Resilient Coast Strategic Plan - Supplement D

Adaptation actions - summary sheets

This document is Supplement D to the Douglas Shire Council Resilient Coast Strategic Plan (2019 – 2029)[1]. The summary sheets 1 – 10 provide additional information on each of the adaptation actions identified in the Strategic Plan.

Theme	Adaptation options	Description	Supplement D summary sheet number
Shire-wide initiatives to enhance 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
Planning updates	Land use planning	Informing statutory planning and strategic plans Includes consideration of land purchase or land swap/relocation	Sheet 4
	Disaster management	Updating emergency response planning	
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	
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

*Note: An additional option – offshore breakwaters or artificial reefs to dissipate wave energy (submerged or exposed) are not considered as 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.

[1] Douglas Shire Council (2019b). Resilient Coast Strategic Plan.

SHEET 1 TO 3 – ADAPTATION ACTIONS – SHIRE-WIDE INITATIVES TO ENHANCE ADAPTATIVE CAPACITY

SHEET 1 - COMMUNITY STEWARDSHIP

Active community stewardship of the coastline provides a strong foundation for long term success in coastal management. Supporting the shared care of the Douglas Shire coastline is a priority action in the Resilient Coast Strategic Plan.

Enhancing stewardship of the coastline
Community involvement in coastal management is important for enhancing the resilience of our beaches to coastal hazards. Across Douglas Shire, many community members and groups are active in the care of the coastline.

The Resilient Coast Strategic Plan identifies as a priority action the co-ordination of a stewardship program that will seek to further empower and equip Douglas communities to:

- Contribute to on-ground dune protection and maintenance
- Promote and advocate for the care and protection of dune systems
- Share knowledge on observed changes to the coast
- Contribute to monitoring and evaluation of the implementation and success of adaptation actions.

Initiatives and activities that Council may undertake as part of the stewardship program include to:

- Create a dedicated role for a Council officer
- Utilise new communication platforms (website, apps)
- Seek new funding and grant opportunities
- Co-ordinate and facilitate community events
- Provide support to volunteer groups
- Identify complementary activities and synergies
- Seek partnerships and collaboration opportunities
- Deliver education and training programs, including engaging school groups - consider an 'adopt a beach' type imitative
- Promote use and development of innovative tools and products
- Encourage participation and awareness.

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

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

Relevant and priroity areas
Delivery of the community stewardship program is a relevant action across all localities in the Shire, and a priority for the main settlements and areas with high visitation.

Community stewardship		
	Programs and partnerships to enhance stewardship of the coastline	Dune protection, maintenance and 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		

Relevant / feasible
Priority
Not applicable

SHEET 1 TO 3 – ADAPTATION ACTIONS – SHIRE-WIDE INITATIVES TO ENHANCE ADAPTATIVE CAPACITY

SHEET 2 - KNOWLEDGE SHARING

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

The Resilient Coast Strategic Plan identifies as a priority action the co-ordination of a knowledge sharing initiatives that will seek to further empower and equip stakeholders and the Douglas Communities to:

- Understand coastal hazard risk and adaptation options
- Contribute to community stewardship initiatives
- Be informed, empowered and equipped to manage risk to private assets
- Be informed of implementation progress of the Resilient Coast Strategic Plan
- Contribute to the monitoring program.

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

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

Relevant and priority areas

Knowledge sharing initiatives are relevant across all localities in the Shire, with a priority focus on the main settlement areas.

Knowledge sharing		
	Facilitating knowledge sharing and education on hazards and adaptation	Other
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		

	Relevant / feasible
	Priority
	Not applicable

SHEET 1 TO 3 – ADAPTATION ACTIONS – SHIRE-WIDE INITATIVES TO ENHANCE ADAPTATIVE CAPACITY

SHEET 3 - MONITORING

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

The Resilient Coast Strategic Plan recognises as a priority action the development and implementation of a targeted monitoring program to inform adaptive management.

A useful approach to monitoring coastal environments includes:

- Simple and frequent photo point monitoring and on-ground observations suitable for community participation
- Plus more detailed surveys every 5 – 10 years, and event-based monitoring.

Monitoring observations may include:

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

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

- Establish a photo point monitoring system
- Create a platform and process for data management
- Tailor the monitoring program to align with / inform the 10 year review of the Resilient Coast Strategic Plan.

Photo point monitoring
Photos posts with a defined outlook/viewpoint can be installed to enable photos to be captured from the same perspective each time. Systems use an email address or online app to help collect and collate photos, creating a photo record over time. This approach provides a simply way for community members and visitors to contribute to monitoring of the beach.

CoastSnap
community beach monitoring

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

Relevant and priority areas
Targeted monitoring is a relevant action across all localities in the Shire. Photo point monitoring is considered to be a priority for the main settlement areas.

