'Modify' options consist of planning to construct a causeway at Moore Park Road to prevent regular inundation of these key access routes.
- » The next step will be to commence planning for beach nourishment along the beach front which should commence after the 0.2m sea level rise scenario in time for a 0.4m sea level rise scenario when intolerable risks may occur. Then, in the longer term, planning for raising Murdochs Linking Road should commence after the 0.4m sea level rise scenario in time for a 0.8m sea level rise scenario.
- » Modification of operations at the surf club may be required to facilitate a relocation out of the erosion prone area via a land swap.





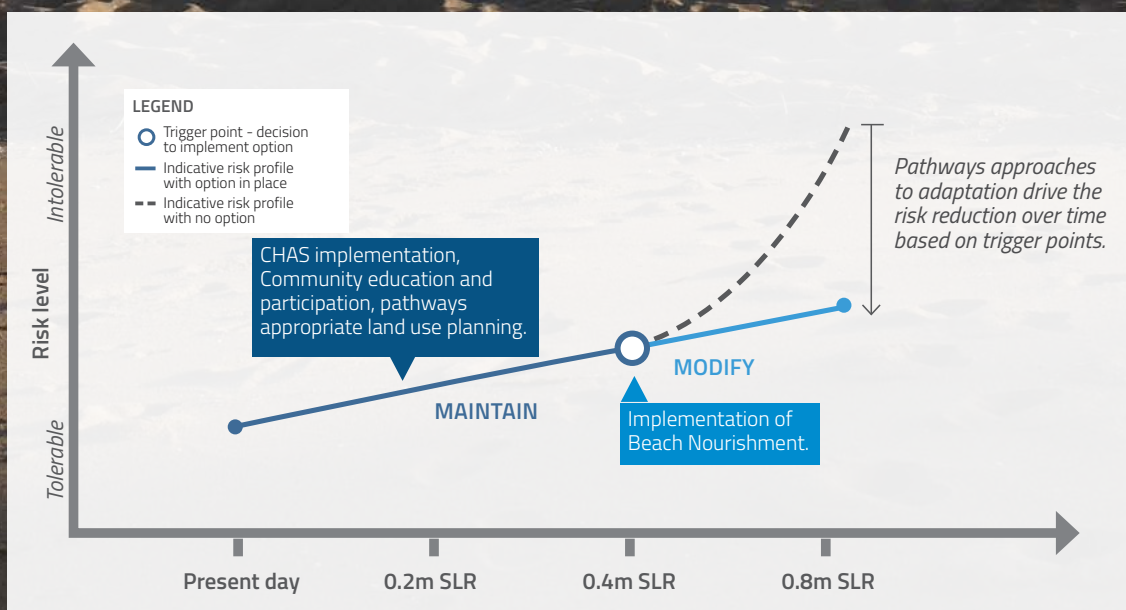
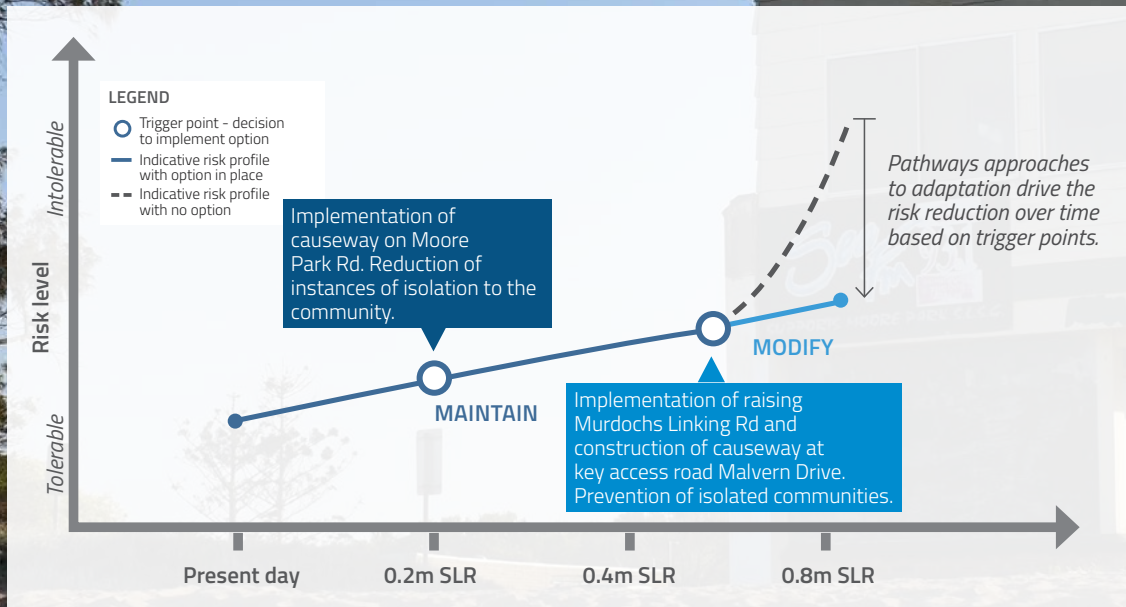
## Moore Park Beach

Risk of coastal erosion becomes **intolerable** with a 0.4m sea level rise scenario.

Risk of storm tide inundation is considered **tolerable** with all scenarios.

Potential for catastrophic damages to buildings and infrastructure. Potential isolation of community.

*If we don't look after our coastline, we will lose our wonderful asset*



# Burnett Heads

**Burnett Heads is a coastal growth centre, with public foreshore parks providing open space and recreation opportunities. It services locals and the region with employment opportunities at the port and is provided with the full range of urban infrastructure.**

Burnett Heads has been identified as a settlement subject to intolerable risks of storm tide inundation. Many highly critical services are subject to intolerable risks under a 0.8m sea level rise scenario. With some growth expected in the area, new infrastructure and upgrades to existing services will need to be built with coastal hazard factored into the design.

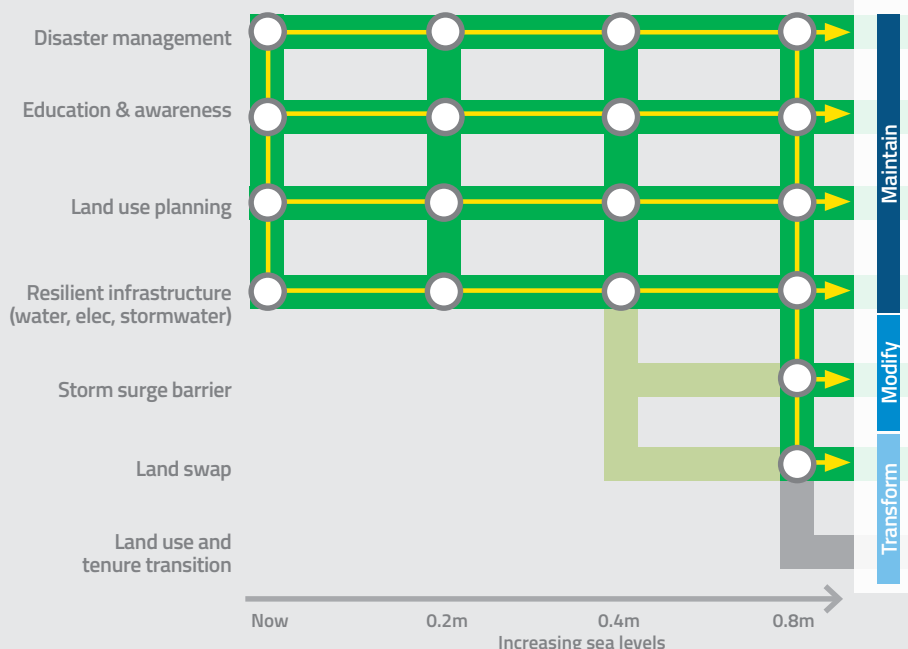
Recently the settlement has undergone additional local area planning including expansion

