Supplement A
Fact Sheets

Factsheet | Commonly Used Terms

This fact sheet provides a description of some of the more commonly used terms relevant to coastal hazard adaptation.

The Coastal Setting

Coastal geomorphology	The physical shape, processes and patterns associated with the coast, including landforms, soils, and geology.
Landform	The natural shape of the Earth's surface. Landforms range in size from small features such as dunes and estuaries found at a local scale, to large features such as mountain ranges and coastal plains that may exist at regional scales.
Shoreline	A designated line representing the landward limit of the sea. Methods used to define shorelines include fixed vertical levels or identifying the physical interface of water and land (e.g. with aerial photography).
Beach	The portion of the coastal zone periodically subjected to wave action. The seaward limit of a beach is typically defined as the spring low tide line, while the landward limit, as the vegetation line.
Coastal dunes	A ridge or series of sand ridges that form at the rear of the beach, by wind action (aeolian transport of sand).
Bay	A part of the coast where the land curves so that the sea is surrounded by land on three sides.
Harbour	A part of the coast deep enough for anchoring ships that is protected from winds, waves and currents by natural or artificial structures.
Tides	The regular rise and fall of the water surface resulting from gravitational attraction of the moon and sun and other astronomical bodies acting upon the rotating earth.
Relative sea level	Sea level as measured by an official tide gauge with respect to the land upon which it is situated.
Climate change	A change in the state of the climate that persists for an extended period, typically decades or longer.
Sea-level rise	An increase in the mean level of the ocean.

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Factsheet | Commonly Used Terms

Coastal hazards

Coastal hazards	Natural coastal processes that may negatively impact on the natural environment and human use of the coastal zone. Hazards include coastal erosion, storm tide inundation, and inundation due to sea-level rise.
Storm surge	Elevated sea level at the coast caused by the combined influence of low pressure and high winds associated with a severe storm such as a tropical cyclone or East Coast Low.
Storm tide	The total elevated sea height at the coast combining storm surge and the predicted tide height.
Storm tide inundation	When ocean water levels and waves are high enough to cause localised flooding of normally dry land.
Coastal erosion	Erosion occurs when winds, waves and coastal currents act to shift sediments away from an area of the shore.
Short term erosion	(storm bite) Erosion that occurs periodically on a short-term basis, often during a storm. The shoreline and beach then gradually regain sediment (rebuild).
Long term erosion	(recession or retreat) Erosion resulting in a continuing landward movement (loss) of the shoreline or a net landward movement of the shoreline within a specified time.
Accreting coast	Coasts that experience a deposition of sand instead of erosion. Accretion occurs during the calmer seasons. Beach accretion is generally much slower than beach erosion.

Resilience and adaptation

Coastal vulnerability	The threat to coastal landforms, social, economic and environmental systems, associated infrastructure or land use that may be caused by a sustained shift in environmental conditions.
Risk assessment	A systematic process of evaluating the potential risks that may be associated with an event or activity.
Resilience	The capacity of social, economic and environmental systems to cope with or 'bounce back' following a hazardous event or disturbance, responding or reorganising in ways that maintain their essential function, identity and structure, while also maintaining the capacity to adapt and transform.
Adaptation	The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm, or exploit beneficial opportunities. In some natural systems, human intervention may help a system adjust to the expected climate and its effects.
Adaptive capacity	The ability of systems, institutions, humans, plants and animals to adjust to potential damage, to take advantage of opportunities or to respond to consequences.
Adaptation pathway	A series or sequence of management actions (over time) directed to achieving long-term adaptation objectives.
Coastal adaptation	Future modification of actions and behaviour through construction of infrastructure or change in land use practices that prevents or reduces adverse impacts associated with coastal hazards.

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Factsheet | Commonly Used Terms

Reference

Terminology has been tailored for the Gladstone Region *Our Coast Our Future* program and is consistent with the National CoastAdapt information manuals: https://coastadapt.com.au/information-manuals, and other sources.

Working together

Across Queensland, councils and communities are working together to develop a tailored approach to adaptation across different localities.

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Factsheet | Our Coastal Landscape

Across the Gladstone Region, the coastal landscape supports a diversity of cultural, economic and environmental values, and is highly valued by our Traditional Owners, local communities and visitors to the area. The shoreline stretches over 150 km from Raglan Creek in the north to Baffle Creek in the south. The coastal region includes Gladstone Harbour, which is a deep-water harbour that services a number of industries and exports that combined, contribute over half of the economic value for the region.

The Gladstone coastal landscape is characterised by a network of sandy beach systems backed by elevated coastal dunes, interspersed with rocky headlands, estuaries, coastal creeks and wetlands, and pockets of adjacent coastal plains. A number of islands sit off the coast, including the larger continental barrier islands of Curtis Island and Facing Island and smaller islands further offshore, which comprise the most southern islands of the Great Barrier Reef.

One of the more challenging aspects of the coastal landscape is that it experiences constant, and often rapid change. Wind and wave action continually work to move sediment and shape the shoreline and adjacent coastal land. Understanding the key drivers of landscape change in the coastal zone is the first step to developing a strategic plan to balance key values and land use, both now and into the future.

What changes do we need to plan for?

Tides: The periodic rise and fall (or flood and ebb) of the daily tide moves sediment both on and off-shore and shapes the form of the beach and near-shore environment. The Gladstone coast experiences semi-diurnal tides, meaning there are

two high tides and two low tides each day. The difference between the lowest and highest tides experienced under normal conditions is called the tidal range. The tidal range is around 4.83 m at Gladstone, but extreme weather events can cause considerably higher tides.

Wind and waves: Waves are generated by wind blowing across the water. Wind, combined with the morphology (shape) of the sea floor, drives the size, frequency, duration and energy of waves. Wave energy has the potential to move sediment both off-shore, on-shore, and along the coastline. Data on tides, wind, waves and climate patterns are collected by buoys, gauges and weather stations situated along our coastline

Weather and climate patterns: Local climatic conditions (e.g. dominant wind patterns) as well as extreme events like cyclones will influence how the coastal landscape develops and changes over time. Extreme weather events can drive major coastline changes in a short period of time, including erosion (loss) of sand. Sandy beaches and dunes typically rebuild gradually between extreme events. Long-term changes in climate also influence sea level and coastal processes.

