RESILIENT COAST

DOUGLAS SHIRE COUNCIL

RESILIENT COAST

STRATEGIC PLAN

2019 - 2029

DOUGLAS SHIRE COUNCIL

MAYOR'S MESSAGE

Douglas Shire is a place of spectacular beauty. Our coastal zone encompasses world-class landscape features, including pristine rainforest and beaches, and a diversity of cultural, economic and environmental values. The coast is highly valued by our Traditional Owners, Douglas communities and visitors to the area.

The Traditional Owners of the land, including the Eastern Kuku Yalanji to the north and Yirrganydji to the south, have inhabited and cared for this ancient landscape for thousands of years.

The natural beauty of our region now underpins our economy. Douglas Shire Council recognises this, as we seek to provide safe, accessible and liveable communities.

Coastlines are dynamic, ever-changing with each tide and storm event. Erosion and storm tide events are natural processes that shape the coast over long timeframes. However, these events become coastal hazards when they impact on our communities. Douglas Shire is prone to cyclone and storm events, and coastal hazard impacts are predicted to increase with a changing climate.

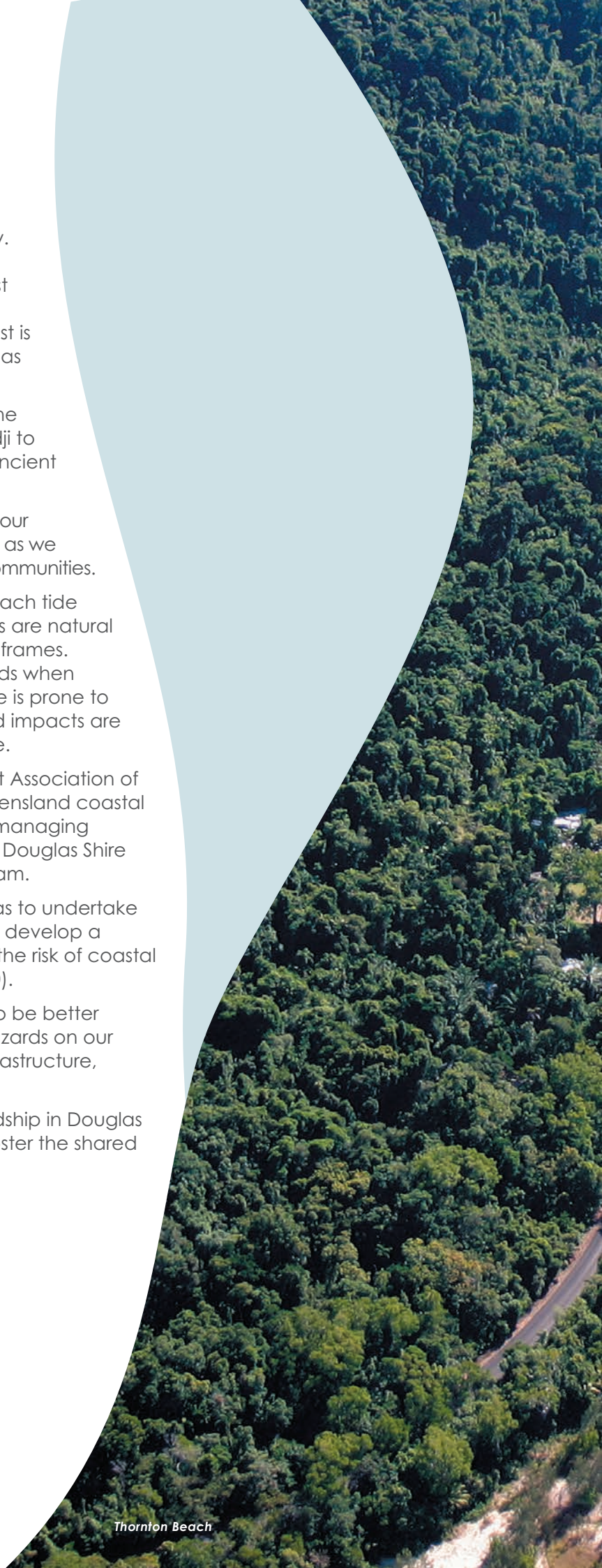
The State Government and Local Government Association of Queensland (LGAQ) provided funding to Queensland coastal Councils to develop a strategic approach to managing coastal hazards. With the funding awarded to Douglas Shire Council, we created the Resilient Coast program.

The purpose of the Resilient Coast program was to undertake a transparent process with our communities to develop a Strategic Plan to help us proactively manage the risk of coastal hazards, both now and into the future (to 2100).

Our Resilient Coast Strategic Plan enables us to be better prepared to reduce the impacts of coastal hazards on our communities, environment, cultural values, infrastructure, liveability and services.

We have a strong sense of community stewardship in Douglas Shire, and our Strategic Plan will continue to foster the shared care of our spectacular coastline.

Julia Leu



Thornton Beach

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Yule Point

QCoast2100
COUNCILS LEADING COASTAL ADAPTATION

Thala Beach

1. INTRODUCTION

1.1 OUR COASTLINE

Douglas Shire has over 100 km of coastline extending from Degarra in the north, to south of Wangetti (**Figure 1**). Famous for its Rainforest to Reef setting, our coastal zone is at the interface of two World Heritage Listed areas: The Great Barrier Reef and the Wet Tropics, including the ancient rainforest of the Daintree.

The coastline is characterised by a unique combination of coastal landforms, including rocky headlands, pocket beaches, bays, estuaries, dune systems, near shore reefs, and the ecosystems they support.

Our coastal landscape supports a diversity of landuse types, communities, and cultural, environmental and economic values.

The landscape has been shaped by coastal processes over many thousands of years. Erosion and accretion of the shoreline, and inundation of coastal areas, are part of these natural processes. However, erosion and inundation are also considered to be coastal hazards due to the potential disruptive impacts for communities, services, lifestyle and the economy.

Famous for its Rainforest to Reef setting, our coastal zone is at the interface of two World Heritage Listed areas.

Figure 1. Douglas Shire coastline

Dickson Inlet

1.2 THE STRATEGIC PLAN

Context

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

Douglas Shire Council was awarded funding through QCoast2100 to undertake the Resilient Coast program and develop a Coastal Hazard Adaptation Strategy (CHAS), which is presented as the Resilient Coast Strategic Plan.

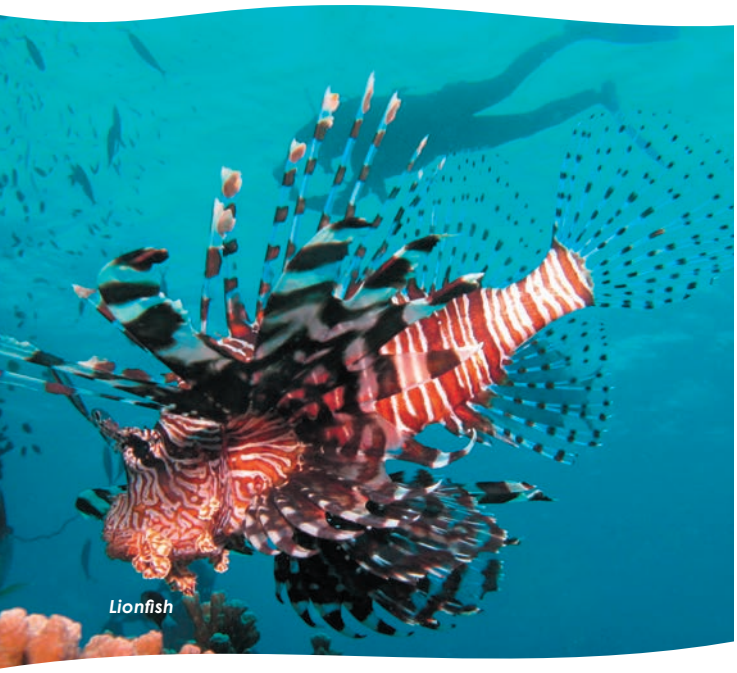
The Resilient Coast Strategic Plan:

- Has been developed to proactively manage the impact of coastal hazards, now and into the future
- Was developed in partnership with communities and other stakeholders
- Includes our full coastal landscape and all our coastal communities

Purpose

The purpose of the Strategic Plan is to:

- Inform future decisions regarding the protection and management of our coast and foreshore
- Inform future land use planning
- Guide the management of public utilities and facilities
- Guide the management of areas of environmental and cultural significance
- Foster collaboration and the shared care of our coastline.



Lionfish

Approach

The Resilient Coast Strategic Plan has been developed through an eight-phase process (**Figure 2**) as outlined in the QCoast2100 Minimum Standards & Guidelines (LGAQ and DEHP 2016).

The process has included a series of studies and activities that sought to:

- Identify coastal hazard areas
- Understand vulnerabilities and risks to assets
- Engage with the community to understand the preferred approaches to adaptation
- Determine adaptation actions, costs, priorities and timeframes for implementation.

Figure 2. QCoast2100 eight-phase process

1.3 ENGAGEMENT

Process

The Strategic Plan has been developed via a transparent process with all our Douglas communities. Community workshops were held in May and October 2018, at multiple venues including Mossman, Cape Tribulation and Port Douglas. Two community surveys and online knowledge sharing was also completed over 2018, attracting over 200 responses.

A Stakeholder Advisory Group has provided input and feedback during each phase of the process. The Stakeholder Advisory Group, Chaired by Mayor Julia Leu, included representatives from:

- Australian Cane Farmers Association / Next Gen
- Canegrowers Mossman
- Daintree Marketing Cooperative
- Department of Agriculture and Fisheries
- Douglas Shire Council
- Jabalbina Yalanji Corporation
- Queensland Parks and Wildlife Service (QPWS)
- Terrain NRM
- Tourism Port Douglas Daintree (TPDD)
- Wet Tropics Management Authority (WTMA)

Other special interest groups also provided input and feedback via tailored briefings, including:

- State Government and Local Government Association of Queensland (LGAQ)
- Transport and Main Roads (TMR)
- Utilities providers (Telstra, Ergon Energy, National Broadband Network)
- Douglas Local Marine Advisory Committee (LMAC)
- Local Disaster Management Group (LDMG) Douglas.

All stakeholders and our Douglas communities provided meaningful input and ideas that shaped the direction of technical investigations underpinning the Strategic Plan.

Scuba Diving in the Great Barrier Reef

Myall Beach

Communication

During development of the Strategic Plan, the Resilient Coast communication materials included monthly project updates and a series of tailored fact sheets relevant to coastal hazard adaptation. Stakeholder groups and Douglas communities also co-designed a coastal story timeline on past events that have shaped the character of the coastline, and identified the important elements of a future Resilient Coast.

The coastal story timeline and fact sheets are provided in Supplement A and B to this Strategic Plan. The fact sheets include:

- Terminology
- Coastal landscapes
- Coastal adaptation
- Coastal hazards
- Adaptation framework
- Resilient homes
- Economics.

A dedicated Resilient Coast website page was established for the life of the program (2018-2019) to provide a central place for all project updates, fact sheets, event information and an interactive map.

The engagement and communication process across all phases of the Resilient Coast program was informed by planning undertaken in Phase 1 (DSC 2017a), and specific action plans developed for Phases 3 – 8 (DSC 2018a – 2018f).

Outcomes

Outcomes from engagement events during the program included:

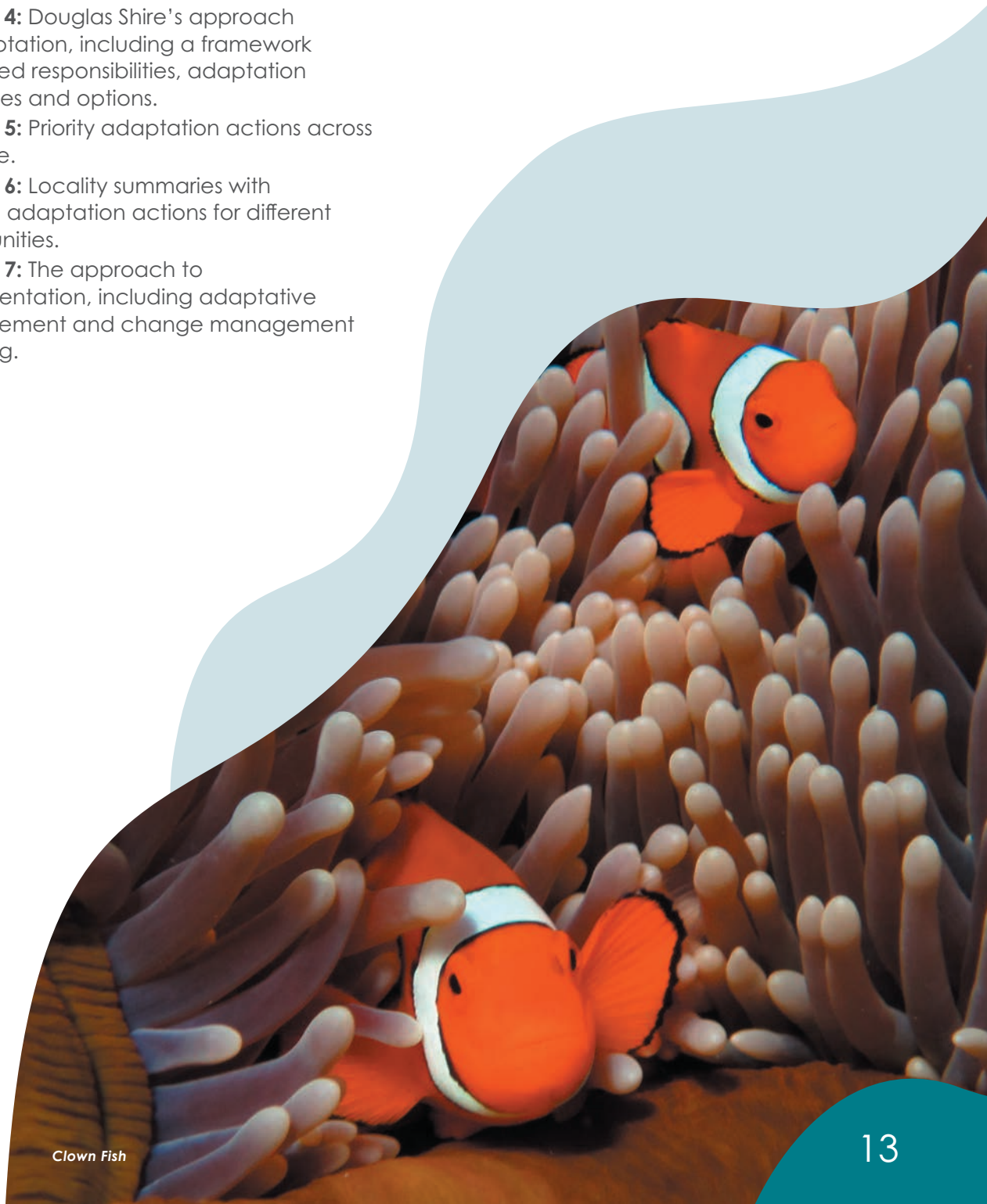
- A shared understanding of
  - > Values and issues for the coastline and different communities
  - > Past events, and a vision for what a Resilient Coast looks like in the future for Douglas Shire
  - > Coastal hazards and risk (likelihood and consequence)
- Tailoring of technical investigations based on input from stakeholder groups and Douglas communities
- Appreciation of the shared objectives for coastal management, and preferred approaches to adaptation.

1.4 CONTENT OF THE PLAN

The Strategic Plan includes:

- **Section 2:** An overview of landscape features, values, history, and important elements of a Resilient Coast for Douglas Shire.
- **Section 3:** An overview of coastal hazards, including erosion and storm tide inundation, areas that may be exposed to coastal hazards, and the implications of exposure including potential economic costs.
- **Section 4:** Douglas Shire's approach to adaptation, including a framework for shared responsibilities, adaptation responses and options.
- **Section 5:** Priority adaptation actions across the Shire.
- **Section 6:** Locality summaries with tailored adaptation actions for different communities.
- **Section 7:** The approach to implementation, including adaptative management and change management planning.

The Strategic Plan has been developed via a transparent process with all our Douglas communities



Clown Fish

Mowbray

2. DOUGLAS SHIRE COASTAL ZONE

2.1 COASTAL LANDSCAPE

Values

The Douglas Region is the traditional homeland of Aboriginal Rainforest People (Bama), including the Eastern Kuku Yalanji to the north and Yirrganydji to the south. The coastal landscape has high cultural significance to the Traditional Owners, who value the protection and sustainability of the land and sea (country).

Well known features of our Douglas Shire coastline include:

- World class natural beauty
- The unique 'Rainforest to Reef' setting
- Pristine rainforest and sandy beaches
- Dynamic river and estuary systems.