of the Port of Bundaberg State Development Area. The current planning scheme amendments propose changes to the Coastal Urban Growth Area to incorporate a boat harbour at Burnett Heads and associated supporting land uses.

The preferred adaptation pathway involves the investigation of a storm surge barrier and earth dyke before a 0.8m sea level rise scenario to protect against storm tide inundation.

## Adaptation pathway summary

- » Adaptation in Burnett Heads will require a focus on disaster management, education and awareness campaigns.
- » Communication with the Port of Bundaberg throughout its development to ensure proposals for the State Development Area (SDA) recognise the risk exposure via appropriate land use planning responses.
- » The preferred 'Modify' option consists of a feasibility investigation into the timing of a possible storm surge barrier and dyke.
- » Modification of operations at the Lighthouse Holiday Park may be required to facilitate a relocation via a land swap in the longer term.



"We live here  
because it is our  
idea of Paradise"

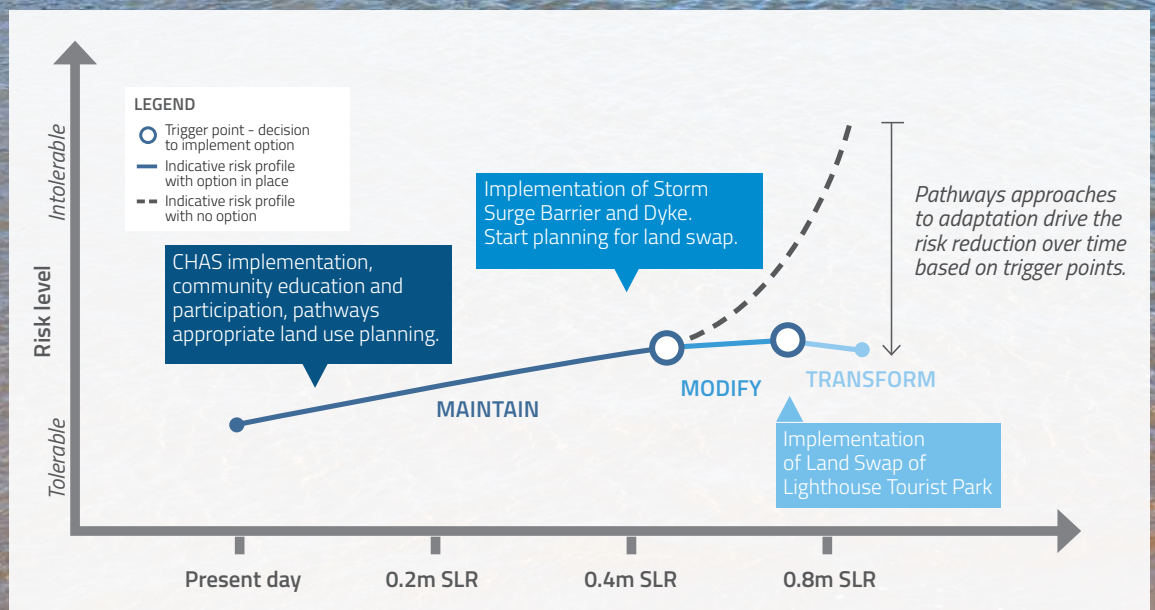


## Burnett Heads

Risk of coastal erosion remains **tolerable** with all scenarios.

Risk of storm tide inundation becomes **intolerable** with a 0.8m sea level rise scenario.

Potential for catastrophic damages to buildings and infrastructure.



# Bargara

**Bargara is the commercial and service hub for the Coastal Urban Growth Area. It is the primary tourism destination and services the local coastal settlements. Its seaside setting with coastal themes and sub-tropical architecture influences development form as it grows to meet demand.**

The vision for Bargara is to be the coastal hub for the region. The north end of Bargara at Mon Repos and Rookery Road is exposed to erosion and inundation; however, this is not zoned for development nor does it have an existing settlement.

Coastal erosion has been identified as a potential hazard at Nielson Beach and the Bargara foreshore. Ongoing monitoring will provide

evidence for any future modification responses. Further investigation will be required in the form of a Shoreline Erosion Management Plan for these sites.

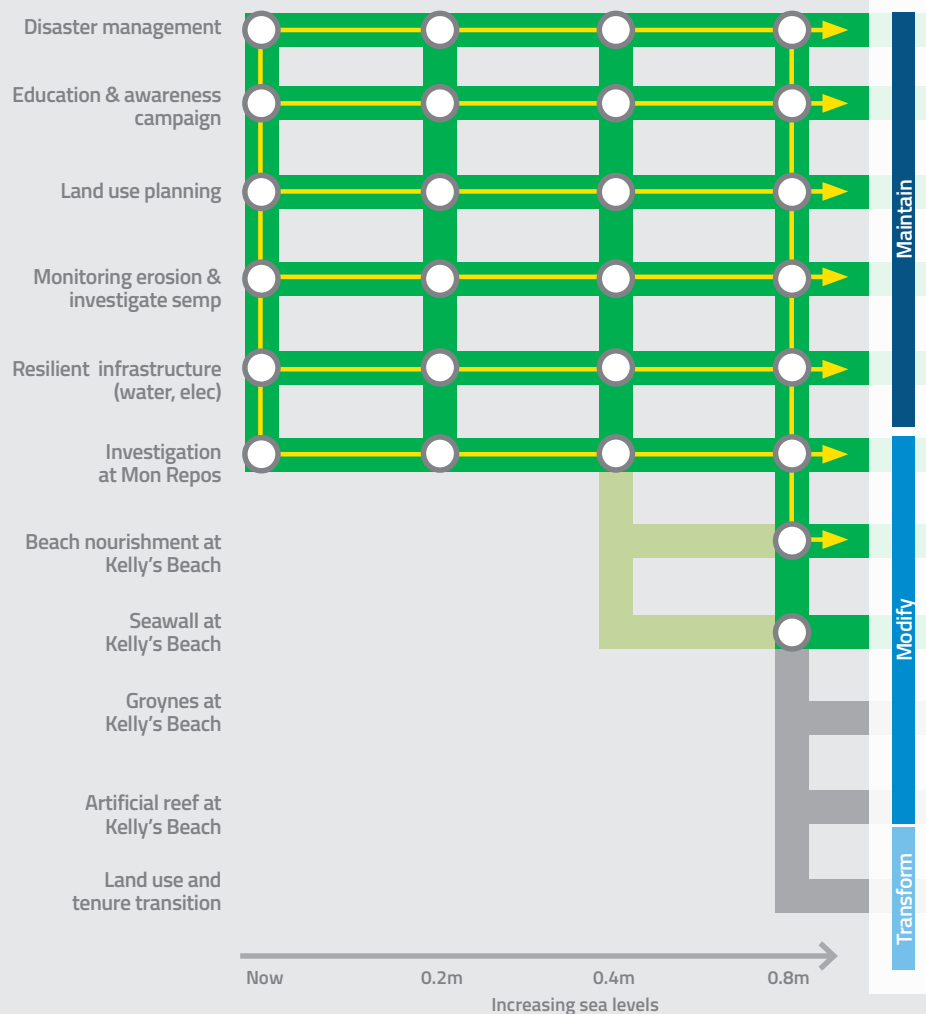
The coastal erosion risk at Kelly's Beach is considered to become Intolerable in a 0.8m sea level rise scenario. This is driven by the economic consequences of a coastal erosion impact upon the properties