Monitoring		
	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		

Relevant / feasible
Priority
Not applicable

SHEET 4 – ADAPTATION ACTIONS - PLANNING UPDATES

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

Statutory planning / planning scheme
Updated Erosion Prone Area mapping produced as part of the Resilient Coast program will be adopted by State Government and Council. Once adopted, Council will have reference to the Erosion Prone Areas for planning overlays and controls. The updated Erosion Prone Areas, together with the recommendations in the Resilient Coast Strategic Plan, will enable Council to:

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

Other strategic planning
The Resilient Coast Strategic Plan outcomes will also inform other planning related to infrastructure, open space, foreshore master plans and asset management. Integrating an up-to date understanding of coastal hazards and appropriate mitigation options into existing and new relevant strategies will assist to mitigate risk, enhance resilience, and achieve multiple benefits from adaptation (e.g. aesthetic and recreation benefits combined with risk mitigation). As part of strategic planning, Council may look to consider options of land purchase / swap / relocation for limited areas where a transition response is identified.

Disaster management
A review and update of emergency response planning based on outcomes of the Resilient Coast Strategic Plan will allow Council to plan accordingly with an aim to minimise the consequence of coastal hazard impacts.

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

Priority areas
Planning updates are relevant across all localities in Douglas Shire, and are considered a priority action for the major settlement areas of Wonga Beach, Newell, Cooya Beach, Port Douglas and Craiglie.

Updates to emergency response planning are also a priority for settlements north of the river that can become isolated for a period of time following an extreme event, including Degarra, Cape Tribulation, and Thornton Beach.

Planning updates			
	Statutory planning / planning scheme updates	Other strategic planning – including land purchase / swap / relocation	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			

	Relevant / feasible
	Priority
	Not applicable

SHEET 5 – ADAPTATION ACTIONS - MODIFYING INFRASTRUCTURE

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

Upgrading critical infrastructure
Upgrades can be made to critical infrastructure that cannot be readily relocated out of a coastal hazard zone. Typical upgrades include raising floor levels to reduce inundation risk, and changing infrastructure design and materials to be more flood tolerant (reduce the consequence of inundation). For efficiency, upgrades would typically coincide with upgrades and renewals scheduled in an asset management / maintenance program. Updated coastal hazards zones, identified risks to critical infrastructure, and recommendations in the Resilient Coast Strategic Plan will inform updates to asset management plans.

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

Improving drainage networks
Improving drainage networks in the areas immediately surrounding critical infrastructure and in the main settlement areas can reduce the duration and consequence of storm tide inundation.

Building resilient homes
In coastal areas, private dwellings may be exposed to impacts from coastal hazards, including flooding associated with storm tide inundation. Smart choices in the design of homes can reduce the impact of flooding. For rebuilding, renovating, or building a new dwelling, tips for a resilient home are provided in the fact sheet in Attachment B and at https://ourcoast.douglas.qld.gov.au/building-a-resilient-coast-for-the-douglas-shire. Some of these changes may have higher initial upfront costs, but provide a longer term benefit. Making these changes over time can reduce damage from future flooding, and help residents get back to normal quicker after a flood event.

Relevant and priority areas
Modifying infrastructure is a relevant option to all localities in the Douglas Shire with existing Council owned critical assets and infrastructure, and settlement areas. Priority areas are considered to be the main settlement areas of Wonga Beach, Newell, Cooya, Port Douglas and Craiglie.

Modifying infrastructure				
	Upgrading 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				

	Relevant / feasible
	Priority
	Not applicable

SHEET 6 TO 10 – ADAPTATION ACTIONS – COASTAL MANAGEMENT AND ENGINERRING

SHEET 6 - DUNE PROTECTION AND MAINTENANCE

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

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

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

Dune protection and maintenance is a recommendation of the Resilient Coast Strategic Plan for all parts of the Shire.

Reduce disturbance
Reducing disturbance to the dune system can be achieved through fencing, signage, and providing defined / formalised access points and walkways / boardwalks at the most appropriate locations. Minimising through-traffic across the dune system is important to allow native vegetation to establish and contribute to building the dune system.

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

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

Sand fencing can also be employed as part of dune protection and maintenance to encourage sand accumulation, protect revegetated areas, and reduce disturbance to dunes.

Relevant and priority areas
Dune protection and maintenance is a priority action for all localities across Douglas Shire. In the more developed areas south of the Daintree River, some native revegetation may be required in some locations as part of the program.

Dune protection and maintenance			
	Reduce disturbance (fencing)	Weed removal and encourage native regeneration	Native revegetation if required
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			

	Relevant / feasible
	Priority
	Not applicable

SHEET 6 TO 10 – ADAPTATION ACTIONS – COASTAL MANAGEMENT AND ENGINERRING

SHEET 7 – BEACH NOURISHMENT

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

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

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

Sand scraping
Sand scraping involves mechanically moving sand from the intertidal zone to the dune or upper beach zone, mimicking the natural beach recovery processes (at an accelerated rate). The overall sediment budget of the beach remains the same.

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

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

Relevant and priority areas
Beach nourishment is considered to be a relevant coastal hazard adaptation option for several localities in the Douglas Shire.