Key environmental values include:

Coastal landforms – including sandy embayments, rocky headlands, pocket beaches, estuaries, dune systems and near shore reefs

Vegetation communities and ecosystems – including the rainforest, mangroves and native dune vegetation

Significant and endangered species – including both land and marine environments (e.g. turtles, birds and fish).

Our coastal zone supports a diversity of landuse types including productive agriculture, urban development and critical infrastructure, recreation and amenity space, and conservation areas.

Wangetti Beach

Low Island

Economy

Our economy is underpinned by the natural beauty of the landscape, which attracts residents and visitors to the region.

Tourism is the dominant industry sector in Douglas Shire attracting over 420,000 tourists that stay a total of over 2.2 million guest nights per annum. The region also attracts significant levels of day visitors, particularly out of Cairns (both tourists and regional residents).

The direct contribution of tourism to the Douglas Shire economy is estimated to be in the order of $140 million per annum[1], or 26% of the total economy (compared to the averaged 3% contribution of tourism to the QLD State economy).

Agriculture is also an important industry for Douglas Shire, with a direct contribution of 6.6% to the total economy (compared to the average 3.7% contribution of agriculture to the QLD State economy).

Primary production is a significant part of the natural resource and landscape value of the Shire. The Shire's townships and villages rely heavily on their surrounding sugar cultivation, tropical agriculture, horticulture and grazing industries. The sugar industry has been an important component of the Douglas Shire community for more than 120 years.

The top five sectors contributing to our economy are:

- Accommodation and food services
- Transport, postal and warehousing
- Administrative and support services
- Agriculture, forestry and fishing
- Retail trade.

1 National Institute of Economic and Industry Research (NIEIR 2018)

2.2 TOWARDS A RESILIENT COAST

Change and resilience

The coastline is a dynamic and picturesque part of the landscape, where the land meets the sea. One of the more challenging aspects of the coastal landscape is that it experiences constant, and often rapid change.

Wind and waves continually work to move sediment and shape the shoreline, and extreme weather events can periodically result in substantial erosion and inundation of coastal land.

Rivers also have capacity to deliver large volumes of sediment to the coastal zone, and have a strong influence on estuary and coastline dynamics.

A resilient coast has social, economic and environmental systems in place to avoid, manage and mitigate the impact of hazardous events or disturbances (e.g. coastal hazards). Resilience also means the ability to respond or reorganise in ways that maintain the essential function, identity and values of a region.

For Douglas Shire, coastal hazard adaptation options have been developed in keeping with the identity and values of our coastal communities.

A shared visioning process was undertaken with Douglas communities and all stakeholder groups as part of the Strategic Plan development. The following elements were identified as important for a Resilient Coast across Douglas Shire:

- Community services and lifestyle
- Environmental values
- Traditional Owner values
- Infrastructure
- Economy and growth
- Public safety.

Additional comments from the visioning discussions is provided in the coastal story timeline included in Supplement B.

Four Mile Beach (northern)

RESILIENT COAST SURVEY #1 MAY 2018:

The first survey for the Resilient Coast program was completed in May 2018. Over 100 responses were received. The survey helped inform an understanding of key values, awareness of coastal hazards, and past experiences.
Highlights from the survey findings include:

THE TOP VALUES ARE NATURAL BEAUTY AND ACCESS:

Unique landscape features, natural ecosystems, and access to the beaches were the highest ranked values. 100% of respondents identified the natural beauty of the region as a main factor attracting people to live on and visit the Douglas Shire coastline.

THERE IS GOOD AWARENESS OF COASTAL HAZARDS:

Awareness of coastal hazards is high: 90% of respondents expect that the Douglas Shire coastline is likely to be affected by coastal erosion or coastal flooding in the future.

COMMUNITIES HAVE BEEN IMPACTED BY PAST HAZARDS:

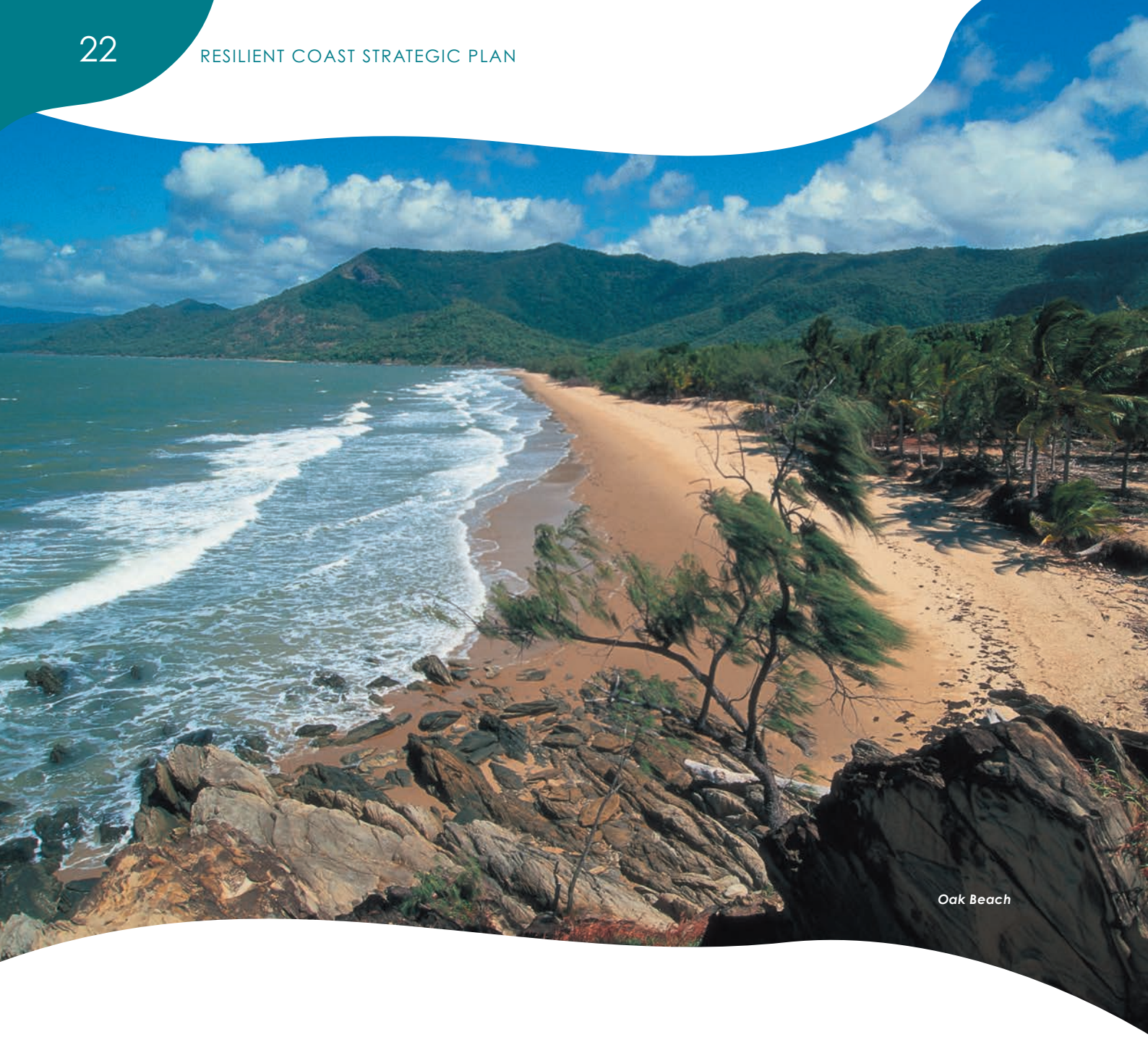
50% of respondents had been previously impacted by coastal erosion and/or inundation once or several times in recent decades.

THERE IS SUPPORT FOR PRO-ACTIVE PLANNING:

80% of respondents agree there is more planning and preparation needed to withstand and recover from potential impacts of coastal hazards.

Newell Beach

3. COASTAL HAZARDS



Oak Beach

Periodic inundation and erosion are natural processes and contribute to shaping the unique landforms of our coastal zone.

3.1 HAZARDS

Coastal hazards include storm tide inundation of low-lying coastal land, and / or erosion of the shoreline.

Periodic inundation and erosion are natural processes and contribute to shaping the unique landforms of our coastal zone. However, when these processes have an adverse impact on communities, infrastructure and some natural assets, they are considered coastal hazards. In north Queensland, major coastal hazard impacts are typically associated with Tropical Cyclones.

3.2 STORM TIDE INUNDATION

Storm tide inundation is the flooding of low-lying coastal land from a locally elevated sea level (the 'storm tide'). The storm tide is a combination of the predicted tide, storm surge, and wave action (**Figure 3**). Storm surge is driven by the combined influence of low atmospheric pressure and high winds associated with events such as Tropical Cyclones.

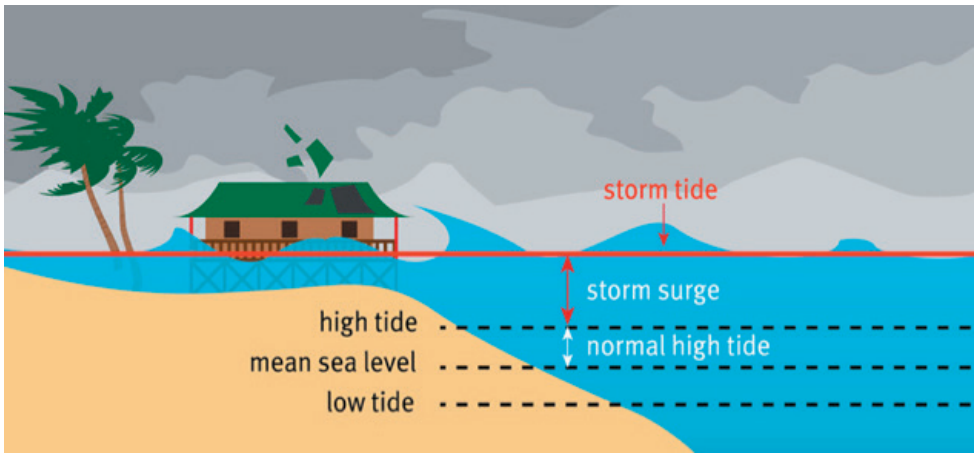


Figure 3. Components of storm tide (source: coastadapt.com.au).

3.3 COASTAL EROSION

Coastlines naturally erode and accrete over time, driven by variations in sediment supply and climate patterns.

Short term erosion

Coastal erosion occurs when winds, waves and coastal currents act to shift sediment away from the shoreline. This can be a short-term shift, often associated with storm activity (termed storm bite), and the beach will then gradually rebuild (**Figure 4**).

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

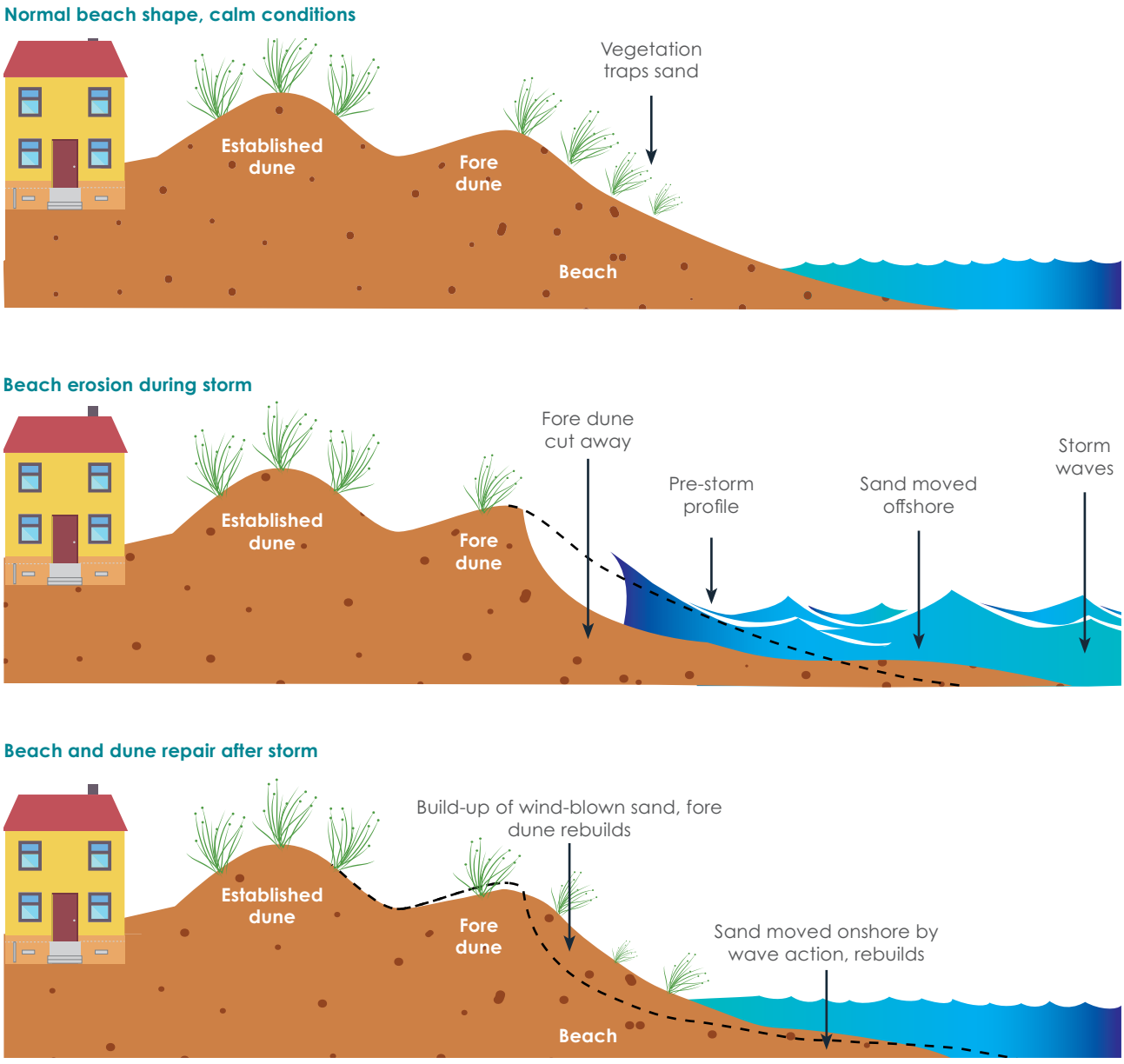


Figure 4. Natural short-term erosion and rebuilding process

Four Mile Beach (northern)

Long term erosion

In other cases, due to changing sediment supply or climate conditions, the beach may not have sufficient capacity to rebuild between storm events. In the absence of intervention, long-term erosion (termed recession) may occur, which is the landward movement of the shoreline over a longer timeframes (decades).

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

3.4 CURRENT AND FUTURE EXPOSURE

Updated mapping

Douglas Shire is prone to cyclone and storm events, and coastal hazard impacts are predicted to increase with a changing climate.

As part of the Resilient Coast program, the existing mapping for Erosion Prone Areas and predicted storm tide inundation zones has been updated for the full Douglas Shire coastline.

These updates have been based on the best available technical data, and have included:

- New modelling of open coast erosion[2]
- Application of the State Government approach to defining Erosion Prone Areas, tailored to the Douglas Shire region in consultation with State and LGAQ[3]
- Updated mapping of storm tide inundation zones based on the Cairns Regional Storm Tide Study[4][5] outputs.

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

- Modelled open coast erosion potential
- A rocky coast buffer zone
- 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 State Government, a sea level rise of 0.8 m by 2100 has been adopted for the Resilient Coast Strategic Plan (with 0.4 m by 2060).

As part of the Resilient Coast program, the existing mapping for Erosion Prone Areas and predicted storm tide inundation zones have been updated for the full Douglas Shire coastline.

2 Refer Phase 3 summary report (DSC 2018a)
3 Refer Phase 3 summary report (DSC 2018a)
4 Cairns Regional Storm Tide Study (BMT 2013)
5 Refer Phase 3 summary report (DSC 2018a)

Planning horizons

Mapping for both erosion and storm tide inundation includes consideration of three planning horizons - present day, an intermediate horizon (2060) and 2100. For each of these planning horizons, three likelihoods of exposure are also mapped (likely, possible, rare) which correspond to the Annual Exceedance Probability (AEP) of different events (10%, 1% and 0.2%) (**Table 1**).

Likelihood of occurrence	Hazard AEP	Planning horizons
Likely	10%	Present-day, 2060, 2100
Possible	1%	Present-day, 2060, 2100
Rare	0.2%	Present-day, 2060, 2100

Table 1. Likelihood of occurrence scenarios.

Maps are provided in Supplement C to the Strategic Plan. 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 the impacts can be avoided, mitigated or managed through adaptation planning.

Additional detail on the mapped components and the approach is provided in the Phase 3 summary report (DSC 2018a).

Cooper Creek

Exposure

Planning scheme zones associated with residential areas, tourist accommodation, recreation and open space, community facilities, rural residential and special purpose areas, are likely to experience increased exposure to erosion and inundation by 2100. For these zones, there is typically up to a 20% increase in total area exposed to coastal hazards by 2100[6].