fronting the beach.

The preferred adaptation pathway involves the planning and investigation of beach nourishment at Kelly's Beach in time for a 0.8m sea level rise scenario. Protection of private infrastructure and property will be guided through action by property owners. The Strategy provides universal steps for a risk aware and adaptive Action Plan.

## Adaptation pathway summary

- » Council to continue to monitor the erosion at the Bargara Foreshore and Nielson Beach which may lead to a shoreline erosion management plan in these locations
- » As an economically and environmentally important site to the region, a resilience and adaptation investigation should be undertaken at the Mon Repos Turtle Centre
- » The preferred 'Modify' option is beach nourishment at Kelly's Beach. Collectively, private property owners are to investigate the feasibility of protecting their assets.



"A balance between development and keeping the beach relaxed atmosphere"

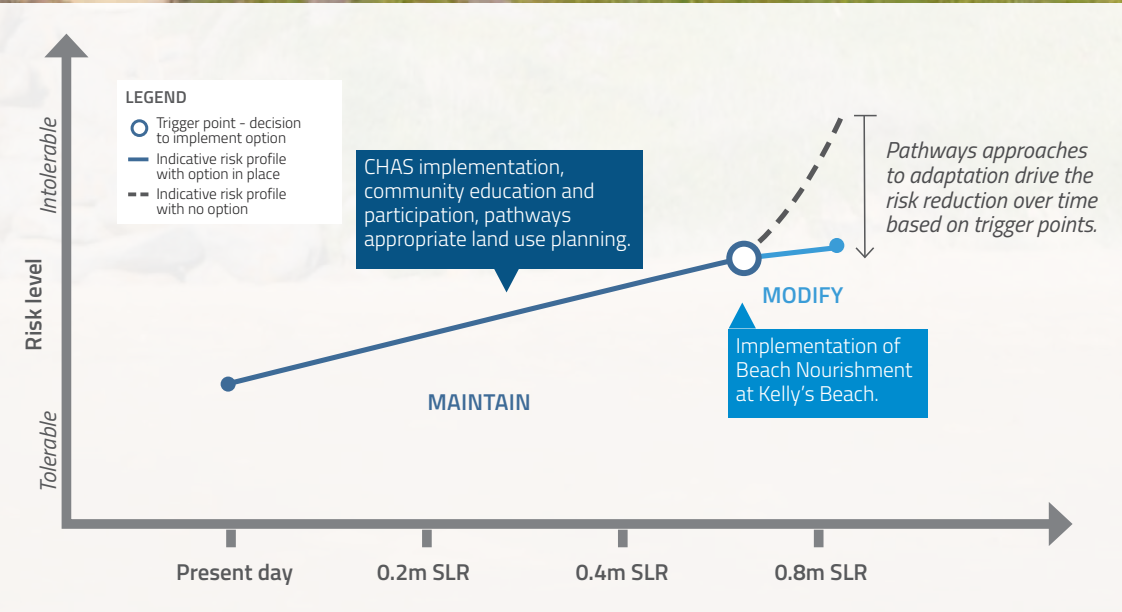


### Bargara

Risk of coastal erosion becomes **intolerable** with a 0.8m sea level rise scenario.

Risk of storm tide inundation is **tolerable** with all scenarios.

Potential for catastrophic damages to buildings and infrastructure.



# Innes Park & Coral Cove

Innes Park and Coral Cove contribute significantly to the projected urban growth of Bundaberg's coastal centres, providing future residential development opportunities. Liveability and amenity of these settlements are enhanced by the surrounding natural environment.



## Innes Park & Coral Cove

Risk of coastal erosion becomes **intolerable** with a 0.8m sea level rise scenario.

Risk of storm tide inundation is **tolerable** with all scenarios.

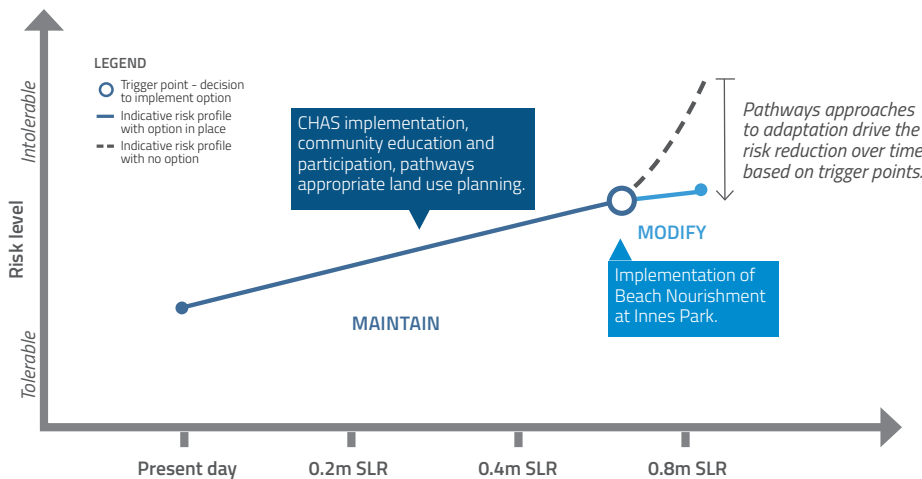
Potential for catastrophic damages to buildings and infrastructure.

The shoreline of Innes Park is subject to erosion risks considered intolerable in a 0.8m sea level rise scenario. Coral Cove is typified by a rocky foreshore, however, there are assets and features mapped as being at risk to coastal erosion.