Sediment supply: Sediment is delivered to coastlines from catchments, rivers, dunes and offshore environments. When historical sediment supplies reduce or cease, coastlines may be prone to erosion. When sediment supply is abundant, coastlines will tend to build seaward. Sources of sand to the Gladstone coast include sand delivered to the coast by the major waterways, as well as sediment transport from offshore and along the coast.

Population dynamics: The number of people living, working and visiting coastal zones is also a key driver of landscape change. Particularly as population increases, the development of urban areas, infrastructure and farmland, can restrict and/or accelerate change.

How do we plan for change?

Understanding the key drivers of change in the coastal zone helps to inform management activities. This includes pro-active planning to mitigate the risk of coastal hazards. Coastal hazards typically include flooding of low-lying coastal land and erosion of the existing shoreline. Managing the risk (likelihood and consequence) of coastal hazards involves understanding which areas are likely to be impacted, both now and into the future. The development of a Coastal Hazard Adaptation Strategy, as part of the Gladstone *Our Coast Our Future* project, will assist to inform both short and long-term management of our coastline.

Working together

Across Queensland, councils and communities are working together to develop a tailored approach to adaptation across different localities.

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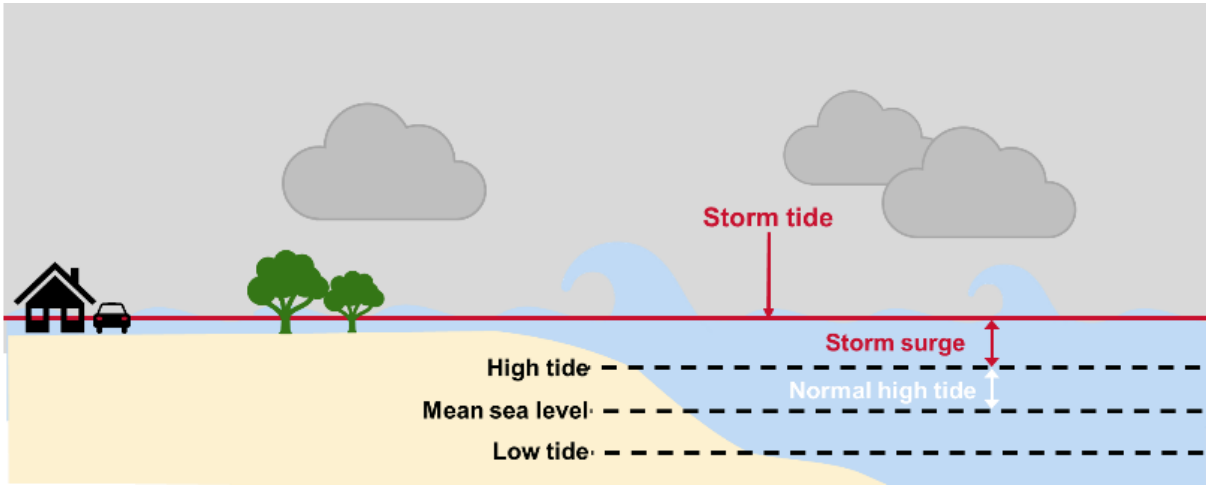
Factsheet | Coastal Hazards

What are coastal hazards?

Flooding and erosion are natural processes that contribute to shaping the unique landforms of each coastal region. These processes become hazards when they have adverse impacts on infrastructure and natural assets, and the way people use and enjoy the coast. In Central Queensland, major coastal hazard impacts are typically associated with storms and tropical cyclones.

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. Storm surge is driven by the combined influence of low atmospheric pressure and high winds associated with events such as East Coast Lows and tropical cyclones.

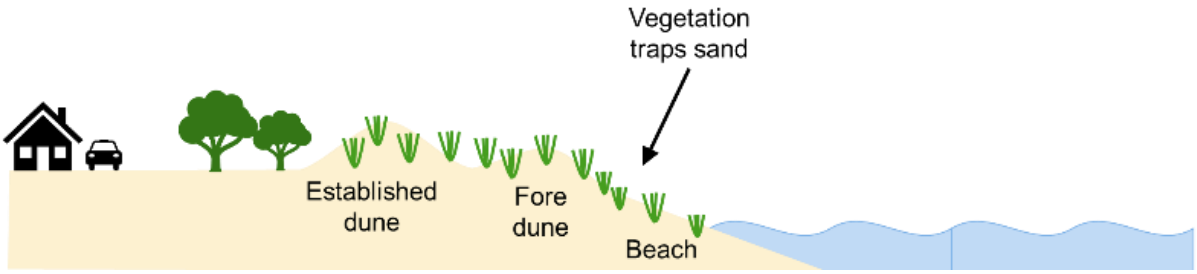


Coastal erosion

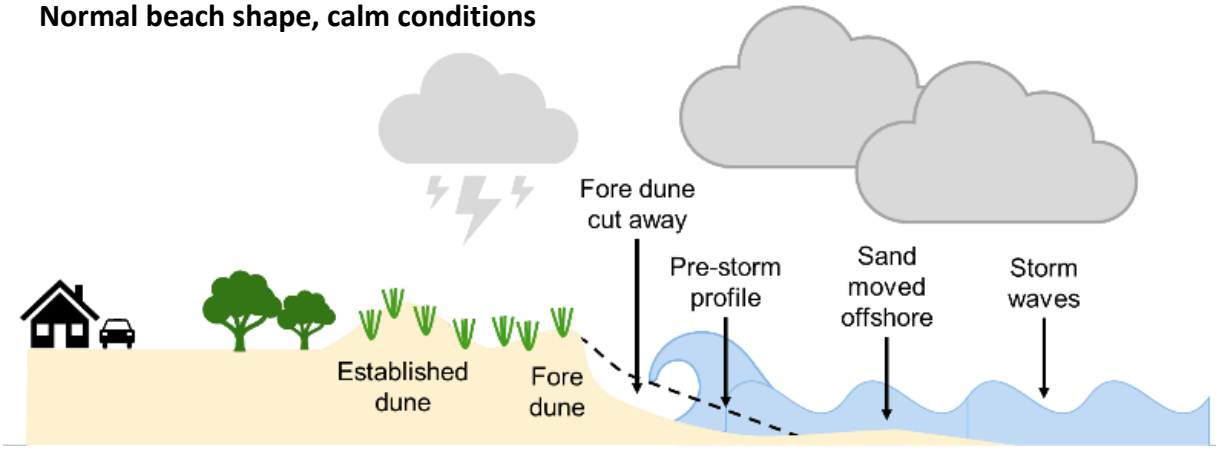
Coastlines naturally erode and accrete (accumulate) over time, driven by variations in sediment supply and climate patterns. Both short- term and long-term erosion processes may impact on coastal assets, depending on how close to the foredune the assets are located.