The area of agricultural land exposed to coastal hazards may double by 2100, increasing from 7% of total area exposed at the present day, to 14% by 2100.

Areas of indigenous land, high ecological value wetlands and mangroves may experience a small increase in area exposed to coastal hazards (in the order of 2%) by 2100.

Additional information on exposure is provided in the Phase 4 summary report (DSC 2018b).

6 Refer Phase 4 summary report (DSC 2018b)

FUTURE COASTAL HAZARDS

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)

Sugar Wharf, Port Douglas

3.5 POTENTIAL IMPACTS

Approach

Coastal hazards have the potential to have adverse impacts on Douglas Shire communities, services and lifestyle, in both the present day and by 2100.

As part of the Resilient Coast program, new technical assessments were undertaken to review coastal hazard risk for a range of assets across the Shire. The risk assessment has included analysis of:

- Data collated in an updated database of infrastructure assets (drainage, sewerage, water reticulation, roads, marine, beach and foreshore)
- The Douglas Shire planning scheme land parcels
- New information collated on dwellings (building locations, types)
- Critical Council infrastructure.

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 stakeholder and community feedback on the important elements for the coastal zone (property and infrastructure, economy and growth, public safety, environmental values, Traditional Owner values, community services and lifestyle).

Humphead Maori Wrasse

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 (**Table 3**)
- Coastal hazard risk was assessed (low, medium, high, very high), based on the likelihood and consequence for each asset or land parcel, separately for erosion and inundation.

		Consequence				
		Insignificant	**Minor**	**Moderate**	**Major**	**Catastrophic**
Likelihood	**Likely 10% AEP**	Low	Medium	High	Very high	Very high
	Possible 1% AEP	Low	Medium	Medium	High	Very high
	Rare 0.2% AEP	Low	Low	Medium	Medium	High

Table 2. Risk matrix.

Consequence	Property and infrastructure	Economy and growth	Environmental values
Catastrophic	Widespread major damage or loss of property or infrastructure with total value >$50 million. Partial recovery/repair may take many years.	Regional economic decline, widespread business failure and impacts on state economy.	Severe and widespread, permanent impact on multiple regionally or nationally significant ecosystem services and natural features of the region. Recovery unlikely.
Major	Major damage or loss of property or infrastructure with total value >$5 million. Full recovery/repair may take several years.	Lasting downturn of local economy with isolated business failures and major impacts on regional economy.	Severe and widespread semi-permanent impact on one or more regionally or nationally significant ecosystem services and natural features of the region. Partial recovery may take many years.
Moderate	Moderate - major damage to property or infrastructure with total value >$1 million. Full recovery may take less than 1 year.	Significant impacts on local economy and minor impacts on regional economy.	Substantial impact on one or more locally significant ecosystem services and natural features of the region. Full recovery may take several years
Minor	Minor damage to properties or infrastructure with total value >$200,000.	Individually significant but isolated impacts on local 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
Insignificant	Minimal damage to properties or infrastructure with total value >$50,000.	Minor short-term impact on local economy.	Little to no environmental impact

Table 3. Consequence categories for the Douglas Shire Resilient Coast Strategic Plan (modified after LGAQ and DEHP 2016)

Public safety	Traditional Owner values	Community services and lifestyle	Consequence
Loss of lives and/or permanent disabilities.	Severe and widespread, permanent impact on multiple sites of indigenous significance, including loss of land, connection to land, and ability to continue traditional practices. Recovery unlikely.	Widespread semi-permanent impact (~1year) to highly utilised community services, wellbeing, or culture of the community with no suitable alternatives.	**Catastrophic**
Widespread series injuries/ illnesses.	Severe and widespread semi-permanent impact on one or more sites of indigenous significance, including loss of land, connection to land, and ability to continue traditional practices. Partial recovery may take many years.	Major widespread long-term (~1 month) disruption to well-utilised services, wellbeing, or culture of the community with very few alternatives available.	**Major**
Isolated series injuries/ illnesses and/or multiple minor injuries/ illnesses.	Substantial impact on one or more sites of local indigenous significance. Full recovery may take several years.	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.	**Moderate**
Minor and isolated injuries and illnesses.	Small, contained and reversible short-term impact on sites of indigenous significance. Full recovery may take less than 1 year.	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.	**Minor**
Negligible injuries or illnesses.	Little to no impact to sites of indigenous significance.	Very small short-term disruption (~1 hour) to services, wellbeing, finances, or culture of the community with numerous alternatives available.	**Insignificant**

Assets at risk

Outputs from the risk analysis were mapped for all localities across the Shire[7], to review the distribution of assets / land at risk from coastal hazards. 'At risk' assets is inclusive of any assets with a medium to very high risk of adverse impacts from coastal hazards.

For infrastructure, up to 50% of beach and foreshore assets are currently at risk from coastal hazards, increasing to 85% by 2100 (**Table 4**). Sewerage, drainage and water reticulation assets currently have a relatively low risk (<5% of assets at risk), increasing to 10% of assets at risk by 2100. Roads at risk of coastal hazards may increase from 5% to 20% by 2100.

	Erosion processes (EPA)			Storm tide inundation		
% infrastructure assets at risk from coastal hazards	**Present day**	**2060**	**2100**	**Present day**	**2060**	**2100**
Beach and foreshore	50%	69%	85%	27%	31%	33%
Marine	25%	25%	25%	23%	23%	25%
Sewerage	3%	7%	16%	1%	4%	5%
Water reticulation	1%	1.5%	10%	1%	2%	3%
Drainage	4%	6%	10%	0%	0%	0%
Roads	5%	15%	20%	8%	25%	44%

Table 4. Infrastructure assets at risk.

7 Refer Phase 5 and 6 Summary reports (DSC 2018c and 2018d)

Potato Cod

For our planning scheme zones, recreation and open space, special purpose and environmental management areas are the main zones at risk from coastal hazards in the present day (with 20 – 40% of land at risk), increasing by 2100 (with up to 55% of land in these zones at risk) (**Table 5**).

Coastal hazard risk will increase notably by 2100 for residential zones, tourist accommodation and town centre zones. At present <5% of the area of these zones are exposed to coastal hazards, which may increase to 10-30% of the total area at risk by 2100.

	Erosion processes (EPA)			Storm tide inundation		
% planning scheme zone areas at risk from coastal hazards	Present day	2060	2100	Present day	2060	2100
Conservation	3%	3%	3%	2%	3%	3%
Rural	5%	7%	10%	5%	7%	9%
Low-medium Density Residential	2%	4%	9%	1%	9%	17%
Recreation and Open Space	32%	40%	52%	0%	0%	0%
Tourist Accommodation	3%	6%	16%	3%	18%	22%
Low Density Residential	1%	4%	10%	1%	8%	15%
Community Facilities	1%	2%	5%	4%	11%	13%
Rural Residential	9%	16%	28%	7%	14%	20%
Special Purpose	42%	48%	55%	37%	44%	47%
Environmental Management	22%	23%	25%	21%	22%	23%
Centre	6%	11%	20%	8%	23%	23%
Industry	3%	4%	6%	2%	5%	5%
Medium Density Residential	1%	2%	7%	0%	4%	4%
Tourism	0%	0%	0%	0%	0%	0%

Table 5. Area of planning scheme zones at risk.

Coastal hazard risk for residential dwellings at the present day is in the order of 150 dwellings across the whole Shire. By 2100, this may double to over 300 dwellings in the at-risk zone for coastal hazards.

Local ecosystems and significant species may also be at risk of adverse impacts from coastal hazards. The nature of these risks are complex and the subject of ongoing research.

Additional detail on the asset and risk assessment, and associated mapping, is provided in the Phase 5 and 6 summary reports (DSC 2018c and 2018d).

Communities

Our understanding of coastal hazard risk for assets and land across our Shire, provides a basis to begin targeting our adaptation response and actions. All our Douglas coastal communities are included in this Strategic Plan, with the adaptation effort, response and actions tailored to the location specific needs (**Table 6**).

Communities	Implications for adaptation
Wonga Beach, Newell, Cooya Beach, Port Douglas and Craiglie	• Larger settlements • Typically a diversity of assets with medium to very high risk (present day and by 2100) • Mitigating coastal hazards will involve a suite of adaptation options to collectively reduce the risk
Thornton Beach, Rocky Point, Pebbly Beach, Oak Beach	• Smaller settlements • Several types of assets with medium to very high risk (present day and by 2100) • Mitigating coastal hazards will involve several adaptation options to reduce risk at location or site scale
Degarra, Cowie Point, Cape Tribulation, Cow Bay and Cape Kimberley, Wangetti, South of Wangetti	• Smaller settlements / site specific locations • Limited assets at risk (if any) present day, may change by 2100 • Mitigating coastal hazards (if relevant) will involve targeted adaptation options to address site specific issues

Table 6. Communities and adaptation needs.

Mowbray

Economic costs (base case)

In the absence of intervention / adaptation, there are economic costs associated with coastal hazards.


White Lipped Tree Frog

Economic analysis is important for determining the best approach to coastal hazard adaptation for different localities. Economics is used in several ways including to:

- Value assets and key industries
- Define a base case (cost of no action)
- Assess adaptation options.

After assigning values to key infrastructure and natural assets[8], the foundational step of an economic assessment in coastal hazard adaptation is to define a base case. This means determining the potential economic costs or losses associated with coastal hazards (and no adaptation) (**Figure 5**). This becomes the baseline for a cost-benefit assessment of implementing adaptation options.

8 Refer to Phase 7 summary report (DSC 2018e)

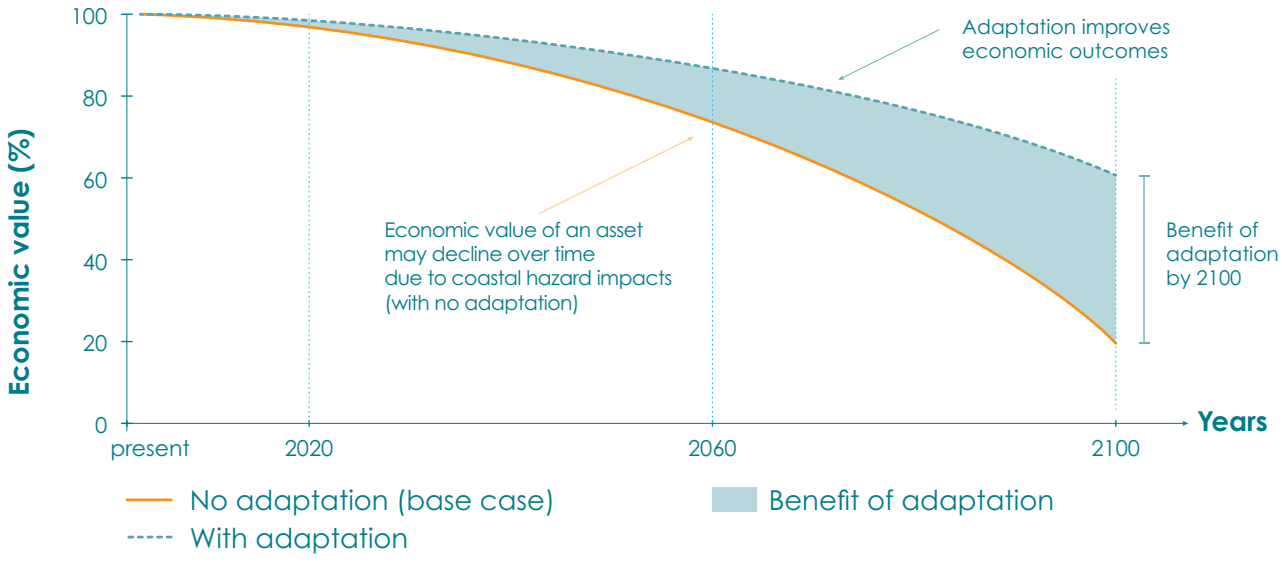


Figure 5. Economic benefit of adaptation

The base case for Douglas Shire has been determined by examining the likelihood and consequence ($ damage) of coastal hazard impacts on assets across the region, and at different timeframes (e.g. present day, 2060, 2100).

For Douglas Shire, four key components of damages / losses have been considered for the base case:

1. **Damage to public assets** - Council infrastructure, e.g. culverts, roads and wastewater treatment plants
2. **Damage to private building assets** - Dwellings in the coastal hazard zone
3. **Damage to natural assets** - e.g. Mangroves, wetlands and coastal forests
4. **Loss of production** for agriculture - e.g. lost cane production.

For Douglas Shire, the average annual damages associated with coastal hazard impacts is estimated to be in the order of $6 million dollars (**Figure 6**).

In the absence of adaptation, this is likely to increase up to $42 million dollars (average annual damages) by 2060, and over $140 million dollars (average annual damages) by 2100. The predicted increase in tidal areas linked to sea level rise is the main driver of the increase. The majority of damages are linked to private dwellings.

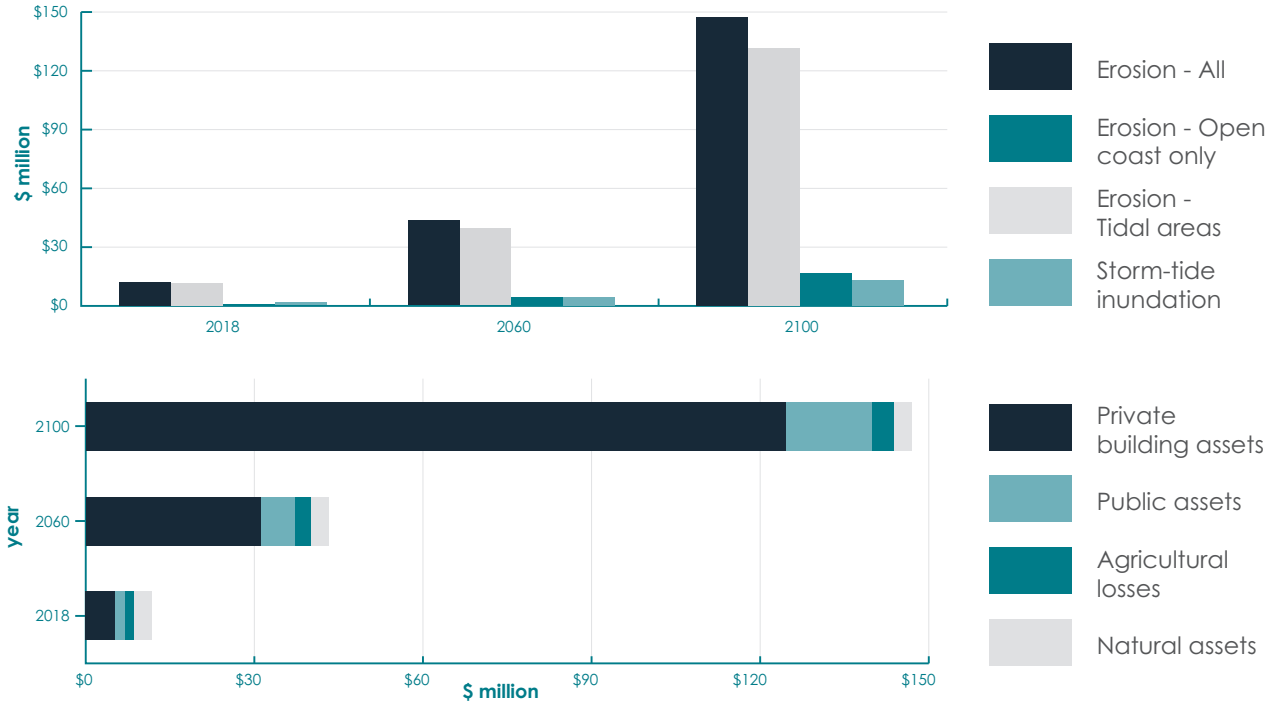
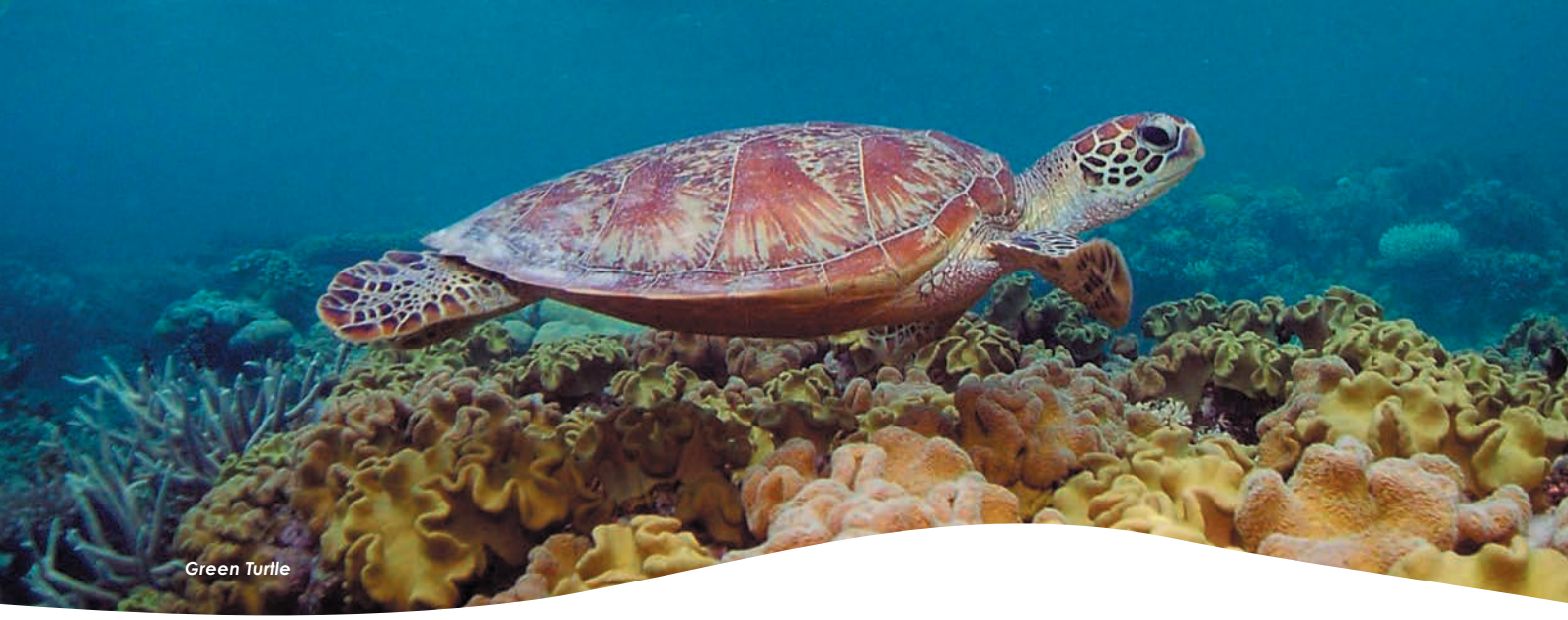


Figure 6. Potential average annual damages from coastal hazards (base case)



Green Turtle

Coastal hazards also have potential to impact on access to and across Douglas Shire, with flow on impacts for the economy.