The settlement areas benefit from open space on the foreshore that buffer residential uses from coastal processes.

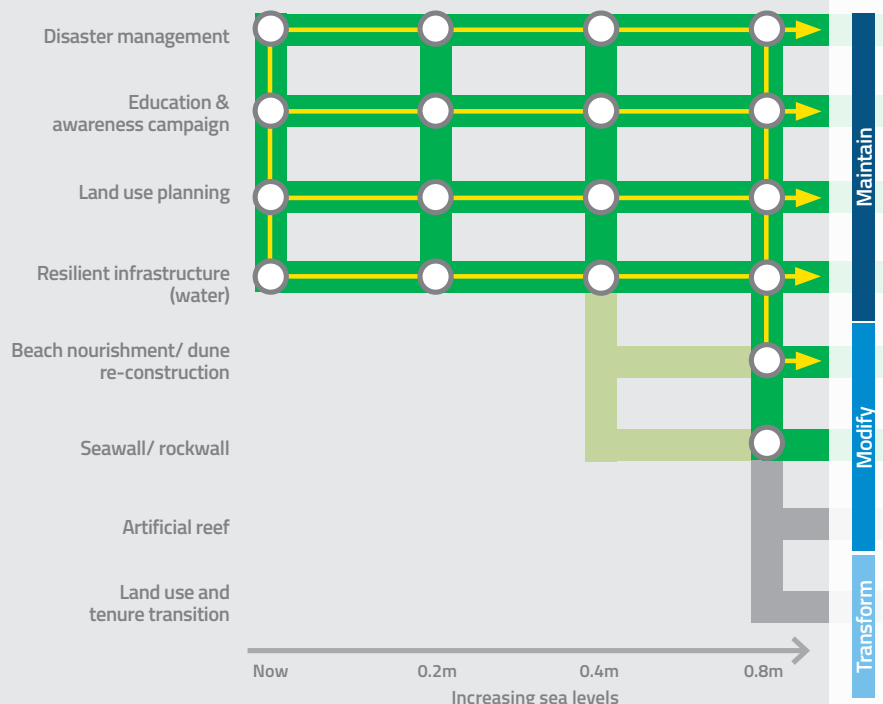
It is important this buffer is maintained into the future as the vision for the area is for growth.

The preferred adaptation pathway is to plan and investigate beach nourishment either side of the mouth of Palmer's Creek to mitigate impacts of coastal erosion.



### Adaptation pathway summary

- » Adaptation in Innes Park and Coral Cove will require a focus on disaster management, education and awareness campaigns and land use planning to ensure a low-density settlement pattern with open space around the foreshore continues
- » The preferred 'Modify' option in this settlement consists of beach nourishment in the longer term in the area of Innes Park and Palmer's Creek.





# Elliott Heads

Elliott Heads is the southern-most coastal growth centre, with public foreshore parks providing open space and recreation opportunities. The settlement is serviced with public infrastructure and is a quiet tourist destination with beautiful surrounds.



## Elliott Heads

Risk of coastal erosion is **tolerable** with all scenarios.

Risk of storm tide inundation is **tolerable** with all scenarios.

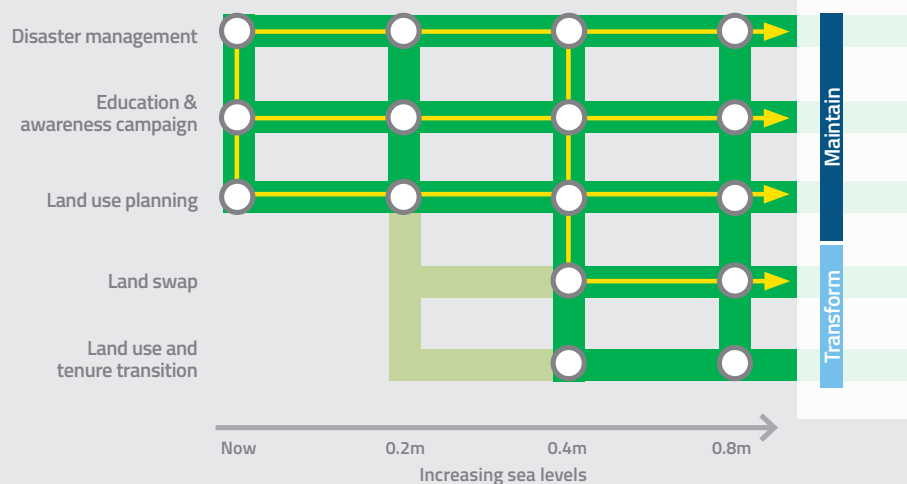
Potential for major damages to buildings and infrastructure.

The risk at Elliott Heads from both storm tide inundation and coastal erosion remains in the tolerable range under all sea level scenarios. That said, there is risk present within the settlement associated with potential impacts to buildings and associated infrastructure. The Strategy provides recommended actions to maintain the current risk profile through a council-wide implementation of disaster management planning, land use responses and community education.

Elliott Heads Holiday Park is likely to be frequently inundated in a 0.8m sea level rise scenario, adaptation options for this location include a relocation where an alternative suitable location can be found.

## Adaptation pathway summary

- » Adaptation in Elliott Heads will require a focus on disaster management, education and awareness campaigns, and land use planning to ensure the existing zoning pattern is maintained and to ensure no intensification or increase in risk.
- » There are no 'Modify' options appropriate for this settlement.
- » In the medium term, the Elliott Heads Tourist Park may consider modifying some operational practices with a long-term view of transforming or relocation via a land swap.



# Coonarr



**Coonarr is a coastal character village which will retain its current form, preserving the distinctive character that reflects the connection with the landscape and the history of the region. Coonarr has no urban infrastructure.**

The settlement of Coonarr has been identified as a priority settlement for adaptation responses to coastal hazards. The main issues at Coonarr relate to coastal erosion of the shorefront, and potential permanent inundation causing isolation of the small community under a 0.2m sea level rise scenario.

Given the potential intolerable risk at 0.2m sea level rise, there is a clear priority for immediate

implementation of disaster management planning, an education and awareness campaign, land use planning and continued monitoring of erosion at Coonarr. However, the timing of projected impacts means that planning for a range of additional options needs to commence immediately, focusing on beach nourishment, tenure conversion and road raising.

## Adaptation pathway summary

- » The timing of projected impacts means that planning for a range of additional 'Modify' options needs to commence immediately
- » The preferred adaptation options consist of beach nourishment, raising Coonarr Beach Road to prevent potential isolation to the beach front properties, and potential land use and tenure transition of the same properties
- » The way in which these options are implemented, either individually or as a combined package of solutions, requires further investigation during the planning stage with input from the local community.