Coastal erosion occurs when winds, waves and coastal currents act to shift sediment (sand) 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. When a beach is stable, all of the sand moved offshore during a storm eventually moves back onto the beach (over months or years).

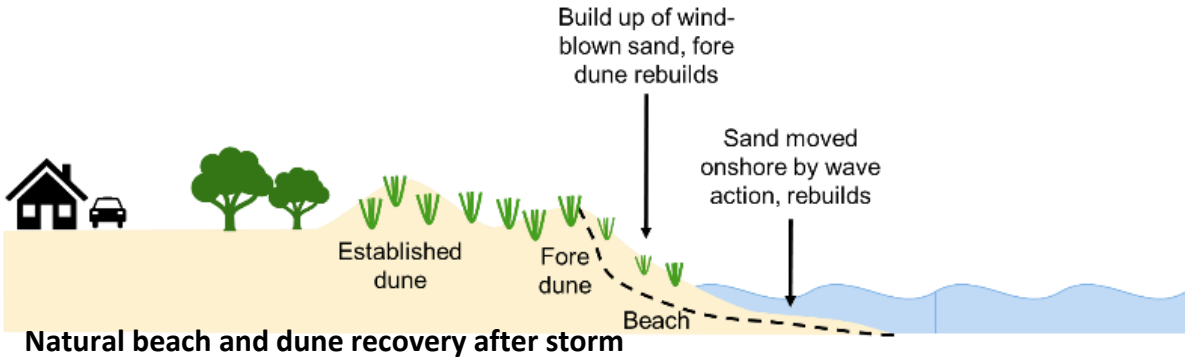
In other cases, due to changing sediment supply or climate conditions, the beach may not have sufficient capacity to rebuild between storm events. In the absence of intervention, long-term erosion (termed recession) may occur, which is the landward movement of the shoreline over longer timeframes (decades).



Normal beach shape, calm conditions



Beach erosion during storm



Natural beach and dune recovery after storm

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Factsheet | Coastal Hazards

Future impacts

Projected sea level rise and an increase in storm intensity for the Central 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 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 storm intensity will add to the magnitude of storm tide events and the extent of inundation.**

Source Coastal Hazard Technical Guideline (DEHP 2013)

Planning to adapt

Erosion and inundation have the potential to adversely impact existing and future assets in the coastal zone. These impacts can be minimised through strategic planning and adaptation actions. This involves:

- Understanding the physical processes
- Assessing the likely extent of storm tide inundation and erosion, now and in the future, and assets that may be impacted
- Assessing the consequence of impacts for communities and ecosystems
- Considering the range of planning and adaption options and developing an adaptation plan.

Through the *Our Coast Our Future* project, Gladstone Regional Council and the State Government are actively planning to avoid or mitigate the impact of coastal hazards, both now and into the future.

Working together

Across Queensland, councils and communities are working together to develop a tailored approach to adaptation across different localities.

More information on coastal adaptation can be found at:

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Factsheet | Coastal Hazard Adaptation

The coastal landscape experiences constant, and often rapid change. Wind and wave action continually work to move sediment and shape the shoreline and adjacent coastal land. These are naturally occurring processes that contribute to create the unique landforms of each coastal region, however, also have the potential to adversely impact infrastructure, public safety, and natural assets. As changes to our climate occur, these impacts are expected to become more severe. Gladstone Regional Council and the wider community can work together to adapt to change.

A resilient coast has social, economic and environmental systems in place to cope with or 'bounce back' following a hazardous event or disturbance. Resilience also means the ability to respond or reorganise in ways that maintain the essential function, identity and values of a region, while also being able to adapt and transform.

How can we adapt to coastal hazards?

There are a range of ways we can adapt to coastal hazards such as erosion and inundation.

Adaptation options include:

1. Updates to land use planning
2. Changes and upgrades to infrastructure
3. Coastal engineering options
4. Initiatives to build adaptive capacity across communities.

1. Updates to land use planning

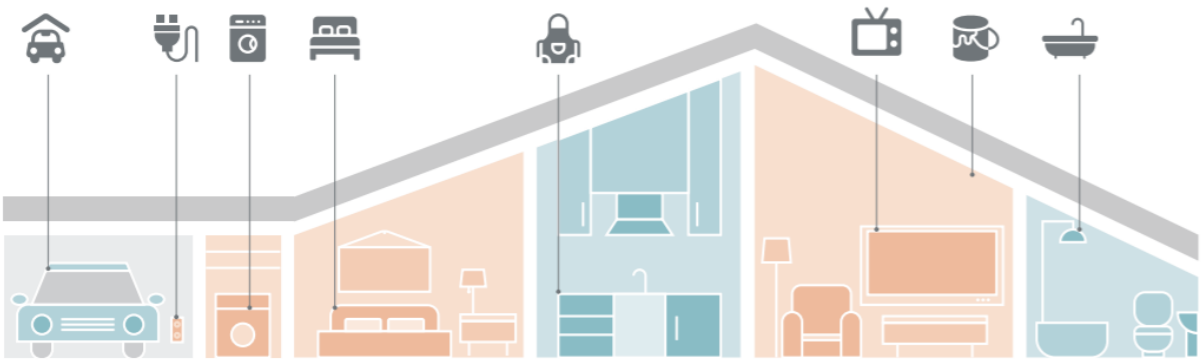
Updates to land use planning may include:

- Identifying appropriate areas for new development (residential, industrial, tourism), and new critical infrastructure (e.g. roads, hospitals)
- Tailoring specific uses for inundation and erosion prone areas (e.g. recreational uses, open space and parklands, conservation zones)
- Planning for urban, industry, tourism and ecosystem changes
- Updating emergency response planning, including early warnings for impacted areas.