The impact of coastal hazards on road access is one of the greater risks to tourism in the Shire. A number of roads are potentially at risk from inundation or erosion. The most notable of these is the Cape Tribulation Road that provides the gateway to much of the Daintree Rainforest, a major attraction for visitors.

Visitor survey data indicates high levels of visitation for *all three* rainforest locations (Mossman Gorge 62.5%, Daintree Village 46.3%, Cape Tribulation 63.1%), indicating that visitors tend to visit multiple sites. The temporarily loss of access to Cape Tribulation due to a road closure means visitors will tend to shorten their length of stay in the region by up to one full day.

The cost to the local economy from a one-day closure of the Cape Tribulation Road is estimated to be in the range of $33,000 to $184,000 per day[9].

Closure for one week has an estimated cost of between $0.25 million and $1.30 million, while a closure for a month could have a cost exceeding $5 million.

Strategic adaptation can assist to avoid, mitigate and manage the impacts and potential economic damage associated with coastal hazards.

9 Refer Phase 7 summary report (DSC 2018e)

Implementing the adaptation approach and actions in the Resilient Coast Strategic Plan will contribute to avoiding potential economic costs to the Shire of up to:

PRESENT DAY:

$6 million dollars per annum

BY 2060:

$42 million dollars per annum

BY 2100:

$140 million dollars per annum.

Myall Beach

4. APPROACH TO ADAPTATION

4.1 FRAMEWORK

Shared roles and responsibilities

Douglas Shire Council recognise a shared responsibility for the management of coastal hazard risk; shared by Council, other land managers and private land owners.

Council have a role to set the strategic adaptation response for different localities across the Shire. Council will undertake adaptation actions relevant to the maintenance and protection of Council's land and assets, and inform statutory planning.

The shared management of coastal hazard risk includes to: observe changes in the risk profile over time, plan to adapt, and act (implement actions) (**Table 7**). Council's role includes to:

- **Inform** – Council will make available to all stakeholders (including public and private land and asset owners) the outcomes of relevant Council-led investigations on coastal hazard risk, planning and adaptation options.
- **Observe** – Council will actively observe / monitor coastal hazard risk for Council owned land and assets. For land and assets owned or managed by others, Council may, as part of everyday activities, observe a risk from coastal hazards and will notify the relevant land owner / manager.
- **Plan** – Council will set the adaptation response at localities across the Shire, and plan to mitigate the risk of coastal hazard impacts on Council owned land and assets. Council will also inform appropriate land use planning and adaptation actions across the Shire.
- **Act** – Council will implement adaptation actions to mitigate the risk of coastal hazard impacts on Council owned land and assets. Council will also inform appropriate adaptation actions and land use across the Shire.

Initiatives in the Resilient Coast Strategic Plan seek to foster and enable other stakeholders to proactively manage coastal hazard impacts with their own land / assets in accordance with the Strategic Plan and in consultation with Council.

		Land or asset type		
		Council owned	Managed by other authorities	Privately owned
Council's role	Inform	✓	✓	✓
	Observe	✓	✗	✗
	Plan	✓	✗	✗
	Act	✓	✗	✗

Table 7. Council's role in coastal hazard adaptation

Oak Beach

Tailored 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:

- Assigning a strategic **adaptation response** to different localities, to guide decision making over 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 strategic plan for coastal adaptation, with prioritised actions over a 5—10 year timeframe.

A tailored framework has been developed for Douglas Shire, to guide decision making on adaptation response and options across the region. This framework has been informed by:

- Consultation with stakeholders, including our Douglas communities
- The values and objectives for different locations across our Shire
- An understanding of the risk of coastal hazards
- A Shire-scale perspective of the range of values, uses and pressures in the coastal zone.

Adaptation objectives

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

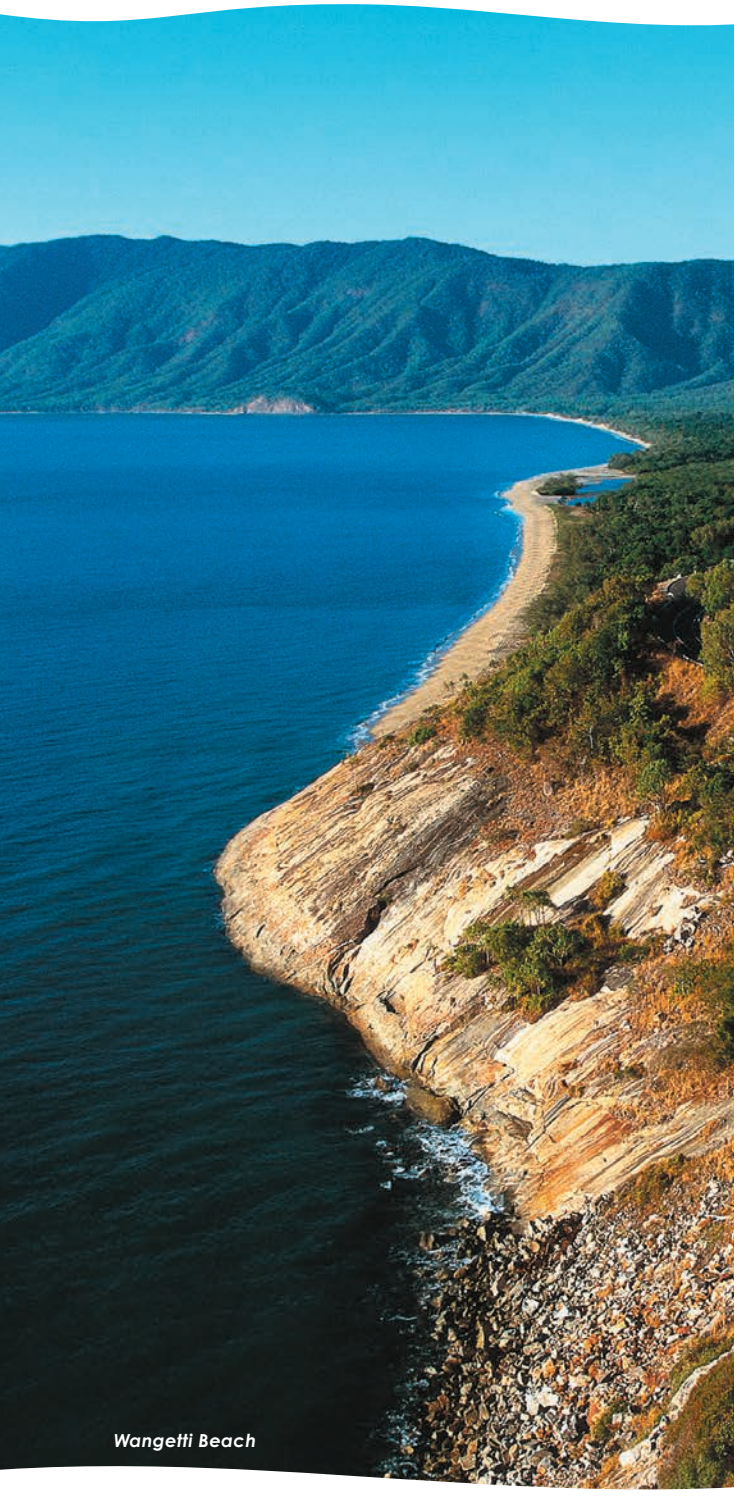
Community perspectives on coastal values and the vision for a Resilient Coast have informed an understanding of adaptation objectives across Douglas Shire. These perspectives have been gathered through community workshops, online surveys, and direct feedback to Council and the project team.

ADAPTATION OBJECTIVES INCLUDE TO:

- Retain the natural beauty of the coast
- Limit adverse impacts on scenic amenity
- Protect important ecosystems
- Protect important rainforests, vegetation and tree canopies (especially north of the Daintree River)
- Maintain access to the region
- Minimise potential impacts on tourism
- Protect significant, protected and sensitive areas (environment and biodiversity)
- Retain sandy beaches
- Maintain access to beach and assets
- Limit impact on assets and infrastructure (including new developments) within hazard zone (particularly south of the Daintree River)
- Retain arable land (cane farming).

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

Blue Sea Star



Wangetti Beach

Adaptation response

The tailored framework includes three adaptation responses – Monitor, Mitigate, and Transition (**Table 8**).

MONITOR

At localities where the coastal hazard risk profile is low (according to the Strategic Plan), the adaptation response is to monitor risk and undertake existing maintenance/asset management activities. If, over time, the risk profile is observed to increase (as indicated by local trigger levels), then the adaptation response may shift to mitigate.

MITIGATE

At localities where coastal hazard risks have been identified (according to the Strategic Plan), the adaptation response is to actively mitigate the risk through implementing a range of adaptation options. Mitigation 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 mitigation becomes infeasible (due to economic or other factors), then the adaptation response may shift to transition.

TRANSITION

In some specific areas within a locality, if the coastal hazard risk profile is very high (according to the Strategic Plan), and mitigation becomes infeasible (due to economic or other factors), a strategic decision may be made 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.

VISION	A RESILIENT COAST FOR DOUGLAS SHIRE		
Adaptation response	**Coastal hazard adaptation** →		
	Monitor	**Mitigate**	**Transition**
	Monitor the risk of coastal hazards. Monitor until local trigger levels are reached to initiate mitigation.	Actively mitigate the risk of coastal hazards through a range of adaptation options. Mitigate until local trigger levels are reached to initiate transition.	A strategic decision to transition to an alternative landuse in some areas. Mitigation may be part of the transition process.
		Adaptation options	

Table 8. Resilient Coast - Adaptation response for Council owned land and assets.

Myall Creek

Adaptation options

Four themes of adaptation options have been defined for the Strategic Plan, with a range of options that relate to avoiding, mitigating and managing the risk of coastal hazards.

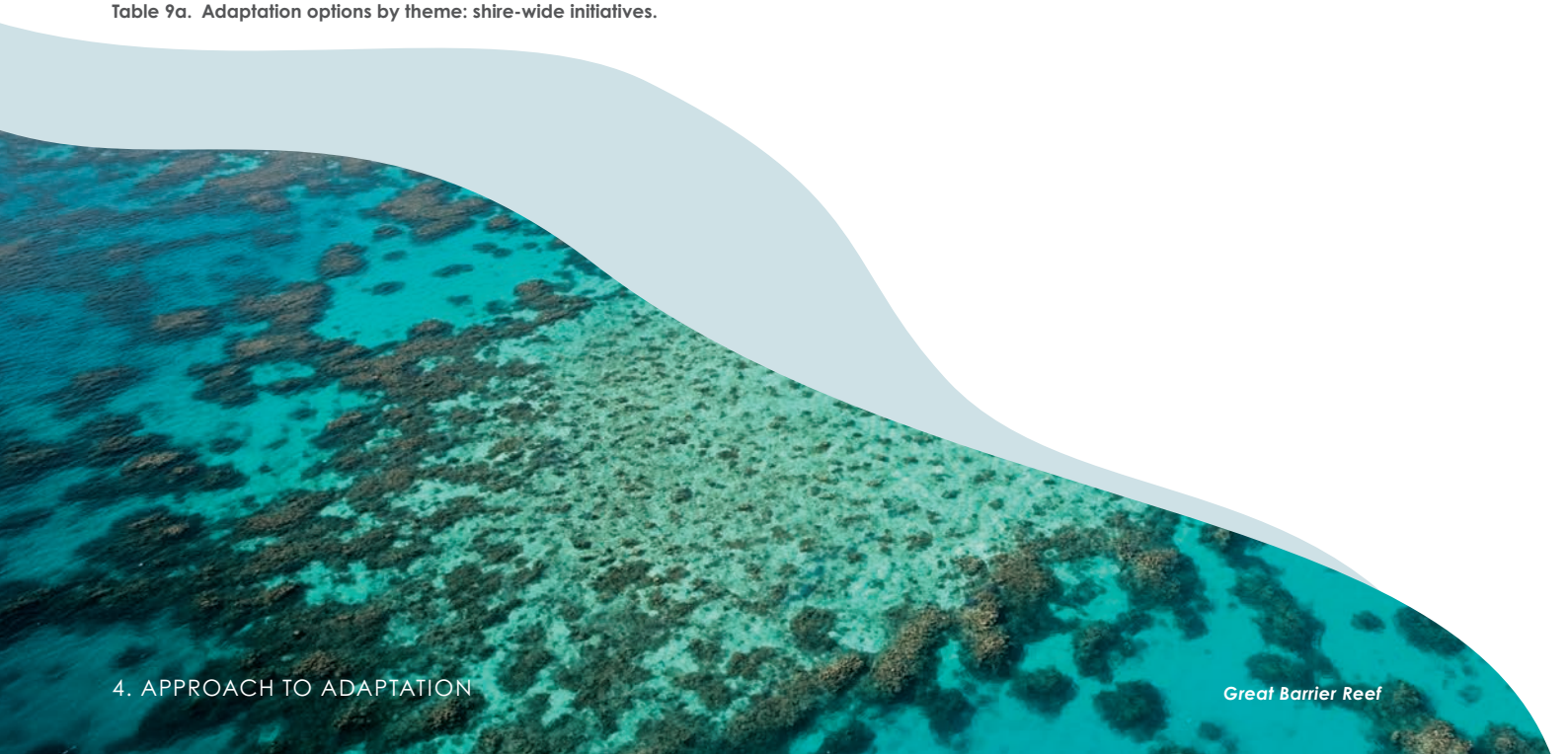
The themes are:

1. **Shire-wide initiatives to enhance resilience and adaptive capacity**
2. **Planning updates**
3. **Modifying infrastructure**
4. **Coastal management and engineering.**

The adaptation options are described in the following tables (**Tables 9a and 9b**). More detailed descriptions of the options are provided in Supplement D to the Strategic Plan, along with preliminary screening of the relevance of options to different localities.

	Theme	Adaptation options	Description	Supplement D summary sheet number
1	**Shire-wide initiatives to enhance resilience and adaptive capacity**	Community stewardship	Developing programs and partnerships to enhance stewardship of the coastline	Sheet 1
		Knowledge sharing	Facilitating knowledge sharing and education on hazards and adaptation	Sheet 2
		Monitoring	Monitoring changes in coastal hazard risk and effectiveness of adaptation.	Sheet 3

Table 9a. Adaptation options by theme: shire-wide initiatives.