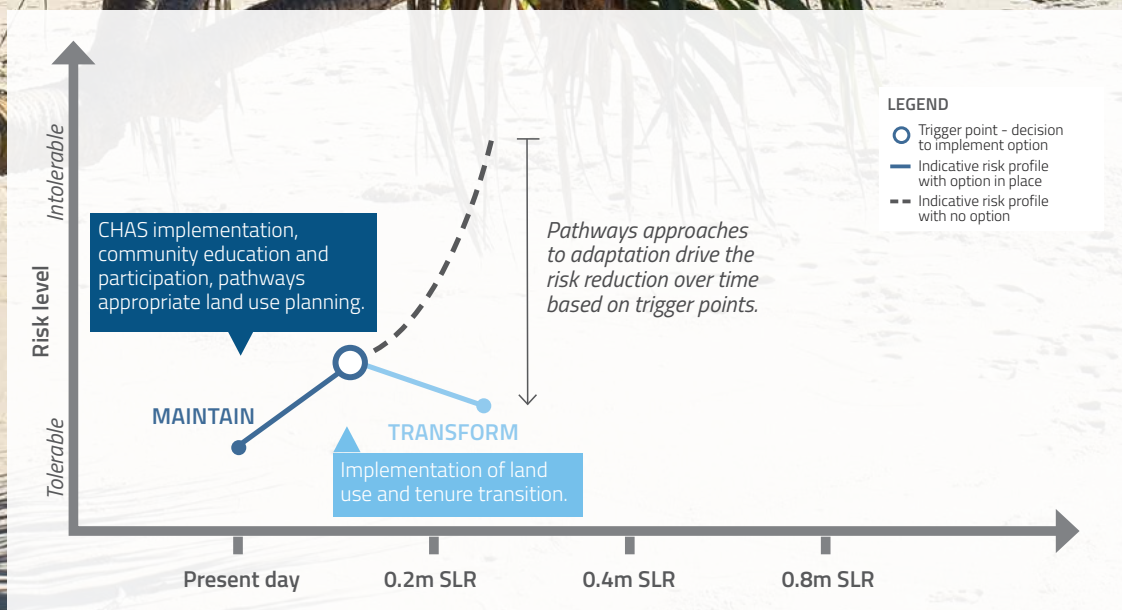
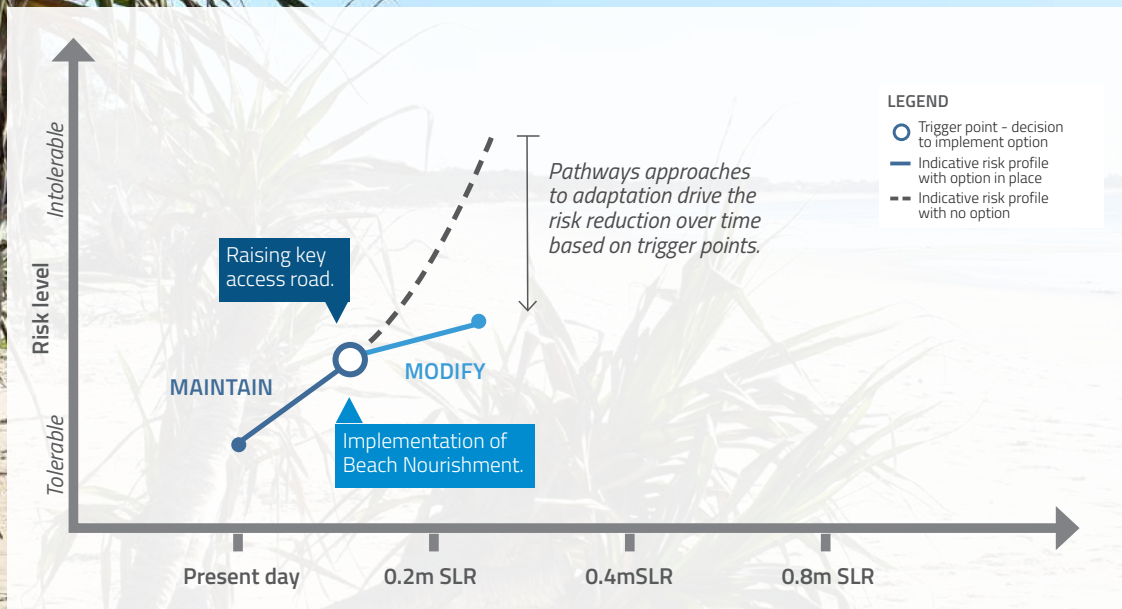


## Coonarr

Risk of coastal erosion becomes **intolerable** with a 0.2m sea level rise scenario.

Risk of storm tide inundation is **tolerable** with all scenarios.

Potential isolation of community.



# Woodgate Beach & Walkers Point

Woodgate Beach is a coastal township which will cater for modest growth that reflects and preserves the character, identity and history of the relaxed coastal settlement. It supports facilities and services for local residents and visitors drawing its character and lifestyle from surrounding natural features.

Woodgate Beach and Walkers Point have been identified as priority settlements for adaptation responses to coastal hazards. Permanent inundation of low-lying areas in a 0.8m sea level rise scenario may lead to intolerable risk to the entire settlement caused by the effects of isolation.

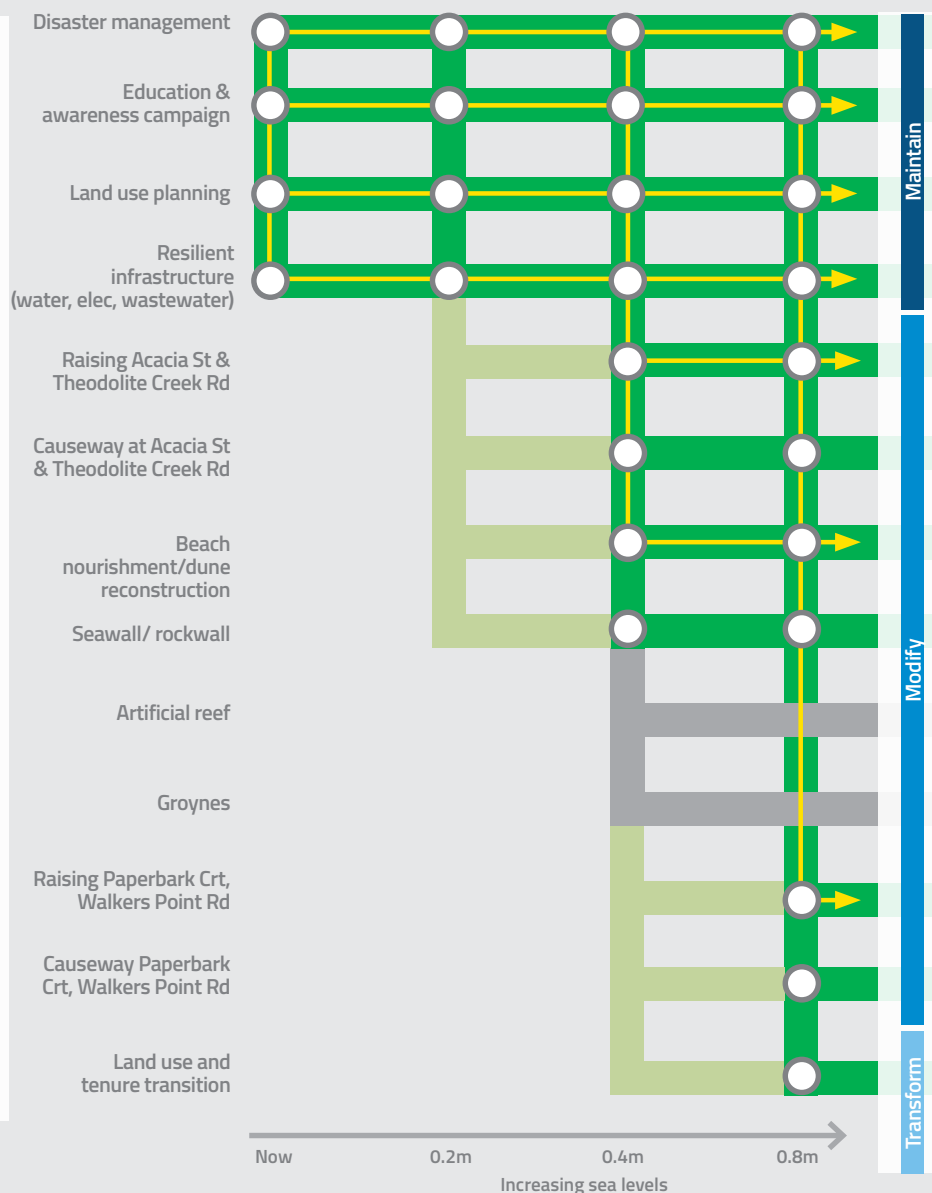
Key access routes to this location have been identified for adaptation to reduce the impacts of regular