2. Changes and upgrades to infrastructure

Changes to infrastructure may include:

- Relocating critical infrastructure (e.g. essential access and services)
- Upgrading critical infrastructure that cannot readily be relocated
- Increasing floor levels (freeboard) of buildings in flood prone areas
- Building resilient homes
- Updating drainage networks and systems.



3. Coastal engineering

There are a range of coastal engineering adaptation options including the following.

Dune protection and maintenance

Dune protection and maintenance involves limiting disturbance to dunes and protecting/enhancing dune vegetation to increase the stability of the dunes.

Where present, the dune system is the beach's natural defence to coastal hazards. The foredunes dissipate wave energy and protect the land behind from impacts of erosion and inundation. Vegetation across the dunes traps windblown sand and enhances the ability of dunes to rebuild after storm activity.

Vegetation plans can be tailored to each site, and with consideration of other needs (e.g. views, access).

Beach nourishment

Beach nourishment can include scraping of sand from the intertidal zone to accelerate recovery of the upper beach, and/or importing additional sand to increase the overall volume. Imported sand can be sourced from off-shore, quarries or other sources. Beach nourishment is typically combined with dune maintenance, to enhance the level of protection against erosion and inundation.

Beach nourishment has the benefit of providing increased protection from coastal hazards while maintaining the natural values of the beach and coastline.

Structures to assist with sand retention

Structures can be installed to assist with retaining sand in a specific area of the shoreline. Usually combined with beach nourishment and dune maintenance, these structures typically take the form of one or many groynes that extend perpendicular to the long-shore sand transport. Groynes will accumulate sand to the side where sand moves towards the groyne. Groynes are typically made of rock, wood, or geo-fabric bags.

Structures to assist with off-shore energy dissipation

Structures can be installed off-shore to create a zone where wave energy will break and dissipate prior to reaching the beach. These structures include breakwaters and artificial reefs, typically composed of materials such as rock, concrete or geotextile materials.

Living shorelines are a more recent concept of off-shore energy dissipation using a suite of erosion control techniques that combine natural coastal habitats with a natural or engineered means of breaking up a wave energy (e.g. mangrove island, oyster farm reefs/breakwater).

Mangroves have an important role in providing natural dissipation of wave energy. The significance of mangrove communities in providing coastal hazard protection is becoming increasingly recognised. Mangroves are well established along many parts of the Gladstone coastline and have an important role in protecting the shoreline from erosion.

Last line of defence structures

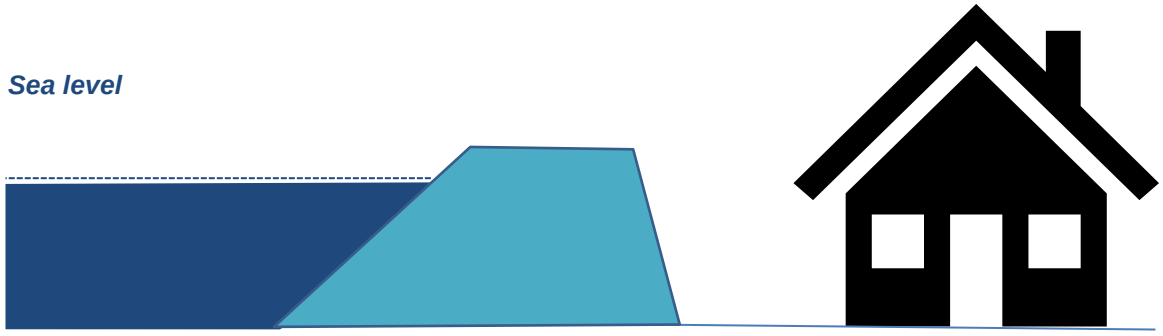
Seawalls provide a physical barrier between the ocean and adjacent coastal land, and protect the coastal assets behind the wall from erosion. Seawalls are typically made of rock, concrete, synthetic blocks or geo-fabric bags, and can be designed as buried revetments or exposed walls.

A seawall is a hard barrier to wave energy. As a result, waves refract off the seawall and scour sand away from the base (or toe). The presence of a seawall can often result in a complete loss of the high tide sandy beach. The appropriateness of seawalls is considered on a site by site basis.

Structures to minimise inundation

A range of structures can be used to keep floodwaters from entering specific areas.

Dykes and levees are artificially elevated mounds or walls that can be made of earth, rock, concrete, geo-fabric bags or other materials. The presence of dykes and levees can be either part of an emergency planning approach, or more permanent features as part of a drainage network.



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

Storm tide 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.

Tidal gates provide an opening through which water may flow freely when the tide moves in one direction, but which closes automatically and prevents the water from flowing in the other direction.

Backflow protection involves the use of valves, flap gates or similar to stop backflow through drainage pipes that can occur at high tide.

4. Initiatives to build adaptive capacity

Initiatives to build adaptive capacity across our communities include:

- Developing programs and partnerships to support and enhance stewardship of the coastline
- Facilitating knowledge sharing and education on hazards and adaptation
- Monitoring changes in coastal hazard risk and effectiveness of adaptation.

Working together

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Adaptation approaches:

- Will vary from site to site within each region
- Are tailored to the needs of local communities
- Consider the relative impacts of coastal hazards
- Seek to safeguard the values (social, environmental and economic) and character of the landscape.

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OUR VALUES | What are our shared values?