Great Barrier Reef

Daintree Village Boat Ramp

	Theme	Adaptation options	Description	Supplement D summary sheet number
2	**Planning updates**	Land use planning	Informing statutory planning and strategic plans	Sheet 4
		Disaster management	Updating emergency response planning	
3	**Modifying infrastructure**	Build resilience	• Modifying critical infrastructure (e.g. raising floor levels) • Modifying drainage networks • Building resilient homes	Sheet 5
		Relocate infrastructure	• Relocating critical infrastructure	
4	**Coastal management and engineering***	Dune protection and maintenance	Minimising dune disturbance, maintaining vegetation	Sheet 6
		Beach nourishment	Providing additional sand to the beach	Sheet 7
		Structures to assist with sand retention	Using structures (groynes, sand fencing) to help retain sand	Sheet 8
		Last line of defence structures	Constructing seawalls / revetments	Sheet 9
		Structures to minimise inundation	Constructing levees / dykes	Sheet 10

Table 9b. Adaptation options by theme: planning updates, modifying infrastructure and coastal management and engineering.

***Note:** An additional option – offshore breakwaters or artificial reefs to dissipate wave energy (submerged or exposed) are not considered a feasible options for Douglas Shire due to the proximity of the Great Barrier Reef marine Park and protected / sensitive marine areas. Therefore this option has been excluded from the adaptation options at this time.


Spotted Sweetlip

4.2 ADAPTATION RESPONSE BY LOCALITY

For a series of key localities across the Shire, consideration of the risk profile, what is at risk (land and assets), and how the risk profile is changing over time (present day, 2060, and 2100)[10], has informed the adaptation response assigned to each locality for each timeframe (**Table 10**).

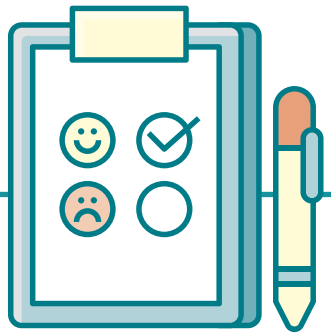
By 2100 there are some limited areas within Wonga Beach, Newell, Cooya Beach, Port Douglas and Craiglie where transition to an alternative landuse may be appropriate (due to increasing coastal hazard risk).

10 As per technical investigations in the Phase 5 summary report (DSC 2018c)

	Adaptation response		
	Present day	**2060**	**2100**
Degarra	Monitor	Mitigate	Mitigate
Cowie Point	Monitor	Monitor	Monitor
Cape Tribulation	Monitor	Mitigate	Mitigate
Thornton Beach	Mitigate	Mitigate	Mitigate
Cow Bay and Cape Kimberley	Monitor	Monitor	Monitor
Wonga Beach	Mitigate	Mitigate	Mitigate*
Rocky Point	Mitigate	Mitigate	Mitigate
Newell	Mitigate	Mitigate	Mitigate*
Cooya Beach	Mitigate	Mitigate	Mitigate*
Port Douglas and Craiglie	Mitigate	Mitigate	Mitigate*
Pebbly Beach	Mitigate	Mitigate	Mitigate
Oak Beach	Mitigate	Mitigate	Mitigate
Wangetti	Monitor	Mitigate	Mitigate
South of Wangetti	Monitor	Mitigate	Mitigate

* A transition response may be appropriate for limited areas within the locality

Table 10. Adaptation response for each locality.



RESILIENT COAST SURVEY #2 NOVEMBER 2018

The second survey for the Resilient Coast program was completed over November and December 2018.

Over 50 responses were received. The total number of community members who have provided direct input and feedback into the Resilient Coast program is in excess of 250 people (via two surveys, workshops, email and online).

Highlights from the survey findings include:

THERE IS GOOD AWARENESS OF COASTAL HAZARD ADAPTATION OPTIONS:

Awareness of potential adaptation options is relatively high: Over 80% of respondents have a general or good – very good awareness of coastal hazard adaptation options.

DUNE PROTECTION AND LAND USE PLANNING ARE FAVOURED ACTIONS:

Respondents generally felt that dune protection and land use planning were the most suitable adaptation options for their local beach. Last line of defence structures (e.g. seawalls) and retention structures (e.g. groynes) were generally perceived to be the least suitable options.

LOCAL BEACHES ARE VALUED FOR REGULAR ACCESS AND EXERCISE:

More than 50 % of those surveyed visit their local beach more than 2 – 3 times per week, usually for exercise (jogging and walking).

NATURAL BEAUTY OF LOCAL BEACHES IS HIGHLY VALUED:

Over 80% of respondents said that the natural beauty of their local beach was one of the most important values.

Coastal hazards will be actively managed through a range of adaptation actions.

4.3 ADAPTATION OPTIONS AND ACTIONS

Adaptation options relevant to each locality across the Shire are summarised in the following tables (**Tables 11a – 11d**). Descriptions of the actions and initiatives linked to these options are provided in Supplement D to the Strategic Plan.

Turtle Cove

1. SHIRE-WIDE INITIATIVES TO ENHANCE ADAPTIVE CAPACITY						
	Community stewardship		Knowledge sharing		Monitoring	
	Programs and partnerships to enhance stewardship of the coastline	Dune protection, maintenance and monitoring	Facilitating knowledge sharing and education on hazards and adaptation	Other	Monitoring changes in coastal hazard risk and effectiveness of adaptation	Photo point monitoring
Degarra	●	●	●	●	●	●
Cowie Point	●	●	●	●	●	●
Cape Tribulation	◉	◉	●	●	●	●
Thornton Beach	◉	◉	●	●	●	●
Cow Bay and Cape Kimberley	◉	◉	●	●	●	●
Wonga Beach	◉	◉	◉	◉	●	◉
Rocky Point	●	●	●	●	●	●
Newell	◉	◉	◉	◉	●	◉
Cooya Beach	◉	◉	◉	◉	●	◉
Port Douglas and Craiglie	◉	◉	◉	◉	●	◉
Pebbly Beach	●	●	●	●	●	●
Oak Beach	◉	◉	●	●	●	●
Wangetti	●	●	●	●	●	●
South of Wangetti	●	●	●	●	○	○

Table 11a. Adaptation options and actions: shire-wide initiatives.

Key ● Relevant / feasible ◉ Priority ○ Not applicable

2. PLANNING UPDATES	Statutory planning/ planning scheme updates	Other strategic planning updates	Update emergency response planning
Degarra	●	●	●
Cowie Point	●	●	●
Cape Tribulation	●	●	●
Thornton Beach	●	●	●
Cow Bay and Cape Kimberley	●	●	●
Wonga Beach	●	●	●
Rocky Point	●	●	●
Newell	●	●	●
Cooya Beach	●	●	●
Port Douglas and Craiglie	●	●	●
Pebbly Beach	●	●	●
Oak Beach	●	●	●
Wangetti	●	●	●
South of Wangetti	●	●	●

Table 11b. Adaptation options and actions: planning updates.

Key ● Relevant / feasible ● Priority ○ Not applicable

Wonga Beach


Wangetti Beach

3. MODIFYING INFRASTRUCTURE	Modifying critical infrastructure	Relocating critical infrastructure	Improving drainage networks	Building resilient homes
Degarra	●	●	●	●
Cowie Point	●	○	○	○
Cape Tribulation	●	●	●	●
Thornton Beach	●	●	●	●
Cow Bay and Cape Kimberley	●	●	●	●
Wonga Beach	●	●	●	●
Rocky Point	●	●	●	●
Newell	●	●	●	●
Cooya Beach	●	●	●	●
Port Douglas and Craiglie	●	●	●	●
Pebbly Beach	●	●	●	●
Oak Beach	●	●	●	●
Wangetti	●	●	●	●
South of Wangetti	●	●	○	○

Table 11c. Adaptation options and actions: modifying infrastructure.

Key ● Relevant / feasible ● Priority ○ Not applicable

4. COASTAL MANAGEMENT AND ENGINEERING

	Dune protection and maintenance			Beach nourishment		Structures to assist with sand retention			Last line of defence structures		Structures to minimise inundation	
	Reduce disturbance (fencing)	Weed removal and encourage native regeneration	Native revegetation if required	Sand scraping	Import sand to nourish beach	Rock groynes	Geo-bag groynes	Sand fencing	Exposed Seawall	Buried Seawall	Dykes	Levees
Degarra	●	●	○	○	○	○	○	◐	○	○	◐	◐
Cowie Point	●	●	○	○	○	○	○	◐	○	○	○	○
Cape Tribulation	●	●	○	○	○	○	○	◐	○	○	○	○
Thornton Beach	●	●	○	○	○	○	○	◐	○	○	○	○
Cow Bay and Cape Kimberley	●	●	○	○	○	○	○	◐	○	○	○	○
Wonga Beach	●	●	●	◐	◐	○	◐	◐	○	◐	◐	◐
Rocky Point	●	●	●	◐	◐	◐	◐	◐	◐	◐	○	○
Newell	●	●	●	◐	◐	○	◐	◐	○	◐	○	○
Cooya Beach	●	●	●	◐	◐	○	◐	◐	○	◐	○	○
Port Douglas and Craiglie	●	●	●	◐	◐	○	◐	◐	○	◐	◐	○
Pebbly Beach	●	●	●	◐	◐	○	○	◐	◐	○	○	○
Oak Beach	●	●	●	◐	◐	○	◐	◐	○	◐	○	○
Wangetti	●	●	○	○	○	○	○	◐	○	○	○	○
South of Wangetti	●	●	○	○	○	○	○	◐	○	○	○	○

Table 11d. Adaptation options and actions: coastal management and engineering.

Key ◐ Relevant / feasible ● Priority ○ Not applicable

Four Mile Beach (southern)

4.4 COST-BENEFIT ASSESSMENT OF COASTAL MANAGEMENT AND ENGINEERING OPTIONS

A detailed cost-benefit analysis has been undertaken to inform the program of coastal management and engineering actions in the Strategic Plan.

The options assessed comprise five approaches considered to be most appropriate for coastal management in Douglas Shire (based on values, adaptation objectives, and feasibility) (**Figure 7**).

Preliminary locations, extents and characteristics of the different adaptation options have been approximated (i.e. beach and structure lengths, nourishment volumes), as well as estimates of likely associated capital and maintenance costs for the implementation of each options for each locality[11].

Dune protection and maintenance is a baseline action for each option. Due to the importance of natural values and amenity of the Douglas Shire coastline, the seawall option includes nourishment to keep walls buried.

11 Refer Phase 7 summary report (DSC 2018e)

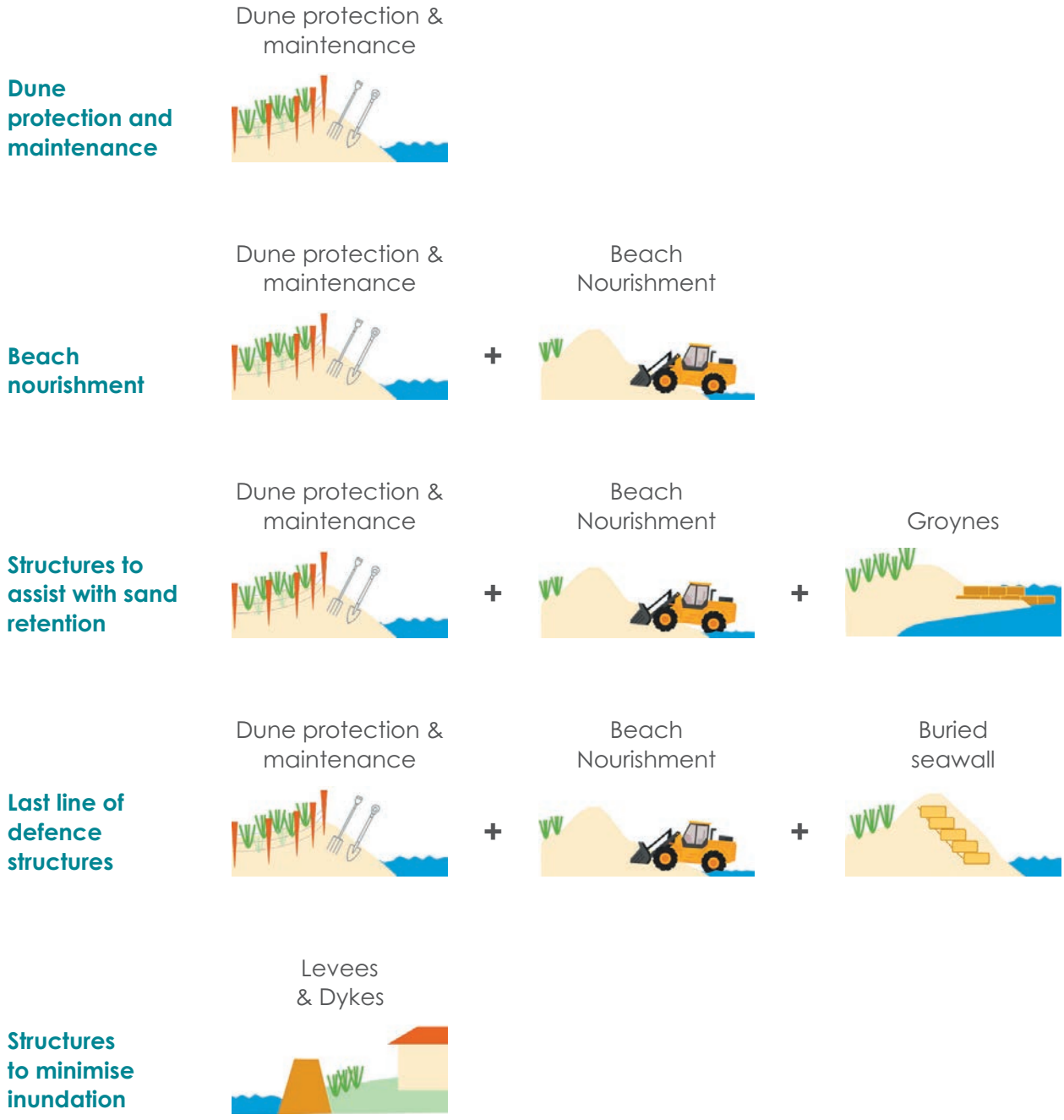


Figure 7. Five appropriate coastal management options for Douglas Shire.

Mossman River

Outcomes from the cost-benefit analysis are summarised in **Tables 12a – 12e.** Priority areas for dune protection and maintenance at the present day include Newell, Port Douglas and Craiglie. Investment into levees/dykes at these locations are also currently economically viable.

Additional coastal management and engineering works become a priority action (and economically viable) for Newell, Port Douglas, Craiglie, and Oak Beach by 2060. By 2100 coastal management and engineering works will likely be required (and viable) at all of the settlement areas.

In most cases >50% of the benefit associated with coastal management and engineering works on the open coast is attributable to private assets[12]. Funding of works may in these cases may require shared investment by asset owners.

12 Refer Phase 7 summary report (DSC 2018e)

Dune protection and maintenance

Dune Protection & Maintenance

	Present day	2060	2100
Degarra	○	●	●
Cowie Point	○	●	●
Cape Tribulation	○	●	●
Thornton Beach	○	●	●
Cow Bay and Cape Kimberley	○	●	●
Wonga Beach	○	●	●
Rocky Point	○	●	●
Newell	●	●	●
Cooya Beach	○	○	●
Port Douglas and Craiglie	●	●	●
Pebbly Beach	○	●	●
Oak Beach	○	●	●
Wangetti	○	○	●
South of Wangetti	○	●	●

Table 12a. Feasibility of coastal management option: Dune protection and maintenance.

Feasible actions (based on CBA outcomes)

- ● Priority action and economically viable
- ● Economically viable Recommended action (open coast)
- ● Economically viable Alternative action (open coast)
- ● Economically viable Alternative action (open coast)
- ● Economically viable Alternative action (tidal areas)
- ○ Action not economically viable
- ○ Action not applicable at the locality scale

	Dune protection and maintenance			Open Coast Erosion: Beach nourishment		
	Dune Protection & Maintenance			Beach nourishment		
				+ 		
	Present day	2060	2100	Present day	2060	2100
Degarra	●	●	●	○	○	○
Cowie Point	●	●	●	○	○	○
Cape Tribulation	●	●	●	○	○	○
Thornton Beach	●	●	●	○	○	○
Cow Bay and Cape Kimberley	●	●	●	○	○	○
Wonga Beach	●	●	●	●	●	●
Rocky Point	●	●	●	●	●	●
Newell	●	●	●	●	●	●
Cooya Beach	●	●	●	●	●	●
Port Douglas and Craiglie	●	●	●	●	●	●
Pebbly Beach	●	●	●	○	○	○
Oak Beach	●	●	●	●	●	●
Wangetti	●	●	●	○	○	○
South of Wangetti	●	●	●	○	○	○

Table 12b. Feasibility of coastal management option: Dune protection and maintenance and beach nourishment.