inundation in the short term and prevent the risks associated with isolation before a 0.8m sea level rise scenario.

Coastal erosion on the foreshore may lead to intolerable risk to residential buildings and infrastructure in a 0.4m sea level rise scenario. The preferred adaptation pathway involves planning and investigating beach nourishment before a 0.4m sea level rise scenario.

## Adaptation pathway summary

- » There is an immediate requirement to focus on disaster management, education and awareness campaigns, and land use planning to maintain the vision for low or no growth and the characteristics of a coastal township. Development capacity should not increase in future planning schemes
- » Council will continue implementation of the recommendations from the shoreline erosion management plan to address erosion issues in the vicinity of the boat ramp
- » In the short to medium term the preferred 'Modify' options consist of beach nourishment and raising Acacia Street and Theodolite Creek Road to prevent regular inundation of these key access routes
- » In the longer term, the preferred adaptation option will be to commence planning for raising Paperbark Court and Walkers Point Road



"Woodgate is like a secret location"

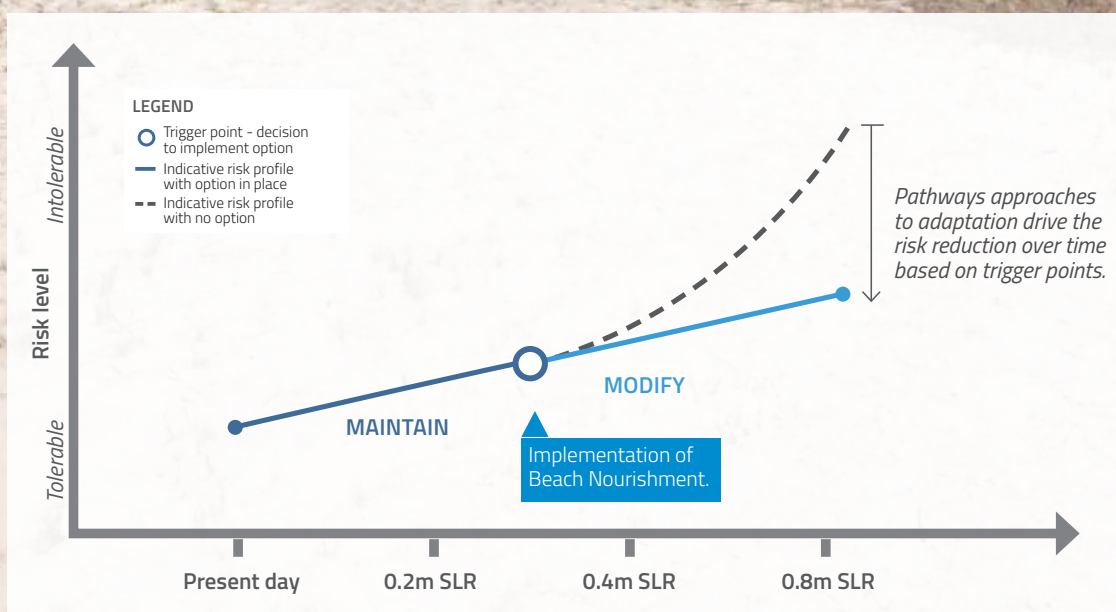
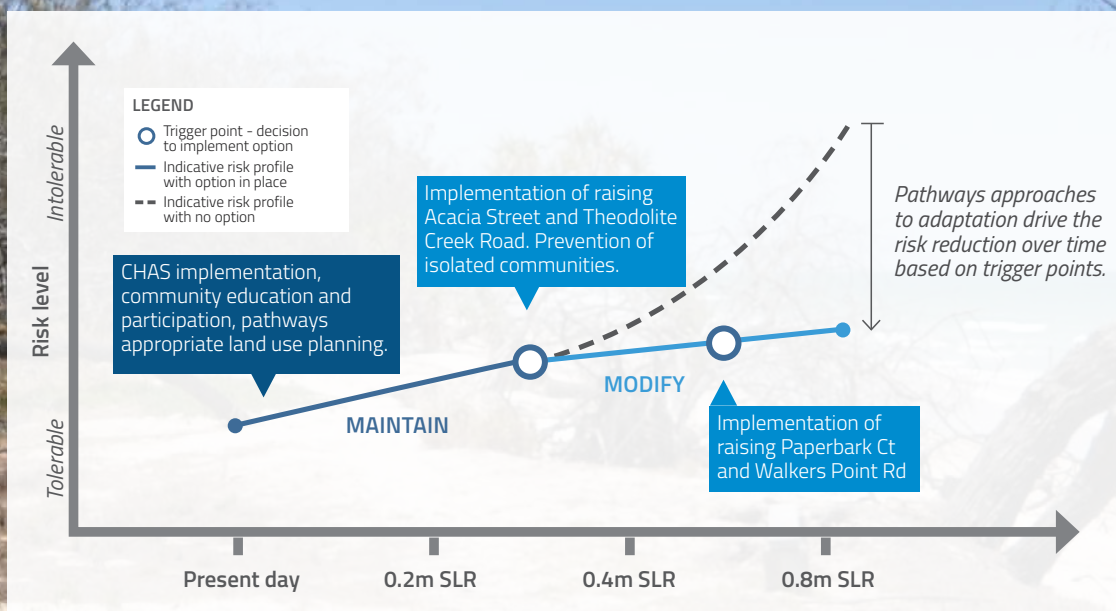


## Woodgate Beach & Walkers Point

Risk of coastal erosion becomes **intolerable** with a 0.4m sea level rise scenario.