The Bailai (Byellee), Gooreng Gooreng, Gurang and Taribelang Bunda people are the Traditional Owners of the Gladstone coastal region. They have a long and deep connection to all the freshwaters, tidal and coastal waters, and the plants and animals that live there. The Gladstone Regional Council would like to acknowledge and pay respect to Elders past, present and emerging, and extend that respect to other Aboriginal and Torres Strait Islander people.

This factsheet shares what the Gladstone community value most about the coast, their memories of the events and factors that can shape the coastline, as well as issues of concern. This information was collected as part of the development of the Gladstone Coastal Hazard Adaptation Strategy during a number of discussions and engagement activities in 2020.

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Photographs used with permission from Jayden Head (Southend, Curtis Island), Machil (Peek a boo), Kelli White (The Larc), Duncan Reilly (Heron Island Sunset), Kris Connor (Curtis Island sunset), Bianca Sparshott (Whales!) and Stuart McKay (1770 From above).

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OUR CHANGING COASTLINE | What has shaped out coast?

All coasts are dynamic and ever changing. Coastal change is caused by both natural processes and human activity. Some of these forces (described below) have shaped the Gladstone region's coastline of the past and present, and will continue to shape the coastline in the future.

Pre - 1800's **1800** **1850** **1**

The port was initially used to export wool and livestock, as well as for import purposes. By the 1860s, cattle, sheep, minerals and timber were being exported. In 1885, the first wharf was built in Gladstone, which was followed by significant dredging and blasting of the area to improve access to the harbour. Today, import and exports are mainly coal, bauxite, alumina, aluminium, cement and LNG.

The colonial history of the region began with the landing of Lieutenant James Cook at Bustard Bay in 1770. The region was later settled by Europeans during 1847 and became a municipality in 1863. Initially known as Port Curtis, the region was established as a pastoral district with sheep and cattle grazing. However, since 1964, Gladstone has continued to develop as a major industrial centre.

Coastal land use includes significant rural areas, historically dominated by livestock and timber. Smaller agricultural sectors include dairy, fruit and crops.

Home to the Gooreng Gooreng, Gurang, Bailai, Bunda People and Taribelang Bunda People the Gladstone region has experienced significant population expansion along the coast. This has impacted the coastline through new land development and increased usage of foreshore areas by residents. In 2020, the Gladstone Region is home to over 63,000 residents with a predicted annual growth of 0.7 % per year over the next 25 years.

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Photographs used with permission from Paulette Lindley (Wild Cattle Island Sunset), Carmen (Gladstone Harbour), Bianca Sparshott (Wild Cattle Creek at low tide), smpender (Tannum Voastrek), Yvonne Crause (Eastside), S W Weatherall (Gladstone Harbour light show), Dee Marie (A Rising Full Moon), Stuart McKay (1770 Marina Sunset), Kaz Plumridge (1770), Ashton S (Channelling Santorini) and Andrew Collis (5 rocks).

The Traditional Owners comprise of four groups, Gooreng Gooreng, Gurang, Bailai and Taribelang Bunda. These groups make up the Native Title claim group, the Port Curtis Coral Coast Trust Limited (PCCC) which has a Traditional Use of Marine Resources Agreement (TUMRA).The Gidarjil Development Corporation was established in 2000 and have since expanded their program to undertake marine management activities throughout the region.

900 1950 2000 2020

In 1863 the burgeoning town became a municipality with Richard Hetherington elected Gladstone's first Mayor. In 1914, the Gladstone Harbour Board was established. Much later, in 2001, the Port Curtis Monitoring Plan released. The Gladstone Regional Council was formed following the amalgamation of Gladstone, Calliope and Miriam Vale local government areas in 2008.

The region offers a wide range of attractions for the local community and its visitors. These include unique and significant natural assets and access to recreation opportunities. Nearby beaches, reserves, parks, islands, national parks, reefs and associated channels and creeks provide an assortment of options for tourists. In 2016, cruise ship visitation commenced.

The coastline has been impacted by major climate events like Tropical Cyclones Dina (1967), David (1979), Marcia (2015) and Debbie (2017). Over the years, storm and king tides have resulted in significant flooding and coastal erosion.

Resource industries play a very significant role through the mining, manufacturing and export of a range of natural resources, including coal, alumina and aluminium.

Curtis Island also contains three liquid natural gas facilities and a large port. The Boyne Island Smelter, located behind Lilley's Beach, is the largest aluminium smelter in Australia.

The coastline and coastal environment are within the World Heritage Area of the Great Barrier Reef, which includes national parks, wetlands of national importance, conservation parks, and is part of the Discovery Coast. The region is home to over 60 rare or threatened species. The Gladstone Healthy Harbour Partnership was formed to coordinate the Healthy Gladstone Harbour Report Card.

In 1915 the Tondoon Creek Dam was built, and in 1966 construction of the Boyne River-Awoonga Weir commenced. Today, built on the Boyne River, the Awoonga Dam is the fourth largest surface water storage in Queensland. In 2018, the Agnes Waters desalination plant commenced operation.

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HOW OUR COAST HAS CHANGED

By documenting and understanding how the coast has changed and what impacts have been experienced over time, we can plan to better manage and mitigate future risks to our Gladstone coast and communities.

Natural beauty

Changes to the coastline due to erosion and aging or unsuitable infrastructure may take away from the natural beauty of our coastline.

"I have many photos from over the years documenting the degradation that happens in 1770."

"There is more of a danger and risk to the community around Wild Cattle creek it has eroded and has changed the appearance of our coast."

Coastal access

"We now have beach access issues in many places along this stretch with timber stairs and walkways too unsafe to use."

"Unable to make full use of 1770 foreshore for walking. On some high tides you have to walk on the road to connect to the butterfly walk near monument. There is no footpath on that section, so care needs to be taken."

Sand movement periodically prevents safe access to local recreational infrastructure and favourite beach spots.

"The erosion to the south on wreck rock beach makes turtle monitoring very difficult and the beach becomes impassable."

"Extended closure of Wild Cattle end of Esplanade. This has been our family's preferred swimming/picnic location my whole life."

Property and infrastructure

"Heavy rains and a significant high tide resulted in our entire boundary fencing being washed away."