Feasible actions (based on CBA outcomes)

- ● Priority action and economically viable
- ● Economically viable Recommended action (open coast)
- ● Economically viable Alternative action (open coast)
- ● Economically viable Alternative action (open coast)
- ● Economically viable Alternative action (tidal areas)
- ● Action not economically viable
- ○ Action not applicable at the locality scale

Open Coast Erosion

	Dune protection and maintenance			Structures to assist with sand retention		
	Dune Protection & Maintenance			Beach Nourish		Groynes
				+ 		
	Present day	2060	2100	Present day	2060	2100
Degarra	●	●	●	○	○	○
Cowie Point	●	●	●	○	○	○
Cape Tribulation	●	●	●	○	○	○
Thornton Beach	●	●	●	○	○	○
Cow Bay and Cape Kimberley	●	●	●	○	○	○
Wonga Beach	●	●	●	●	●	●
Rocky Point	●	●	●	●	●	●
Newell	●	●	●	●	●	●
Cooya Beach	●	●	●	●	●	●
Port Douglas and Craiglie	●	●	●	●	●	●
Pebbly Beach	●	●	●	○	○	○
Oak Beach	●	●	●	●	●	●
Wangetti	●	●	●	○	○	○
South of Wangetti	●	●	●	○	○	○

Table 12c. Feasibility of coastal management option: Dune protection and maintenance, beach nourishment and groynes.

Feasible actions (based on CBA outcomes)

- ● Priority action and economically viable
- ● Economically viable Recommended action (open coast)
- ● Economically viable Alternative action (open coast)
- ● Economically viable Alternative action (open coast)
- ● Economically viable Alternative action (tidal areas)
- ● Action not economically viable
- ○ Action not applicable at the locality scale

Open Coast Erosion

	Dune protection and maintenance			Last line of defence structures		
	Dune Protection & Maintenance			Beach nourish		Buried seawall
				+ 		
	Present day	2060	2100	Present day	2060	2100
Degarra	●	●	●	○	○	○
Cowie Point	●	●	●	○	○	○
Cape Tribulation	●	●	●	○	○	○
Thornton Beach	●	●	●	○	○	○
Cow Bay and Cape Kimberley	●	●	●	○	○	○
Wonga Beach	●	●	●	●	●	●
Rocky Point	●	●	●	●	●	●
Newell	●	●	●	●	●	●
Cooya Beach	●	●	●	●	●	●
Port Douglas and Craiglie	●	●	●	●	●	●
Pebbly Beach	●	●	●	○	○	○
Oak Beach	●	●	●	●	●	●
Wangetti	●	●	●	○	○	○
South of Wangetti	●	●	●	○	○	○

Table 12d. Feasibility of coastal management option: Dune protection and maintenance, beach nourishment and buried seawall.

Feasible actions (based on CBA outcomes)

- ● Priority action and economically viable
- ● Economically viable Recommended action (open coast)
- ● Economically viable Alternative action (open coast)
- ● Economically viable Alternative action (open coast)
- ● Economically viable Alternative action (tidal areas)
- ● Action not economically viable
- ○ Action not applicable at the locality scale

	Dune protection and maintenance			Tidal areas: Structures to minimise inundation		
	Dune Protection & Maintenance			Levees & Dykes		
				+ 		
	Present day	2060	2100	Present day	2060	2100
Degarra	●	●	●	○	○	○
Cowie Point	●	●	●	○	○	○
Cape Tribulation	●	●	●	○	○	○
Thornton Beach	●	●	●	○	○	○
Cow Bay and Cape Kimberley	●	●	●	○	○	○
Wonga Beach	●	●	●	●	●	●
Rocky Point	●	●	●	○	○	○
Newell	●	●	●	●	●	●
Cooya Beach	●	●	●	●	●	●
Port Douglas and Craiglie	●	●	●	●	●	●
Pebbly Beach	●	●	●	○	○	○
Oak Beach	●	●	●	○	○	○
Wangetti	●	●	●	○	○	○
South of Wangetti	●	●	●	○	○	○

Table 12e. Feasibility of coastal management option: Dune protection and maintenance and levees and dykes.

Feasible actions (based on CBA outcomes)

- ● Priority action and economically viable
- ● Economically viable Recommended action (open coast)
- ● Economically viable Alternative action (open coast)
- ● Economically viable Alternative action (open coast)
- ● Economically viable Alternative action (tidal areas)
- ● Action not economically viable
- ○ Action not applicable at the locality scale

Thala Beach

5. SHIRE-WIDE ACTIONS SUMMARY

5.1 THEMES AND ACTIONS

The Resilient Coast Strategic Plan priority actions across the Shire include a range of actions relevant to the four themes identified for the Plan:

1. Shire-wide initiatives
2. Planning updates
3. Modifying infrastructure
4. Coastal management and engineering

Priority 5 – 10 year actions to each of these themes are summarised in the tables (**Tables 13a - Table 13d**) below, with some additional information / guidance in Supplement D to the Strategic Plan. Adaptation response and actions specific to different localities across the Shire are provided in the location summaries (Section 6 of the Strategic Plan).

Emmagen Creek

Theme	Strategic action no.	Description	2020 Priority strategic actions (completed within 5 – 10 years)
1. Shire-wide initiatives	**1.1 Community stewardship program**	Develop programs and partnerships to enhance stewardship of the coastline.	**1.1.1** Establish program / officer role **1.1.2** Establish and implement dune protection and maintenance program utilising a mix of Council and volunteers' time **1.1.3** Seek co-funding / resources for further initiatives.
	1.2 Knowledge sharing	Facilitate knowledge sharing and education on hazards and adaptation.	**1.2.1** Identify networks / forums for knowledge sharing (internal and external) **1.2.2** Generate communication materials (on Strategic Plan implementation) **1.2.3** Facilitate training / education workshops / events **1.2.4** Co-ordinate cross-agency information sharing. **1.2.5** Promote collaborative partnerships to pursue initiatives for integrated catchment and coastal management (rivers, estuaries, coastline) **1.2.6** Promote collaborative partnerships to pursue initiatives for integrated coast and marine management (coastline, marine environment and ecosystems, fisheries) **1.2.7** Promote cross-sector partnerships and initiatives to enhance resilience and strategic adaptation for agriculture **1.2.8** Promote cross-sector collaboration to improve understanding of future coastal hazard implications for local native species and ecosystems, including terrestrial, freshwater and marine environments.
	1.3 Monitoring	Monitor changes in coastal hazard risk and effectiveness of adaptation.	**1.3.1** Establish photo point monitoring system (coast snap or similar) at key areas **1.3.2** Create a platform / process for data management **1.3.3** Develop monitoring / evaluation metrics for implementation of actions, and effectiveness of actions (also a potential post-graduate student project) **1.3.4** Establish drone survey (elevation and aerial imagery) monitoring (every 5 – 10 years), or other tailored monitoring and reporting needed to inform adaptive management and the 10-year planning scheme review.

Table 13a. Strategic actions: Shire-wide initiatives.

Theme	Strategic action no.	Description	2020 Priority strategic actions (completed within 5 – 10 years)
2. Planning updates	**2.1 Land use planning**	Use the outcomes of the Strategic Plan to inform statutory planning and other strategic plans.	**2.1.1** Advocate for all planning matters undertaken by Council to incorporate and have regard to the new coastal hazard information presented in the Resilient Coast Strategic Plan **2.1.2** Submit updated Erosion Prone Area layers to State Government for formal update to the existing State-wide mapping **2.1.3** For un-developed land with existing approvals, share updated information on coastal hazards. When requested to extend any approvals, use that opportunity to review the development footprint, and the implications of the new coastal hazards, to inform those decisions and update conditions where appropriate **2.1.4** Consider implications (within Council) of the Strategic Plan for future development approvals and conditions **2.1.5** Develop triggers for a transition response for targeted areas **2.1.6** For the scheduled Planning Scheme update in 2028, use the updated Erosion Prone Area and outcomes of the Resilient Coast Strategic Plan to inform decisions on development areas and strategic land use planning.
	2.2 Disaster management	Update emergency response planning.	**2.2.1** Use the updated Erosion Prone Area and storm tide mapping, risk assessment and economic implications to update disaster management plans.

Table 13b. Strategic actions: Planning updates.

Port Douglas Marina

Theme	Strategic action no.	Description	2020 Priority strategic actions (completed within 5 – 10 years)
3. Modifying infrastructure	**3.1 Build resilience**	Upgrading infrastructure. Building resilient homes. Improving drainage networks.	**3.1.1** Review at risk infrastructure (from the Resilient Coast technical outputs) and embed risks into current asset management plans. This could include 'betterment' at critical asset refurbishment/ renewals points **3.1.2** Promote resilient homes within the community and building sector (link in with knowledge sharing initiatives) **3.1.3** Review opportunities to improve drainage networks in locations where the risk of inundation from infrastructure is high (embedded within asset management plan) **3.1.4** Undertake more detailed risk assessments of specific assets that create 'pinch point' risk of failure of broader systems (infrastructure networks).
	3.2 Relocate infrastructure	Relocate critical infrastructure.	**3.2.1** When updating asset management plans, consider the long term (2100) coastal hazard risk, and consider options for relocation if needed.

Table 13c. Strategic actions: Modifying infrastructure.

Port Douglas

Theme	Strategic action no.	Description	2020 Priority strategic actions (completed within 5 – 10 years)
4. Coastal management and engineering	**4.1 Dune protection and maintenance**	Minimise dune disturbance, maintain vegetation.	**4.1.1** Dune protection and maintenance **4.1.2** Pilot the dune protection and maintenance program at Port Douglas and Newell (linked to action 1.1.2) **4.1.3** Extend the dune protection and maintenance program to all beaches.
	4.2 Additional open coast erosion mitigation works (if required)	Beach nourishment Plus Structures to assist with sand retention (groynes) OR Last line of defence structures	**4.2.1** Prepare a Shoreline Erosion Management Plan (SEMP) for Port Douglas and Newell (in the next 5 - 10 years). Additional open coast erosion mitigation works (nourishment plus groynes or a buried wall) will be required before 2060 at these localities (and are economically viable). A SEMP is required for the engineering design of the works. **4.2.2** Clarify Council perspectives on funding open coast erosion mitigation works that have differing levels of private and public benefit. Establish a more formal policy on co-funding (e.g. a special levy). **4.2.3** Review and update the CBA every 10 years for open coast erosion mitigation works (in combination with review of the Strategic Plan).
	4.3 Additional protection from tidal and storm tide inundation (if required)	Structures to minimise inundation	**4.3.1** Investigate the concept design of works to provide increased protection from tidal area expansion and storm tide inundation for Port Douglas and Newell. Establish indicative costings to inform any 'betterment' opportunities that arise from disaster relief funding following actual events. **4.3.2** Review and update the CBA every 10 years for works to mitigate inundation (in combination with review of the Strategic Plan).

Table 13d. Strategic actions: Coastal management and engineering.

Four Mile Beach (southern)

6. LOCATION SUMMARIES

6.1 DEGARRA TO CAPE TRIBULATION

Landscape

The Bloomfield River is the northern extent of the Douglas Shire coastline (**Figure 8**). From the Bloomfield River to Cape Tribulation, the coastline is characterised by elevated ranges, rocky coast, and headlands with isolated pocket beaches.

The Daintree Rainforest covers the majority of the terrestrial landscape, much of which is protected as part of the northern section of Daintree National Park (founded in 1981) and Wet Tropics of Queensland World Heritage Site (World Heritage status was declared in 1988).

Notable headlands include Cowie Point and Donovan Point. Cowie Point is situated immediately southeast of Mount Cowie (249 m elevation) and north of Cowie Beach. Donovan Point, equally remote, is approximately 5 km further to the south.

Communities

The small settlement of Degarra is situated on the floodplain south of the Bloomfield River, with around 20 dwellings. The Bobby and Jacky Ball Bloomfield River Bridge was built across the river at Wujal Wujal in 2014, replacing a causeway. The only road between Degarra and Cape Tribulation (approximately 21 km southeast) is the Bloomfield Track, which is unsealed.

The northern part of the Douglas Shire has relatively high natural resilience, and coastal hazard risk is relatively low.

Coastal hazards exposure and implications

This northern part of the Douglas Shire has relatively high natural resilience, and coastal hazard risk is relatively low.

Limited sections of the road near Degarra and along the coastline are at risk from tidal inundation or rocky coast erosion at present day, with risk increasing by 2100. The implications of road closure is significant for local residents and disaster management planning. A small number of properties at Degarra will have low-medium storm tide inundation risk by 2060 and 2100.

The current adaptation response for Degarra and surrounds is Monitor, shifting to Mitigate by 2060 (**Table 14**). The ongoing adaptation response for Cowie Point and surrounding coastline is Monitor (present day through to 2100) (**Table 15**).

Figure 8. Locality map – Degarra to Cape Tribulation.[13]

13 Detailed maps provided in Supplement C and summary reports (DSC 2018a – c)

Pilgrim Sands

Degarra	Present day	2060	2100
Adaptation response	Monitor	Mitigate	Mitigate
Adaptation actions			
1. Shire-wide initiatives	As per Shire-wide actions		
2. Planning updates	As per Shire-wide actions **Focus action: 2.2.1:** Update disaster management planning for this locality based on new EPA and storm tide maps.		
3. Modifying infrastructure	As per Shire-wide actions **Focus action 3.1.1:** Review and update asset management plan, to incorporate upgrades to inundation prone sections of the road. **Focus action 3.1.2:** Promote Resilient homes		
4. Coastal management and engineering	As per Shire-wide actions		
4.1 Dune protection and maintenance	Implement as part of Shire-wide program		
4.2 Additional open coast erosion mitigation works (if required)	N/A	N/A	
4.3 Additional protection from tidal and storm tide inundation (if required)	N/A	Review inundation risk and CBA (or other) case for additional inundation protection.	
Potential average annual damages from coastal hazards (to be mitigated)	$0.5M	$0.5M	$1M

Table 14. Strategic actions for Degarra.

Cowie Point and surrounds	Present day	2060	2100
Adaptation response	Monitor	Monitor	Monitor

Table 15. Strategic action for Cowie Point.

6.2 CAPE TRIBULATION

Landscape

Cape Tribulation, named by Captain James Cook in 1770 after the HMS Endeavour ran aground on a nearby reef, is a prominent headland and remote community within Daintree National Park and the World Heritage area (**Figure 9**). Emmagen Beach is to the north of the headland, Myall Beach and Coconut Beach are to the south, and Mt Sorrow (741 m elevation) is to the west.

Communities

European settlement in the area dates back to the 1930s and now includes tourism facilities such as eco lodges, resorts, backpacker hostels, camping ground, and over twenty dwellings. Cape Tribulation is the northern terminus of the sealed Cape Tribulation Road, which connects the community to those in the south, and becomes the unsealed Bloomfield Track to the north.

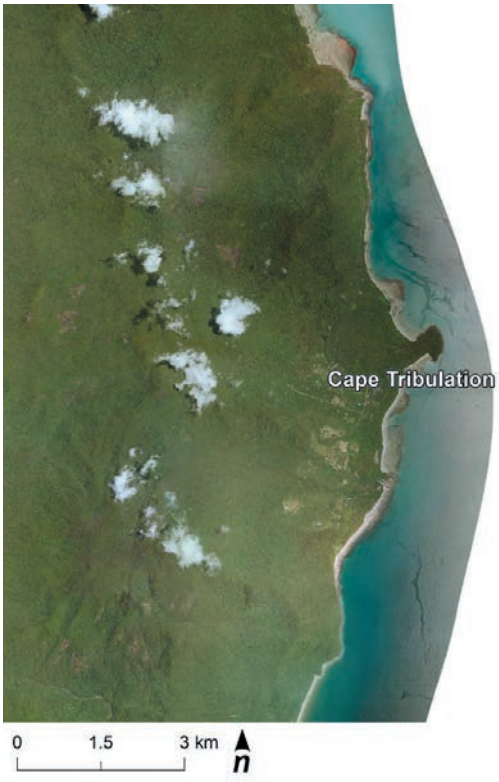


Figure 9. Locality map – Cape Tribulation.[14]

Coastal hazards exposure and implications

The historic impacts of coastal hazards at Cape Tribulation include a 9 m storm surge associated with a cyclone in 1934. Current and future exposure and risk includes:

- Present day medium risk of inundation of low-lying land, impacting the road in some locations, with increasing extent impacted by 2100
- Limited beach and foreshore assets at medium risk from erosion processes (present day and by 2100)
- Local impacts of increased inundation extents by 2060 and 2100 on conservation areas and ecosystems
- By 2100, erosion processes are expected to modify current shoreline positions along the sandy beaches (transition landward).

Increased inundation of low-lying land is expected by 2060 and 2100, due to expanding tidal areas and storm tide inundation.

This may have local ecosystem implications by increasing inundation of low-lying areas, and expanding the habitat favoured by feral pigs who are known to cause substantial damage to wetlands and local ecosystems.

The current adaptation response for Cape Tribulation and surrounding coastline is Monitor, shifting to Mitigate by 2060 and 2100 (**Table 16**).