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

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

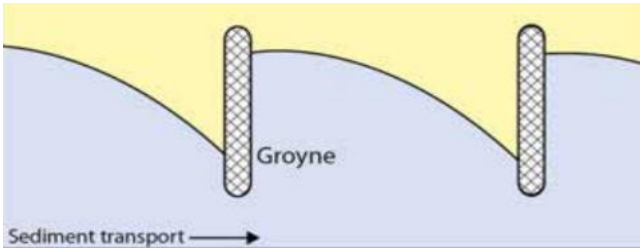
Beach nourishment		
	Sand scraping	Import sand to nourish the beach
Degarra		
Cowie Point		
Cape Tribulation		
Thornton Beach		
Cow Bay and Cape Kimberley		
Wonga Beach		
Rocky Point		
Newell		
Cooya Beach		
Port Douglas and Craiglie		
Pebbly Beach		
Oak Beach		
Wangetti		
South of Wangetti		

	Relevant / feasible
	Priority
	Not applicable

SHEET 6 TO 10 – ADAPTATION ACTIONS – COASTAL MANAGEMENT AND ENGINERRING

SHEET 8 – STRUCTURES TO ASSIST WITH SAND RETENTION

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



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

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

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

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

Sand fencing
Sand fencing or brush matting can also be strategically located to encourage sand accumulation in a desired place, generally along the seaward side of existing or newly constructed dunes to promote dune growth.

Relevant and priority areas
Sand fencing is a relevant action at all locations across the Shire, and a priority where there is a current opportunity to enhance dune accretion (Newell and Port Douglas). Due to the importance of the natural aesthetics of the beaches, rock groynes are not considered appropriate at all locations expect the headland at Rocky Point. Geo-bag groynes are considered a feasible option for beaches in the main settlement areas, but not for the pristine beaches north of the Daintree River.

Structures to assist with sand retention			
	Rock groynes	Geo-bag groynes	Sand fencing
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			

	Relevant / feasible
	Priority
	Not applicable

SHEET 6 TO 10 – ADAPTATION ACTIONS – COASTAL MANAGEMENT AND ENGINERRING

SHEET 9 - LAST LINE OF DEFENCE STRUCTURES

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

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

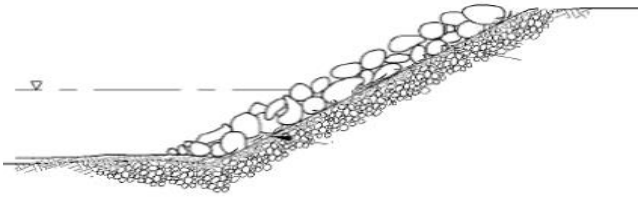


Figure adapted from USACE Coastal Engineering manual

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

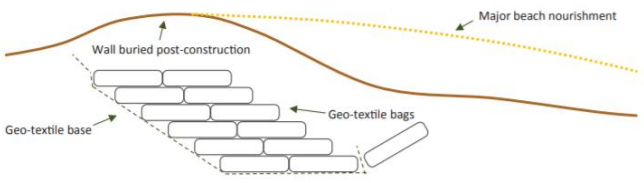
Exposed seawall

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

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

Buried seawall

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



Buried geo-bag seawall at Zilzie, QLD

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

Relevant and priority areas

Given the importance of natural aesthetics of the beaches in Douglas Shire, exposed seawalls are only considered to be appropriate at two locations where existing exposed rock protection is present and further protection of the road is required; Rocky Point and Pebbly Beach. In other settlement areas south of the Daintree River, buried seawalls are feasible for protection from coastal hazards (however may not be economically viable in comparison to other options). Seawalls are not considered appropriate for the pristine coastline north of the Daintree River, however some localised rock/other protection work to specifically address coastal hazard impacts on the road may be required.

Last line of defence structures		
	Exposed seawall	Buried seawall
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		

	Relevant / feasible
	Priority
	Not applicable

SHEET 6 TO 10 – ADAPTATION ACTIONS – COASTAL MANAGEMENT AND ENGINERRING

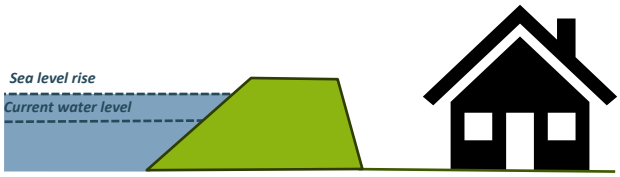
SHEET 10 - STRUCTURES TO MINIMISE FLOODING

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

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

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

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



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

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

Relevant and priority areas

Storm surge barriers are not considered a feasible option for coastal waterways across the Douglas Shire localities at this time, due to the potential disturbance to high value ecosystems (estuary and marine) and impacts on natural aesthetics.

Structures to minimise inundation of low lying land (levees and dykes) are a feasible option for some parts of Wonga Beach, Newell, Cooya Beach, Port Douglas and Craiglie.

Structures to minimise flooding		
	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		

	Relevant / feasible
	Priority
	Not applicable