"Erosion continually affects/damages property and council infrastructure along the Boyne River, Boyne Island following decent rainfall or TC."

Parts of the Gladstone region, including houses and businesses, are vulnerable to temporary storm tide inundation during extreme climate events.

"Over the time our rescue facility has been impacted with water we are lucky to have the assistance of Council at times to assist with sandbagging the doors."

"Houses at Tannum Sands are at risk during storm tides."

"Flooding of the Baffle Creek waterways inundated homes and property in the area."

Dunes and coastal habitats

"Loss of entire front of dune system on Main beach Southend during 2013 turtle nesting season."

"I have seen the dunes along the main beach to surf club stretch of coast erode back by approximately 3 to 4 metres."

Erosion and loss of vegetation could compromise the stability of important dune systems that provide a natural buffer from coastal hazards and support diverse flora and fauna species.

"This erosion takes out Casuarinas trees which are used to protect all vegetation throughout the dunes."

"The vegetation line on the beach at Tannum has been marched back over the years."

Photographs used with permission from Shane McLeod (Wild Cattle Dreaming), Ben Wardell (Cruisy Sunsets) and Angie Kruger (Struck Over Bustard).

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Factsheet | A Strategic Approach to Adaptation

Across Australia and internationally, coastal land managers are taking a strategic approach to managing the risk of coastal hazards. Common elements of this strategic approach include:

- Developing a framework for adaptation, including identifying Council's role (Figure 1), and the range of adaptation responses and options (Figure 2)
- Assigning a strategic 'adaptation response' to different localities to guide decision making over present day, 2060 and 2100 planning horizons
- Assessing the range of 'adaptation options' suitable in different locations to help mitigate the risk of coastal hazards
- Developing a strategic plan for coastal adaptation with prioritised actions over a 5—10 year timeframe.

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

Figure 1. Council's role in coastal hazard adaptation

Adaptation response	Coastal hazard adaptation			
	Avoid	**Monitor**	**Mitigate**	**Transition**
	Avoid placing new development of assets in coastal hazard areas.	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 land use in some areas. Mitigation may be part of the transition process.
Adaptation options		Monitoring and initiatives to enhance adaptive capacity	Full range of adaptation options	

Figure 2. Our Coast Our Future - Adaptation response

Applying the framework

Adaptation response and options (Figure 3) are informed by:

- Consultation with land managers, local communities, and other interested stakeholders
- The values and objectives for different locations
- An understanding of the risk of coastal hazards
- A regional-scale perspective of the range of values, uses and pressures in the coastal zone
- Adaptation framework

In areas where the adaptation response is 'mitigate' (either present day or by 2100), the full range of adaptation options will be considered. These include land use planning, upgrading / relocating infrastructure, and coastal management and engineering. All options are considered for each location, and screened for appropriateness based on consideration of coastal values, objectives, feasibility, cost and community perspectives. For land and assets managed by other authorities, Gladstone Regional Council may, as part of everyday activities, observe a risk from coastal hazards. If the risk is high, and/or continues to increase, Council will notify the relevant authority. Council may then advocate on behalf of directly affected communities. Adaptation response

Adaption Response	Mitigate			
	Actively mitigate the risk of coastal hazards through a range of adaptation options.			
Adaptation options Typically a combination of options in each region	Initiatives to enhance adaptive response	Planning updates	Modifying infrastructure	Coastal management and engineering

Figure 3. Adaptation options

Further information on adaptation options is provided in the 'Coastal Hazard Adaptation' factsheet, available on the website: https://conversations.gladstone.qld.gov.au/our-coast-our-future

More information on coastal hazard adaptation can be found at:

- Coast Adapt: https://coastadapt.com.au/
- QCoast2100: https://www.qcoast2100.com.au/tools/useful-information

Fact sheets in this series:

- Terminology
- Coastal landscape
- Coastal hazards
- Coastal adaptation
- Adaptation framework
- Project updates

Factsheet | *Our Coast. Our Future.* Strategic Plan

The *Our Coast. Our Future.* program aims to work together to proactively plan for the future management of our coastal areas, to increase the resilience of our region.

The *Our Coast. Our Future.* project team have now completed a draft Strategic Plan (the Plan) for the Gladstone Region.

The Plan is a risk and change management initiative to better prepare Council and the community to proactively respond to coastal hazards. This includes initiatives to mitigate and adapt to the social, cultural, economic, and environmental risks associated with current and future coastal hazards.


Image credit: Katherine Salisbury

This is the start of the adaptation pathway

Adapting to coastal hazards is a shared responsibility for all stakeholders and community in the Gladstone Region. We look forward to working together as we continue the adaptation journey.

This draft Plan represents the start of an ongoing process of planned adaptation over time. Adaptation pathways will be continually informed by community input and ideas, new knowledge, and monitoring the effectiveness of initiatives. We encourage everyone to consider how you can build your own resilience and adapt to a changing climate.

The draft Plan has been a joint project with the State Government and Local Government Association of Queensland (LGAQ) who have provided funding through the QCoast$_{2100}$ program to Queensland coastal councils to support the process.


Image credit: Pete Hyne

A collaborative process

Our Coast. Our Future. has included an engagement program throughout 2020, with our communities and key stakeholders, to inform the development of the Plan, through participatory approaches at different stages of the process.

Community and stakeholder feedback has informed the direction of technical assessments as well as the development of the adaptation options and pathways in the Plan.


Image credit: Angie Kruger


Image credit: N. Barrett

Technical assessments

Work completed to inform the strategy has included:

- **Mapping:** Updating the existing State mapping of areas that may be exposed to coastal hazards by 2100. This has included new storm tide modelling for the Gladstone region, to improve information on potential inundation extents and depths for different storm events and planning horizons (present day, 2060 and 2100).
- **Risk assessments:** Undertaking a tailored coastal hazard risk assessment
- **Adaptation actions:** Developing and applying a tailored framework for adaptation, and associated adaptation pathways and actions.

The Strategic Plan includes region-wide and locality-specific actions to manage the current and potential future impacts of coastal erosion, storm tide inundation, and expanding tidal areas due to sea level rise.