Risk of storm tide inundation becomes **intolerable** with a 0.8m sea level rise scenario.

Potential for catastrophic damages to buildings and infrastructure. Potential isolation of community.



# Buxton

**Buxton is a coastal character village which will retain its current form, preserving the distinctive character that reflects the connection with the landscape, especially lifestyle allotments on the waterfront and the history of the region. Buxton has no urban infrastructure.**

The risk of coastal hazards to the settlement of Buxton, situated on the Burrum River, is considered to remain in the tolerable range under all sea level scenarios. That said, there is risk present within the settlement associated with potential impacts to residential buildings. Coastal erosion has been identified as a potential hazard along the foreshore at Wharf Street. Ongoing monitoring will provide evidence for any future modification responses. Further investigation will be required in the form of a Shoreline Erosion Management Plan for this site. The Strategy provides recommended actions to maintain the current risk profile through a council-wide implementation of disaster management planning, land use responses and community education.



## Buxton

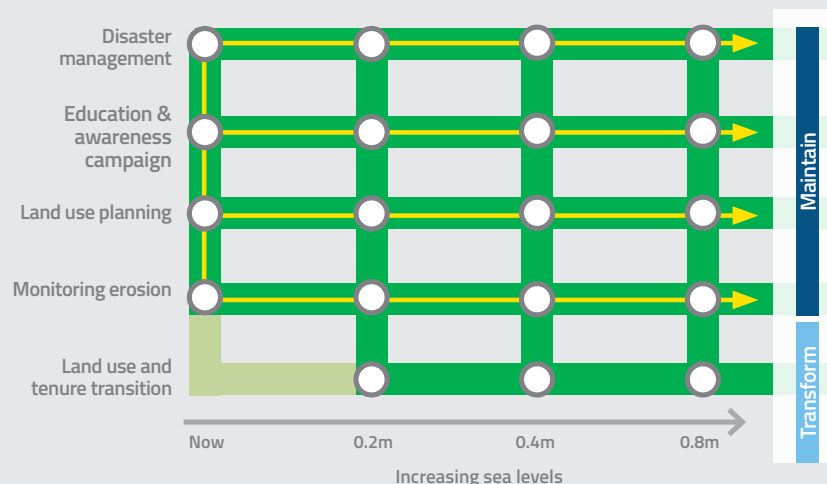
Risk of coastal erosion remains **tolerable** with all scenarios.

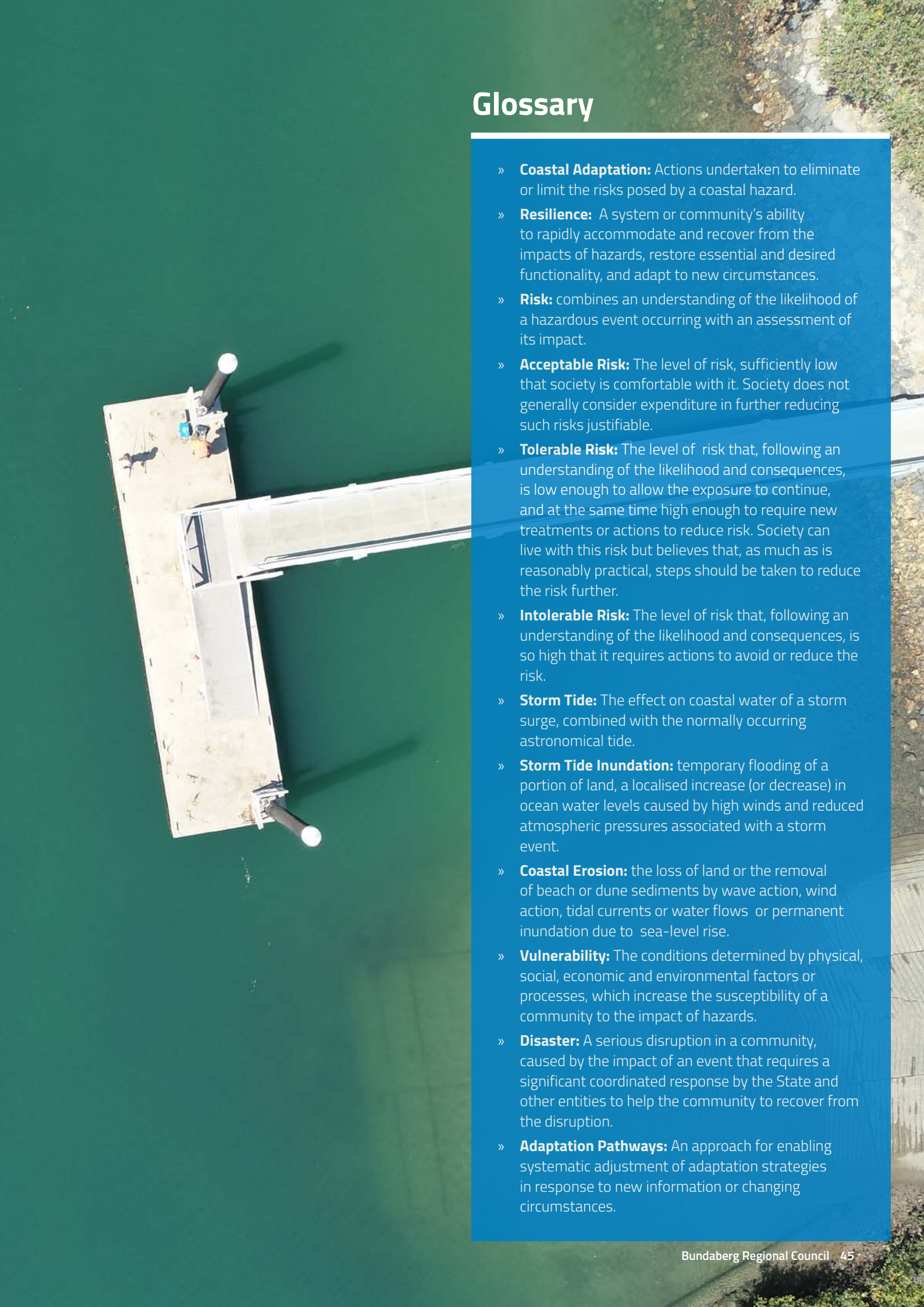
Risk of storm tide inundation is **tolerable** with all scenarios.

Potential for major damages to buildings and infrastructure.