14 Detailed maps provided in Supplement C and summary reports (DSC 2018a – c)

Cape Tribulation	Present day	2060	2100
Adaptation response	Monitor	Mitigate	Mitigate
Adaptation actions			
1. Shire-wide initiatives	As per Shire-wide actions		
2. Planning updates	As per Shire-wide actions **Focus action: 2.2.1:** Update disaster management planning for this locality based on new EPA and storm tide maps.		
3. Modifying infrastructure	As per Shire-wide actions **Focus action 3.1.1:** Review and update asset management plan, to incorporate upgrades to inundation prone sections of the road.		
4. Coastal management and engineering	As per Shire-wide actions Special action: Review implications for ecosystem management, in particular high ecological value wetlands (including feral pig management)		
4.1 Dune protection and maintenance	Implement as part of Shire-wide program		
4.2 Additional open coast erosion mitigation works (if required)	N/A	N/A	
4.3 Additional protection from tidal and storm tide inundation (if required)	N/A	N/A	
Potential average annual damages from coastal hazards (to be mitigated)	$0.25M	$1.5M	$3M

Table 16. Strategic actions for Cape Tribulation.

Tribulation Creek

6.3 THORNTON BEACH

Landscape

Thornton Beach is a sandy embayment approximately 10 km south of Cape Tribulation, in the Daintree National Park (**Figure 10**). The embayment includes the estuary mouth of Cooper Creek. Struck Island and Stuck Reef are situated offshore from the northern extent of the beach.

Communities

The community has 15 dwellings and some tourist facilities, including a café. The majority of dwellings and facilities are situated on the landward side of the Cape Tribulation Road, which runs parallel to the beach. The café is situated on the seaward side of the Road. South of Thornton Beach, Cape Tribulation Road diverts inland around the floodplain of Cooper Creek and Hutchison Creek.

Coastal hazards exposure and implications

Current and future exposure and coastal hazard risk at Thornton Beach includes:

- The café and other beach and foreshore assets have a present day medium – high risk of open coast erosion.
- Sections of Cape Tribulation Road have a present day medium - high risk of inundation and erosion, and the extent of road at risk increases substantially by 2100.

Closure of the road due to coastal hazard impacts can have a substantial impact on the Douglas Shire economy[15], cutting access to Cape Tribulation and the northern region. Relocation of the café and upgrade/ protection works for the road are likely to be required before 2060.

15 Refer Phase 7 Summary report (DSC 2018e)

The current adaptation response for Thornton Beach is to Mitigate coastal hazards through to 2100 (**Table 17**).

Figure 10. Locality map – Thornton Beach.[16]

16 Detailed maps provided in Supplement C and summary reports (DSC 2018a – c)

Thornton Beach	Present day	2060	2100
Adaptation response	Mitigate	Mitigate	Mitigate
Adaptation actions			
1. Shire-wide initiatives	As per Shire-wide actions		
2. Planning updates	As per Shire-wide actions **Focus action: 2.2.1:** Update disaster management planning for this locality based on new EPA and storm tide maps.		
3. Modifying infrastructure	As per Shire-wide actions **Focus action 3.1.1:** Review and update asset management plan, to incorporate upgrades to inundation/erosion prone sections of the road. **Focus action 3.2.1:** Consider options and timing to relocate café by 2060.		
4. Coastal management and engineering	As per Shire-wide actions		
4.1 Dune protection and maintenance	Implement as part of Shire-wide program		
4.2 Additional open coast erosion mitigation works (if required)	N/A Except as part of the road upgrades.	Review erosion risk and CBA (or other) case for additional erosion mitigation works.	
4.3 Additional protection from tidal and storm tide inundation (if required)	N/A Except as part of road upgrades.	Review inundation risk and CBA (or other) case for additional inundation protection works.	
Potential average annual damages from coastal hazards (to be mitigated)	$1M	$1.25M	$2.5M

Table 17. Strategic actions for Thornton Beach.

Noah Creek

6.4 COW BAY AND CAPE KIMBERLEY

Landscape

Elevated terrain and rocky coast continues from Cape Tribulation down to Cow Bay, a small sandy embayment south of Bailey Hill (**Figure 11**). Further south is the prominent headland of Cape Kimberley and the mouth of the Daintree River. The coastal reaches of the Daintree River include estuarine wetlands and mangrove swamps, and a large, shifting barrier spit (sandbar) that forms at the river's mouth.

The Daintree River Ferry, on Cape Tribulation Road, is the only means of crossing the river in the coastal zone. Cape Tribulation Road joins the Mossman-Daintree Road south of the river.

Communities

The community of Cow Bay is set back from the coast, and parts of the area has been farmed since the 1880s, particularly cattle farming and crops such as sugarcane, rice, maize and various fruit. In the present-day tourism is the main industry. There is a range of tourist accommodation, facilities and built attractions, as well as an air strip (Daintree Airport). The beach foreshore includes access infrastructure (ramp, signage). The Cape Kimberly headland has only one dwelling and limited beach foreshore access / infrastructure.

Coastal hazards exposure and implications

Coastal erosion and inundation risk is low for both Cow Bay and Cape Kimberley, as dwellings are set back from the coast and there is minimal foreshore infrastructure. By 2100, erosion processes are expected to modify current shoreline position along the sandy beaches (transition landward).

The adaptation response for Cow Bay and Cape Kimberley is Monitor, from present day through to 2100 (subject to 10 year review) (**Table 18**).

Figure 11. Locality map – Cow Bay to Cape Kimberley.[17]

17 Detailed maps provided in Supplement C and summary reports (DSC 2018a – c)

Cape Kimberley and Snapper Island

Cow Bay and Cape Kimberley	Present day	2060	2100
Adaptation response	Monitor	Monitor	Monitor

Table 18. Strategic actions for Cow Bay and Cape Kimberley

The coastal reaches of the Daintree River include estuarine wetlands and mangrove swamps, and a large, shifting barrier spit (sandbar) that forms at the river's mouth.

6.5 WONGA BEACH

Landscape

To the south of the Daintree River mouth, a broad sandy embayment extends along the coastline (**Figure 12**). The sandy embayment is a beach ridge system, formed in front of the low-lying coastal area of the Daintree River floodplain and associated mangroves, wetlands and Melaleuca forest. To the west and south, Wonga Beach is backed by the Dagmar Range, which is a pocket of the Daintree National Park. The Wonga Beach settlement is situated towards the southern end of the sandy embayment.

Communities

Wonga Beach is one of the regions main settlements, with over 500 dwellings and a number of tourist facilities. The Mossman-Daintree Road runs through the township. The closest road running parallel to the beach is the Old Wonga Esplanade. The densely vegetated area in between includes a camping ground.

Coastal hazards exposure and implications

A well vegetated dune system currently provides some protection from coastal hazards to the residential zones.

At the present day, a limited number of assets currently have medium to high risk of open coast erosion and tidal area inundation, including beach and foreshore, water reticulation assets, and some dwellings. By 2060 there is an increase in assets at risk, and a substantial increase between 2060 and 2100.

The adaptation response for Wonga Beach is to Mitigate coastal hazards through to 2100 (**Table 19**).

Present day mitigation works include the defined Shire-wide actions. The economic case for additional coastal engineering works becomes viable by 2100. By 2100 some limited areas of land within the Wonga Beach locality may need to be transitioned to an alternative landuse.

A well vegetated dune system currently provides protection from coastal hazards to the residential zones.

Figure 12. Locality map – Wonga Beach.[18]

18 Detailed maps provided in Supplement C and summary reports (DSC 2018a – c)

Wonga Beach	Present day	2060	2100
Adaptation response	Mitigate	Mitigate	Mitigate*
Adaptation actions			
1. Shire-wide initiatives	As per Shire-wide actions		
2. Planning updates	As per Shire-wide actions **Focus action 2.1.2:** Review zoning and development approval conditions for un-developed land with existing approvals **Focus action 2.1.3**: Clarify implications for future development approvals and conditions **Focus action 2.1.4**: Develop approach/triggers for a transition response for targeted areas		
3. Modifying infrastructure	As per Shire-wide actions Focus action 3.1.2: Promote Resilient homes		
4. Coastal management and engineering	As per Shire-wide actions		
4.1 Dune protection and maintenance	Implement as part of Shire-wide program		
4.2 Additional open coast erosion mitigation works (if required)	N/A	Develop a SEMP and implement erosion mitigation works.	
4.3 Additional protection from tidal and storm tide inundation (if required)	N/A	Undertake concept design and implement inundation protection works	
Potential average annual damages from coastal hazards (to be mitigated)	$0.5M	$4M	$22M

* A transition response may be appropriate for limited areas

Table 19. Strategic actions for Wonga Beach

6.6 ROCKY POINT, NEWELL AND COOYA BEACH

Landscape

South of the Dagmar Range, a 14 km-long embayment extends between Rocky Point and Port Douglas (**Figure 13**). The coastal zone is characterised by a broad coastal plain, predominantly cleared for agriculture. Extensive mangrove ecosystems are present around the three main estuaries, and coastal dune systems are generally well vegetated.

The northern side of the Rocky Point headland is prone to open coast and rocky coast erosion processes. The Mossman-Daintree Road is the only access road to the northern parts of the Shire.

Newell is situated between the estuary systems of Saltwater Creek (to the north) and the Mossman River (to the south). Both waterways have large areas of estuarine wetlands. The Mossman River mouth is dynamic and has a history of changing position. This includes changes to the shoreline position and coastal process along the beach at Newell.

Figure 13. Locality map – Rocky Point, Newell and Cooya Beach.[19]

Cooya Beach is situated to the south of the Mossman River estuary, on the last section of sandy beach which then transitions to an extensive estuarine mangrove system extending to the Port Douglas headland.

Communities

The northernmost of the three beachside communities is Rocky Point, also known as Dayman Point. There are approximately 30 dwellings at Rocky Point, generally well set-back from the coastline, and boat ramp and parking area is located at the point.

Newell has approximately 200 dwellings and a number of services and tourist facilities. Several houses have close proximity to the beach, and those to the south are very close to the dynamic mouth of the Mossman River.

Past erosion mitigation works have been implemented at the southern end of Newell beach in the form of beach nourishment and geo-bag groynes. These have performed well since establishment, assisting to retain sand on the beach. However the diminished dune vegetation along sections of this reach is increasing exposure to coastal hazards for adjacent residential areas.

Cooya Beach, immediately south of the Mossman River, was planned in the 1960s but not developed until the 1990s. There are now more than 200 dwellings. A well vegetated dune system provides some protection from coastal hazards to the residential zones.

The township of Mossman (which had a population of almost 2000 in the 2016 census) is 3 km west of Cooya Beach. Mossman is an important centre for local sugarcane farming, including a sugar mill that has operated since 1897. Residents of Mossman frequently visit the coast and value the local coastal settlements and access to the beaches.

19 Detailed maps provided in Supplement C and summary reports (DSC 2018a – c)

Coastal hazards exposure and implications

ROCKY POINT

At Rocky Point, several assets currently have a medium - high risk of open coast and rocky coast erosion, and tidal area inundation. These assets include beach and foreshore, marine, road, sewerage and water reticulation assets. There is a notable increase in the number/extent of these assets with medium – high risk by 2100.

The road around Rocky Point extending to Wonga Beach is a potential 'pinch point' for the local distribution network (including telecommunications and electricity services under the road).

The adaptation response for Rocky Point is to Mitigate coastal hazards through to 2100 (**Table 20**).

Present day mitigation works include the defined Shire-wide actions. The economic case for additional coastal engineering works becomes viable by 2060.

Rocky Point	Present day	2060	2100
Adaptation response	Mitigate	Mitigate	Mitigate
Adaptation actions			
1. Shire-wide initiatives	As per Shire-wide actions		
2. Planning updates	As per Shire-wide actions		
3. Modifying infrastructure	As per Shire-wide actions **Focus action 3.1.1:** Review upgrade schedule for critical assets around Rocky Point, including road upgrade / protection works, and embed into asset management plan. **Focus action 3.1.4:** Undertake more detailed risk assessments of specific assets that create 'pinch point' risk of failure of broader systems (infrastructure networks)		
4. Coastal management and engineering	As per Shire-wide actions		
4.1 Dune protection and maintenance	Implement as part of Shire-wide program		
4.2 Additional open coast erosion mitigation works (if required)	N/A	Develop a SEMP and implement erosion mitigation works.	
4.3 Additional protection from tidal and storm tide inundation (if required)	N/A	Undertake concept design and implement inundation protection works	
Potential average annual damages from coastal hazards (to be mitigated)	$0.5M	$0.75M	$1.25M

Table 20. Strategic actions for Rocky Point.

Newell Beach

NEWELL

At Newell, several assets currently have a medium - high risk of open coast erosion and tidal area inundation. These assets include beach and foreshore, marine, road, and water reticulation infrastructure, and a limited number of dwellings. There is a notable increase in the number/extent of these assets at medium – high risk by 2100.

The adaptation response for Newell is to Mitigate coastal hazards through to 2100. Present day mitigation works include the defined Shire-wide actions. The economic case for additional coastal engineering works becomes viable by 2060. By 2100 some limited areas of land within the Newell locality may need to be transitioned to an alternative landuse.

Newell	Present day	2060	2100
Adaptation response	Mitigate	Mitigate	Mitigate*
Adaptation actions			
1. Shire-wide initiatives	As per Shire-wide actions		
2. Planning updates	As per Shire-wide actions **Focus action 2.1.3:** Clarify implications for future development approvals and conditions **Focus action 2.1.4:** Develop approach/triggers for a transition response for targeted areas		
3. Modifying infrastructure	As per Shire-wide actions **Focus action 3.1.2:** Promote Resilient homes		
4. Coastal management and engineering	As per Shire-wide actions		
4.1 Dune protection and maintenance	Implement as a pilot site as part of Shire-wide program		
4.2 Additional open coast erosion mitigation works (if required)	**Focus action 4.2.1:** Develop SEMP	Implement erosion mitigation works as defined by SEMP.	
4.3 Additional protection from tidal and storm tide inundation (if required)	**Focus action 4.3.1:** Concept design of inundation protection works	Implement inundation protection works as defined by concept design.	
Potential average annual damages from coastal hazards (to be mitigated)	$1.25M	$4.5M	$8.75M

* A transition response may be appropriate for limited areas

Table 21. Strategic actions for Newell.

Mossman River, Newell

COOYA BEACH

At Cooya Beach, several assets currently have a medium - high risk of open coast erosion and tidal area inundation. These assets include beach and foreshore, marine, road, and water reticulation assets. There is a notable increase in the number/extent of these assets at medium – high risk by 2100.

The adaptation response for Cooya Beach is to Mitigate coastal hazards through to 2100 (**Table 22**). Present day mitigation works include the defined Shire-wide actions, including maintain the existing vegetated dune system. The economic case for additional coastal engineering works becomes viable by 2100. By 2100 some limited areas of land within the Cooya Beach locality may need to be transitioned to an alternative landuse.

From Rocky Point to Port Douglas extensive mangrove ecosystems are present around the three main estuaries, and coastal dune systems are generally well vegetated.

Cooya Beach

Cooya Beach	Present day	2060	2100
Adaptation response	Mitigate	Mitigate	Mitigate*
Adaptation actions			
1. Shire-wide initiatives	As per Shire-wide actions		
2. Planning updates	As per Shire-wide actions **Focus action 2.1.3:** Clarify implications for future development approvals and conditions **Focus action 2.1.4:** Develop approach/triggers for a transition response for targeted areas		
3. Modifying infrastructure	As per Shire-wide actions **Focus action 3.1.2:** Promote Resilient homes		
4. Coastal management and engineering	As per Shire-wide actions		
4.1 Dune protection and maintenance	Implement as part of Shire-wide program		
4.2 Additional open coast erosion mitigation works (if required)	N/A	Develop a SEMP and implement erosion mitigation works.	
4.3 Additional protection from tidal and storm tide inundation (if required)	N/A	Undertake concept design and implement inundation protection works	
Potential average annual damages from coastal hazards (to be mitigated)	$1M	$1.75M	$7M

* A transition response may be appropriate for limited areas

Table 22. Strategic actions for Cooya Beach.

6.7 PORT DOUGLAS AND CRAIGLIE

Landscape

Port Douglas is situated along a sandy beach ridge system that extends from Craiglie through to the Port Douglas rocky headland (Flagstaff Hill) (**Figure 14**).

A well vegetated dune system extends along the majority of Four Mile Beach to the east, and an extensive mangrove system extends to the west. Across the broader coastal zone, agricultural land also extends along parts of the coastal plane and into the foothills.

Communities

Port Douglas, named after the 1877 Premier of Queensland (John Douglas), is the main settlement along the Douglas coastline. The population was more than 3,500 people in the 2016 census, although it can double during the peak tourism season (May to September). There are more than 1200 dwellings. Historically, apart from tourism, the development of Port Douglas since the 1870s has been influenced by mining (particularly gold and tin), farming (particularly sugarcane), fishing, and the timber industry.