Adaptation initiatives

The Strategic Plan includes over 30 region-wide adaptation initiatives across the themes of:

- Capacity building initiatives
- Planning updates
- Modifying infrastructure
- Coastal management and engineering.

Locality-specific applications of adaptation actions are set out in pathways, from present day to 2100, for 8 coastal reporting regions within the Gladstone region.

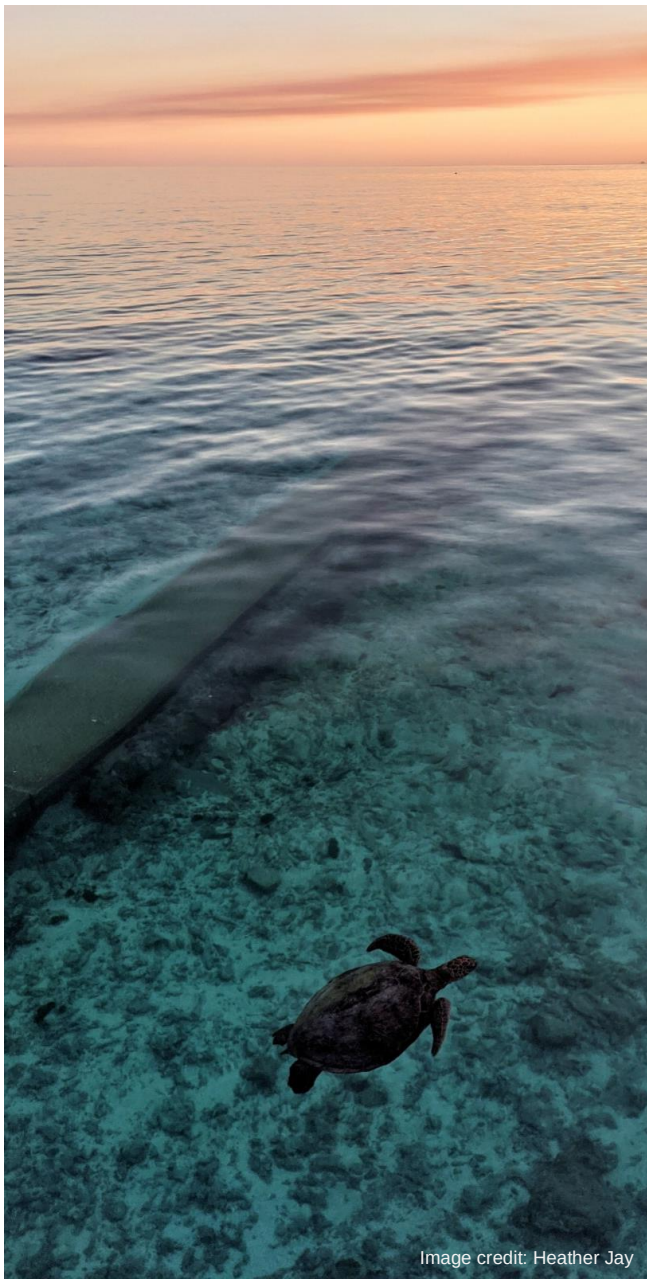

Image credit: Heather Jay

Image credit: Brandon Smart

Example initiatives in the Plan include:

- Region-wide dune protection and maintenance stewardship
- Enhancing social adaptive capacity
- Establishing a monitoring point system at key areas
- Advancing partnerships with our Traditional Owners and First Nations people in coastal adaptation
- Enhancing monitoring programs to inform adaptation planning
- Establishing collaborative research partnerships
- Piloting mangrove protection and enhancement programs at key sites
- Reviewing industrial and port infrastructure in the contexts of long-term coastal hazard areas
- Special area adaptation plans to inform site specific hazard mitigation and land use transition
- Informing infrastructure upgrades and betterment programs
- Reviewing, updating and developing Shoreline Erosion Management Plans (SEMP)
- Reviewing long-term adequacy of evacuation facilities and evacuation routes
- Promoting resilient homes within the community
- Sequencing of locality-specific adaptation actions from present day to 2100 based on the changing risk profile and objectives for management.

How can I help adapt?

There are many ways you can contribute to coastal hazard adaptation in the Gladstone Region.

1. Provide feedback on the draft Strategy – visit the website for options on how to give your feedback
2. Increase your awareness of coastal hazard prone areas - review the State coastal hazard mapping and the updated mapping available on the website
3. Review the adaptation pathway for your local beach/area and provide feedback on the proposed actions
4. Consider the top tips for a resilient home (visit the website for the fact sheet)
5. Contribute to the stewardship of our coastline by protecting our dunes and coastal vegetation. You can also get involved in citizen science projects or local catchment care group.

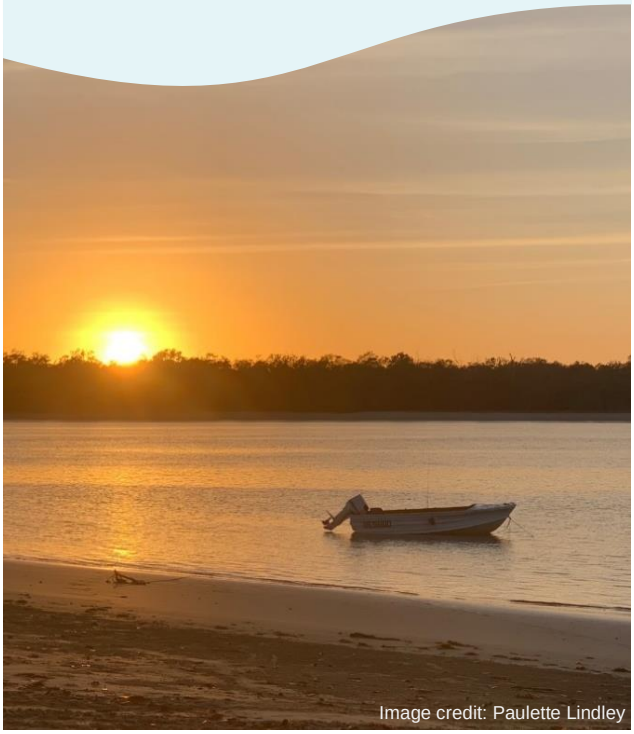

Image credit: Paulette Lindley

Becoming a well-adapted and resilient community is a long-term plan that requires ongoing efforts by everyone in our community. We look forward to continuing this journey together with our community to ensure we maintain our coastal lifestyle both now and into the future.