### Adaptation pathway summary

- » Adaptation in Buxton will require a focus on disaster management, education and awareness campaigns, and land use planning to maintain a vision as a coastal character village with limited growth
- » There are no 'Modify' options appropriate for this settlement study area
- » Council will continue to monitor the erosion in the area of Wharf Street, which may lead to a shoreline erosion management plan in this location





# Glossary

- » **Coastal Adaptation:** Actions undertaken to eliminate or limit the risks posed by a coastal hazard.
- » **Resilience:** A system or community's ability to rapidly accommodate and recover from the impacts of hazards, restore essential and desired functionality, and adapt to new circumstances.
- » **Risk:** combines an understanding of the likelihood of a hazardous event occurring with an assessment of its impact.
- » **Acceptable Risk:** The level of risk, sufficiently low that society is comfortable with it. Society does not generally consider expenditure in further reducing such risks justifiable.
- » **Tolerable Risk:** The level of risk that, following an understanding of the likelihood and consequences, is low enough to allow the exposure to continue, and at the same time high enough to require new treatments or actions to reduce risk. Society can live with this risk but believes that, as much as is reasonably practical, steps should be taken to reduce the risk further.
- » **Intolerable Risk:** The level of risk that, following an understanding of the likelihood and consequences, is so high that it requires actions to avoid or reduce the risk.
- » **Storm Tide:** The effect on coastal water of a storm surge, combined with the normally occurring astronomical tide.
- » **Storm Tide Inundation:** temporary flooding of a portion of land, a localised increase (or decrease) in ocean water levels caused by high winds and reduced atmospheric pressures associated with a storm event.
- » **Coastal Erosion:** the loss of land or the removal of beach or dune sediments by wave action, wind action, tidal currents or water flows or permanent inundation due to sea-level rise.
- » **Vulnerability:** The conditions determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards.
- » **Disaster:** A serious disruption in a community, caused by the impact of an event that requires a significant coordinated response by the State and other entities to help the community to recover from the disruption.
- » **Adaptation Pathways:** An approach for enabling systematic adjustment of adaptation strategies in response to new information or changing circumstances.

## Action plan

| Sea level rise scenario         | Now                                                                                                                                                                                                                                                                                       |                                                                                                                         |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| All settlements                 | Regular monitoring, reporting and review. CHAS update every 5-10 years.<br>Implement 'maintain' strategy of: <ul style="list-style-type: none"> <li>» Disaster Management,</li> <li>» Education and awareness,</li> <li>» Land use planning to maintain vision for settlement.</li> </ul> |                                                                                                                         |
| Miara, Winfield and Norval Park | Implement 'maintain' strategy<br><br>Monitor erosion and investigate shoreline erosion management plan in Colonial Cove, Winfield                                                                                                                                                         | Start planning for land                                                                                                 |
| Moore Park Beach                | Implement 'maintain' strategy<br>Resilient infrastructure                                                                                                                                                                                                                                 | Start planning for a causeway Moore Park Road (alternatively road raising)<br>Start planning for land swap at Surf Club |
|                                 |                                                                                                                                                                                                                                                                                           | Start planning for beach<br>Causeway/Road raising                                                                       |
| Burnett Heads                   | Implement 'maintain' strategy<br>Resilient infrastructure (water, electricity, stormwater)                                                                                                                                                                                                |                                                                                                                         |
| Bargara                         | Implement 'maintain' strategy<br>Monitor erosion and investigate shoreline erosion management plan at Bargara Foreshore and Nielson Beach<br>Resilient infrastructure (water, electricity)<br>Investigate resilience at Mon Repos.                                                        |                                                                                                                         |
| Innes Park and Coral Cove       | Implement 'maintain' strategy<br>Resilient infrastructure (water)                                                                                                                                                                                                                         |                                                                                                                         |
| Elliott Heads                   | Implement 'maintain' strategy                                                                                                                                                                                                                                                             | Start planning for land<br>Holiday Park                                                                                 |
| Coonarr                         | Implement 'maintain' strategy<br>Monitor erosion                                                                                                                                                                                                                                          | Start planning for raising key access road, beach nourishment<br>Investigate land use and tenure transition             |
|                                 |                                                                                                                                                                                                                                                                                           | Raising key access road<br>Beach nourishment<br>Land use and tenure transition                                          |
| Woodgate Beach                  | Implement 'maintain' strategy including the shoreline erosion management plan<br>Resilient infrastructure (water, electricity, wastewater)                                                                                                                                                | Start planning for raising<br>and Theodolite Creek<br>Start planning for beach                                          |
| Buxton                          | Implement 'maintain' strategy<br>Monitor erosion and investigate shoreline erosion management plan at Wharf Street                                                                                                                                                                        |                                                                                                                         |

Legend

Maintain

Modify

Transform

| 0.2m                                         | 0.4m                                                                                                               | 0.8m                                                         |
|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
|                                              |                                                                                                                    |                                                              |
|                                              |                                                                                                                    |                                                              |
| Land swap                                    | Land swap at Miara Holiday Park                                                                                    |                                                              |
| Beach nourishment<br>Raising Moore Park Road | Beach nourishment<br>Start planning for raising Murdochs Linking Road<br>Start planning for causeway Malvern Drive | Road raising Murdochs Linking Road<br>Causeway Malvern Drive |
| b.                                           |                                                                                                                    |                                                              |
|                                              | Start planning for storm surge barrier                                                                             | Storm surge barrier                                          |
|                                              | Start planning for land swap at Lighthouse Tourist Park                                                            | Land swap at Lighthouse Tourist Park                         |
|                                              | Start planning for beach nourishment at Kellys Beach                                                               | Beach nourishment at Kellys Beach                            |
|                                              | Start planning for beach nourishment                                                                               | Beach nourishment                                            |
| Land swap at Elliott Heads                   | Land swap at Elliott Heads Holiday Park                                                                            |                                                              |
| ad                                           |                                                                                                                    |                                                              |
| transition                                   |                                                                                                                    |                                                              |
| Raising Acacia Street<br>Road                | Raising Acacia Street and Theodolite Creek Road<br>Beach nourishment                                               | Raising Paperbark Court,<br>Walkers Point Road               |
| Beach nourishment                            | Start planning for raising Paperbark Court<br>and Walkers Point Road                                               |                                                              |



## More Information

[bundaberg.qld.gov.au/ourcoast](http://bundaberg.qld.gov.au/ourcoast)

### Coastal adaptation resources

[www.qcoast2100.com.au/](http://www.qcoast2100.com.au/)

[www.coastadapt.com.au/](http://www.coastadapt.com.au/)

[www.nccarf.edu.au/](http://www.nccarf.edu.au/)

### Sea level rise projections and monitoring

[www.qld.gov.au/environment/coasts-waterways/plans/hazards/sea-level-mapping](http://www.qld.gov.au/environment/coasts-waterways/plans/hazards/sea-level-mapping)

[www.stateoftheenvironment.des.qld.gov.au/climate/coasts-and-oceans/sea-level](http://www.stateoftheenvironment.des.qld.gov.au/climate/coasts-and-oceans/sea-level)

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