At the southern end of Port Douglas, where Port Douglas Road joins the Captain Cook Highway, the settlement of Craiglie has a population of around 950 and has more than 150 dwellings. Historically, Craiglie (formerly known as Four Mile) was a camp between Port Douglas and the Bump Track; an Aboriginal trail linking the coast to mountain areas that was subsequently developed by miners from 1877 as a means of crossing what is now Mowbray National Park (established in 1989). The camp developed into a village that supplied services such as hotels and a blacksmith. The Bump Track was the only road access to Port Douglas until a coastal road (now the Captain Cook Highway) was built to Cairns in 1933. However, Craiglie is still the access point to Port Douglas and together they now form a contiguous urban and suburban area.

Coastal hazards exposure and implications

Port Douglas has been prone to cyclone damage throughout its history. The most severe cyclone damage occurred in 1911.

Several assets currently have a medium – high risk of open coast erosion and tidal area inundation in Port Douglas. These assets include beach and foreshore, marine, road, sewerage, water reticulation assets and some dwellings. Assets with medium – high risk are mainly clustered towards the north west side of the spit. There is a notable increase in the number/extent of assets with a medium - high risk by 2100, including an increase in assets at risk towards the southern end of the spit as well. Most notable is the risk for sewerage infrastructure.

Figure 14. Locality map – Port Douglas and Craiglie.[20]

20 Detailed maps provided in Supplement C and summary reports (DSC 2018a – c)

Port Douglas (southern)

Some critical infrastructure is at risk by 2100, such as Port Douglas WWTP, sewage pump stations, and drainage.

The adaptation response for Port Douglas is to Mitigate coastal hazards through to 2100 (**Table 23**). Present day mitigation works include the defined Shire-wide actions, including to maintain the existing vegetated dune system along Four Mile Beach. The economic case for additional coastal engineering works becomes viable by 2060. By 2100 some limited areas of land within the Port Douglas locality may need to be transitioned to an alternative landuse.

Port Douglas and Craiglie	Present day	2060	2100
Adaptation response	Mitigate	Mitigate	Mitigate*
Adaptation actions			
1. Shire-wide initiatives	As per Shire-wide actions		
2. Planning updates	As per Shire-wide actions **Focus action 2.1.3:** Clarify implications for future development approvals and conditions **Focus action 2.1.4:** Develop approach/triggers for a transition response for targeted areas		
3. Modifying infrastructure	As per Shire-wide actions **Focus action 3.1.2:** Promote Resilient homes		
4. Coastal management and engineering	As per Shire-wide actions		
4.1 Dune protection and maintenance	Implement as a pilot site as part of Shire-wide program		
4.2 Additional open coast erosion mitigation works (if required)	**Focus action 4.2.1:** Develop SEMP	Implement erosion mitigation works as defined by SEMP.	
4.3 Additional protection from tidal and storm tide inundation (if required)	**Focus action 4.3.1:** Concept design of inundation protection works	Implement inundation protection works as defined by concept design.	
Potential average annual damages from coastal hazards (to be mitigated)	$6M	$29M	$105M

* A transition response may be appropriate for limited areas

Table 23. Strategic actions for Port Douglas and Craiglie.

6.8 PEBBLY BEACH AND OAK BEACH

Landscape

South of the Mowbray River, the coastal plains transition back to elevated terrain that follows the coastline to the south of the Shire. The Captain Cook Highway follows the coast along the rocky cliffs and pockets of low-lying estuary floodplains. Several sandy pocket beaches have developed between headlands along this section of coast (**Figure 15**).

Pebbly Beach is situated between Yule Point and White Cliffs, and is named after the shingle and cobbles that accumulate along the high-tide beach. The Highway runs parallel to the beach and is prone to erosion of the seaward edge.

Immediately around the headland to the south is Oak Beach, a 1.6 km-long pocket beach.

Communities

A small number of dwellings (<20) are present at Pebbly Beach, most situated towards the southern end of the beach.

Oak Beach has approximately 25 dwellings along the foreshore, and the majority of other dwellings are set back from the coast into the foothills. The population was approximately 200 in the 2016 census.

South of Oak Beach, the 8 km of coastline to Wangetti is dominated by the steep slopes and high peaks of Macalister Range National Park. Apart from the Captain Cook Highway and a resort at Turtle Cove, it is mostly undeveloped.

Coastal hazards exposure and implications

For both Pebbly and Oak Beach, several beach and foreshore assets currently have a medium - high risk of open coast erosion, with a similar scenario by 2100. Currently several sections of road have a medium to high risk of rocky and open coast erosion and tidal area, notably increasing in extent by 2100 (**Table 24**).

The adaptation response for Pebbly Beach is to Mitigate coastal hazards through to 2100. Present day mitigation works include the defined Shire-wide actions, and State-led upgrades to the highway.

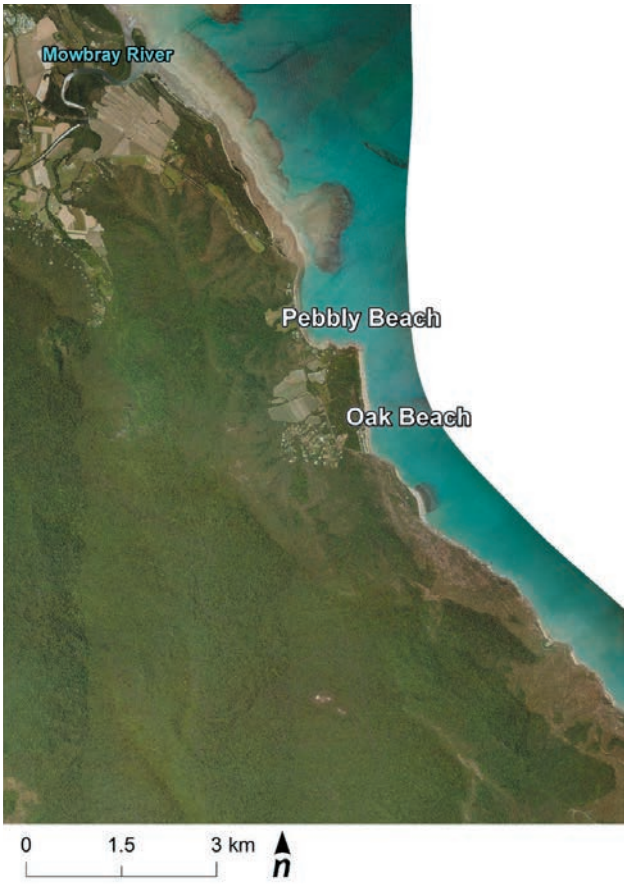


Figure 15. Locality map – Pebbly Beach and Oak Beach.[21]

21 Detailed maps provided in Supplement C and summary reports (DSC 2018a – c)

Oak Beach

Pebbly Beach	Present day	2060	2100
Adaptation response	Mitigate	Mitigate	Mitigate
Adaptation actions			
1. Shire-wide initiatives	As per Shire-wide actions		
2. Planning updates	As per Shire-wide actions		
3. Modifying infrastructure	As per Shire-wide actions Special action: collaborate with State on State-led road upgrades		
4. Coastal management and engineering	As per Shire-wide actions		
4.1 Dune protection and maintenance	Implement as part of Shire-wide program		
4.2 Additional open coast erosion mitigation works (if required)	N/A	Review the need for additional erosion protection works (in addition to State-led road upgrades and protection).	
4.3 Additional protection from tidal and storm tide inundation (if required)	N/A	N/A	
Potential average annual damages from coastal hazards (to be mitigated)	N/A	N/A	N/A

Table 24. Strategic actions for Pebbly Beach.

At Oak Beach, some dwellings and foreshore access is currently at risk from open coast erosion and inundation from tidal areas and storm tide, with risk increasing by 2100.

The adaptation response for Oak Beach is to Mitigate coastal hazards through to 2100 (**Table 25**). The economic case for additional coastal engineering works becomes viable by 2060.

The Captain Cook Highway follows the coast along the rocky cliffs and pockets of low-lying estuary floodplains. Several sandy pocket beaches have developed between headlands along this section of coast.

Pebbly Beach

Oak Beach	Present day	2060	2100
Adaptation response	Mitigate	Mitigate	Mitigate
Adaptation actions			
1. Shire-wide initiatives	As per Shire-wide actions		
2. Planning updates	As per Shire-wide actions Focus action 2.1.3: Clarify implications for future development approvals and conditions		
3. Modifying infrastructure	As per Shire-wide actions **Focus action 3.1.2**: Promote Resilient homes		
4. Coastal management and engineering	As per Shire-wide actions		
4.1 Dune protection and maintenance	Implement as a pilot site as part of Shire-wide program		
4.2 Additional open coast erosion mitigation works (if required)	Concept design for erosion mitigation works	Implement erosion mitigation works	
4.3 Additional protection from tidal and storm tide inundation (if required)	N/A	N/A	
Potential average annual damages from coastal hazards (to be mitigated)	<$0.1M	$0.5M	$2M

Table 25. Strategic actions for Oak Beach.

6.9 WANGETTI AND SOUTH OF WANGETTI

Landscape

The Wangetti coastline includes a 5 km sandy beach ridge system between Slip Cliff Point and Red Cliff Point, and the Hartley's Creek estuary system (**Figure 16**). The dune system is well vegetated. The landward terrain is part of the Macalister Range National Park and the World Heritage area.

Communities

Over twenty residential dwellings are situated set back from the coast (approximately 200 m), adjacent to the highway and the estuary system. The few other developments at Wangetti include a boarding school and a crocodile and wildlife park. Wangetti is the southernmost settlement in Douglas Shire.

Coastal hazards exposure and implications

Limited beach and foreshore assets currently have a medium - high risk of open coast erosion, with a small increase in number of affected assets by 2100. Currently several sections of road have a medium - high risk of rocky and open coast erosion and tidal area, notably increasing in extent by 2100. Dwellings are well protected from open coast erosion by the expansive dune system, however some may be prone to inundation by 2060 and 2100.

The present day adaptation response for Wangetti and south of Wangetti is to continue to Monitor coastal hazards, with Mitigation likely to commence by 2060 and through to 2100 (**Table 26**). Mitigation works include the defined Shire-wide actions, and State-led upgrades to the highway.

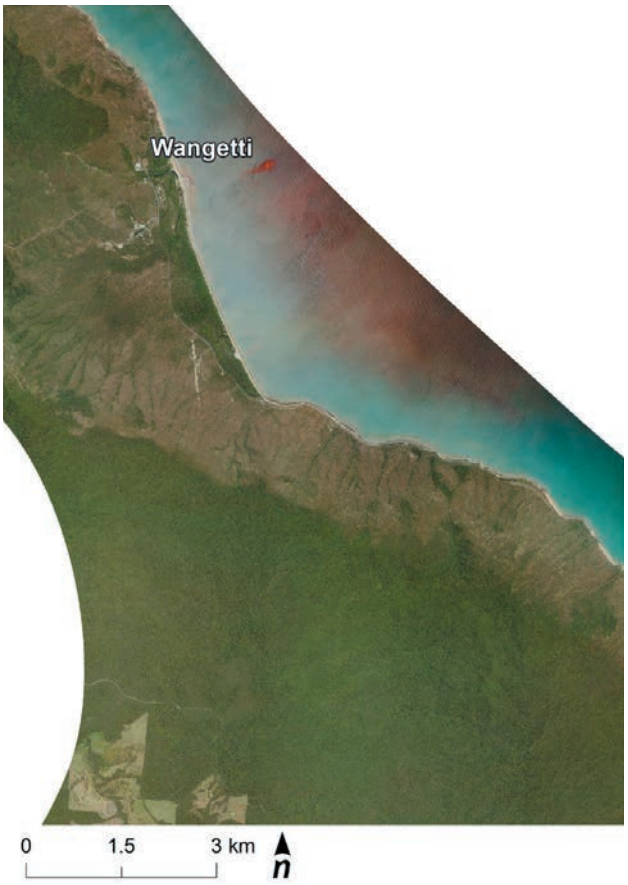


Figure 16. Locality map – Wangetti and south of Wangetti.[22]

22 Detailed maps provided in Supplement C and summary reports (DSC 2018a – c)

Wangetti Beach

Wangetti and south of Wangetti	Present day	2060	2100
Adaptation response	Monitor	Mitigate	Mitigate
Adaptation actions			
1. Shire-wide initiatives	As per Shire-wide actions		
2. Planning updates	As per Shire-wide actions **Focus action 2.1.3**: Clarify implications for future development approvals and conditions		
3. Modifying infrastructure	As per Shire-wide actions **Focus action 3.1.2:** Promote Resilient homes Special action: collaborate with State on State-led road upgrades		
4. Coastal management and engineering	As per Shire-wide actions		
4.1 Dune protection and maintenance	Implement as part of Shire-wide program		
4.2 Additional open coast erosion mitigation works (if required)	N/A	Review erosion risk and CBA (or other) case for additional erosion protection.	
4.3 Additional protection from tidal and storm tide inundation (if required)	N/A	Review inundation risk and CBA (or other) case for additional inundation protection.	
Potential average annual damages from coastal hazards (to be mitigated)	<$0.1M	<$0.1M	$0.25M

Table 26. Strategic actions for Wangetti and south of Wangetti.

7. IMPLEMENTATION

Douglas Shire Council will implement the Resilient Coast Strategic Plan through a range of mechanisms including:

- An adaptive management framework
- Embedding outcomes and actions from the Strategic Plan into existing Council process and activities
- Implementing new initiatives from the Plan.

To guide implementation, a plan has been developed[23] 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.

The Resilient Coast Strategic Plan will be reviewed every 10 years, commencing at least 2 years prior to the Planning Scheme Review which is also undertaken on a 10 year timeframe. The next review of the Plan will be in 2025.

The review will include consideration of:

- **Success of implementation to date:**
  - > Integration into Council and stakeholder plans and processes
  - > Delivery of on-ground activities
  - > Community perspectives
  - > Reduction in coastal hazard risk.
- **Triggers to update the Plan including consideration of:**
  - > Any changes in the policy environment (e.g. sea level risk predictions, approach to defining coastal hazard areas)
  - > Updated technical information that may be available
  - > Any new development and landscape changes in the Shire.

23 Refer Phase 8 Summary report (DSC 2019a)

Craiglie and Mowbray

8. REFERENCES

LGAQ & DEHP (2016) QCoast2100 Developing a Coastal Hazard Adaptation Strategy: Minimum Standards and Guideline for Queensland Local Governments. Local Governments Association Queensland and Department of Environment Heritage and Protection, QLD.

DSC (2017a) Douglas Shire Council Coastal Hazard Adaptation Strategy: Stakeholder Communication and Engagement Plan Phase 1. A report by the 20/20 Group for Douglas Shire Council, QLD.

DSC (2017b) Douglas Shire Council Coastal Hazard Adaptation Strategy: Project Plan & Phase 2 report. Report by GHD for Douglas Shire Council, QLD.

DSC (2018a) Douglas Shire Council Coastal Hazard Adaptation Strategy: Phase 3 summary report. Report by Alluvium and JBP for Douglas Shire Council, QLD.

DSC (2018b) Douglas Shire Council Coastal Hazard Adaptation Strategy: Phase 4 summary report. Report by Alluvium and JBP for Douglas Shire Council, QLD.

DSC (2018c) Douglas Shire Council Coastal Hazard Adaptation Strategy: Phase 5 summary report. Report by Alluvium and JBP for Douglas Shire Council, QLD.

DSC (2018d) Douglas Shire Council Coastal Hazard Adaptation Strategy: Phase 6 summary report. Report by Alluvium and JBP for Douglas Shire Council, QLD.

DSC (2018e) Douglas Shire Council Coastal Hazard Adaptation Strategy: Phase 7 summary report. Report by Alluvium and JBP for Douglas Shire Council, QLD.

DSC (2019a) Douglas Shire Council Coastal Hazard Adaptation Strategy: Phase 8 summary report. Report by Alluvium and JBP for Douglas Shire Council, QLD.

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- Douglas Shire Council
- Jabalbina Yalanji Corporation
- Queensland Parks and Wildlife Service (QPWS)
- Terrain NRM
- Tourism Port Douglas Daintree (TPDD)
- Wet Tropics Management Authority (WTMA).

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- Transport and Main Roads (TMR)
- Utilities providers (Telstra, Ergon Energy, National Broadband Network)
- Douglas Local Marine Advisory Committee (LMAC)
- Local Disaster Management Group (LDMG) Douglas.

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Photos throughout the document have been supplied courtesy of Tourism Port Douglas Daintree (TPDD).

Great Barrier Reef

9. SUPPLEMENTS

The following supplements to this Plan are available from Douglas Shire Council.

- Supplement A: Fact sheets
- Supplement B: Douglas Shire's coastal story
- Supplement C: Coastal hazard mapping
- Supplement D: Adaptation actions summary sheets

Great Barrier Reef