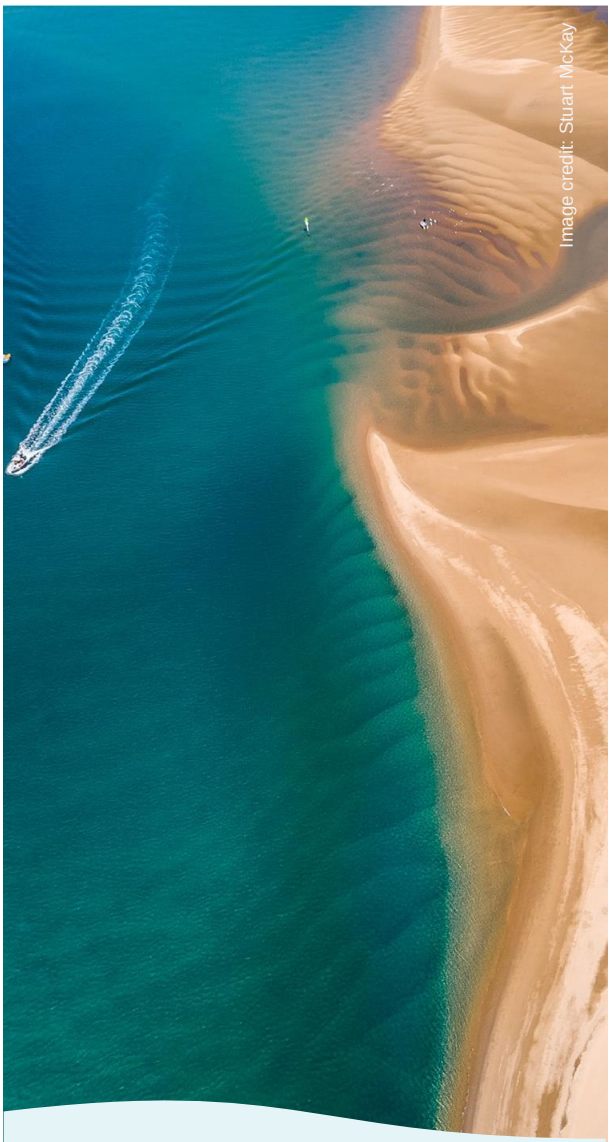

Image credit: Stuart McKay

Visit the website to find out more and to have your say and contribute to refining the draft Strategic Plan:
https://conversations.gladstone.qld.gov.au

Factsheet | Resilient housing

What does a resilient home look like?

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 your home can reduce the impact of tidal flooding. If rebuilding, renovating, or building a new dwelling, it is worth considering these top tips for a resilient home.

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 tidal flooding, and help you get back to normal quicker after a coastal flooding event.

Top tips for a resilient home:

Around the house

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

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

Living room

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

Bathroom

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

Kitchen and laundry

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

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

Bedroom

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

Outside

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

NOTE: Consult a Registered Professional Engineer Queensland (RPEQ) structural engineer for all structural alterations

Tidal flood depth and damage

A relative shallow tidal water depth (10 – 30 cm) can cause substantial damage to the interior of a dwelling (Figure 1). A water depth in the order of 30 cm can often require rewiring, reflooring and replacement of appliances. Investing early in adaptation measures can significantly reduce the damage to your home and the costs associated with clearing up. The top tips for a resilient home are recommended even if your dwelling is only exposed to relatively minor tidal flood events.

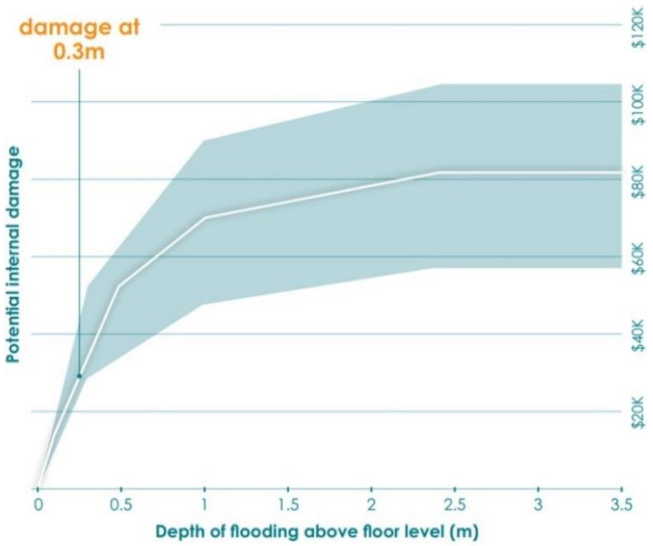

Figure 1. Indicative internal damage cost compared to depth of tidal flooding in residential buildings. Shaded area represents uncertainty and variation from a number of studies.

More information on coastal hazards can be found at:

https://conversations.gladstone.qld.gov.au/our-coast-our-future

FACT SHEETS IN THIS SERIES:

- Our Coastal Landscape
- Commonly Used Terms
- Coastal Hazards
- Coastal Hazard Adaptation
- A Strategic Approach to Adaptation
- *Our Coast. Our Future.* Strategic Plan

Further ideas for resilient homes can be found here:

- Flood Resilient Homes Program – https://www.citysmart.com.au/floodwise/
- Flood-resilience strategies – https://www.citysmart. com.au/wp-content/uploads/2018/07/FWHS-Floodresilience-Strategies.pdf
- Rebuilding in storm tide prone areas – https://therocknews.files.wordpress.com/2011/08/ draft-part-1-lowres1.pdf

More information on coastal hazards can be found at:

Coast Adapt: https://coastadapt.com.au/

QCoast$_{2100}$: https://www.qcoast2100.com.au/