

6. Coastal hazard adaptation actions

Warraber

Community overview

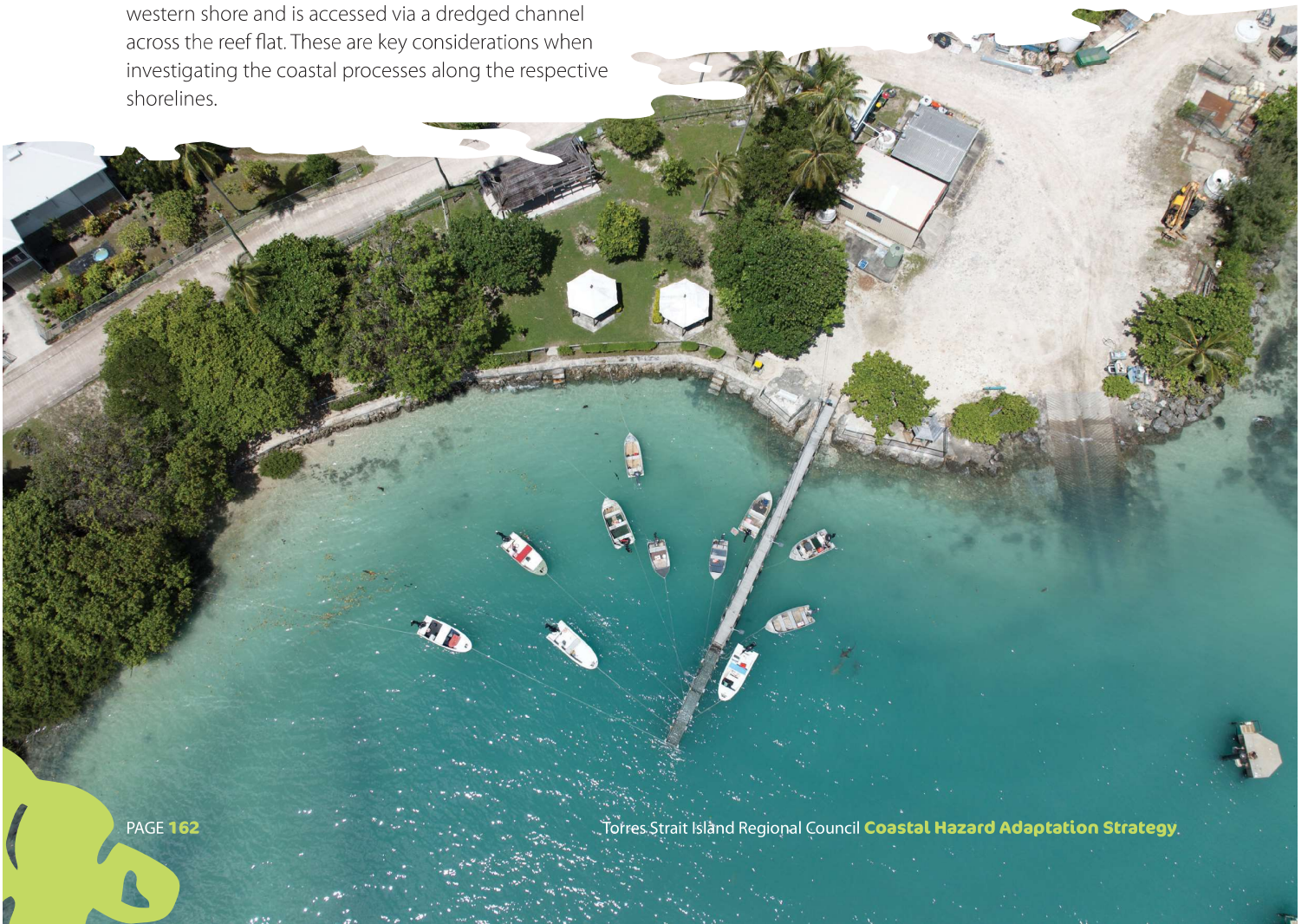
Community	English name	Cluster	Type
Warraber	Sue	Central	Coral Cay

Warraber is part of the central island cluster and is part of three sister islands in the Warraber group (Warraber, Burrar (Bet) Islet, and Guijar (Poll islet)). This island is the only inhabited island in the group and is home to 287 people (ABS, 2021). Warraber is a low-lying coral cay which is just under 0.8 km² in size and is generally less than +5 m AHD above sea level.

The western half of Warraber is higher and older and is thought to have established approximately 3000 years ago with the island subsequently expanding to the south and east (JCU, 2010). Much of the north western shore is comprised of beach rock, with little loose sediment accumulation above reef flat level. The island is located on a platform reef that extends south and east from the island. The island's barge ramp is located on the north western shore and is accessed via a dredged channel across the reef flat. These are key considerations when investigating the coastal processes along the respective shorelines.

Key infrastructure on Warraber includes:

- Airport
- Regional council office
- State school (years pre-prep to year 7)
- Health centre with permanent nurse
- IBIS grocery stores
- SES shed
- Water plant reservoirs/filtration collection wells
- Power station
- Sewerage treatment plant
- Barge ramp
- Pier (small craft and passengers only)
- Accommodation facilities at resort
- Guest house facilities (electricity, water, waste).



Risk

The Warraber community is presently considered low risk for erosion and tidal inundation, in part due to the existing seawall offering protection. However, the community is presently at high risk from storm tide inundation with that risk expected to increase within the medium to long term planning horizons for this strategy.

Any approved upgrades to coastal protection structures will mitigate risk and therefore these classifications should be revisited following their construction.




Coastal hazards risk profile for Warraber from present day to 2100

Warraber Risk Profile	Present Day	2050	2100
Open coast erosion	Low	Medium	Medium
Tidal inundation	Low	Medium	Very high
Storm tide inundation	High	Very high	Very high

Adaptation response

A strategic adaptation response has been developed for Warraber to guide decision making over multiple planning horizons from present day to 2100. Based on the risk assessment and risk profiles for each hazard across the planning horizons, the present day adaptation response for Warraber is to actively manage identified risks, through a range of initiatives including education, nature based and structural engineering solutions. By 2050, the coastal hazard risk profile for Warraber will become too high and some active management options will no longer be feasible (due to economic or other factors), triggering a change into a 'transition' adaptation approach. At this time a broad range of adaptation options exist including engineering options, transition of current land use and relocating current assets to lower risk areas. A strategic decision will need to be made in consultation with the local community and consider the values of the Warraber area. The 'transition' adaptation pathway approach will continue to be implemented in 2100.

Adaptation response profile for Warraber

Present day	2050	2100
<p>Actively manage</p> 	<p>Transition and change</p> 	<p>Transition and change</p> 

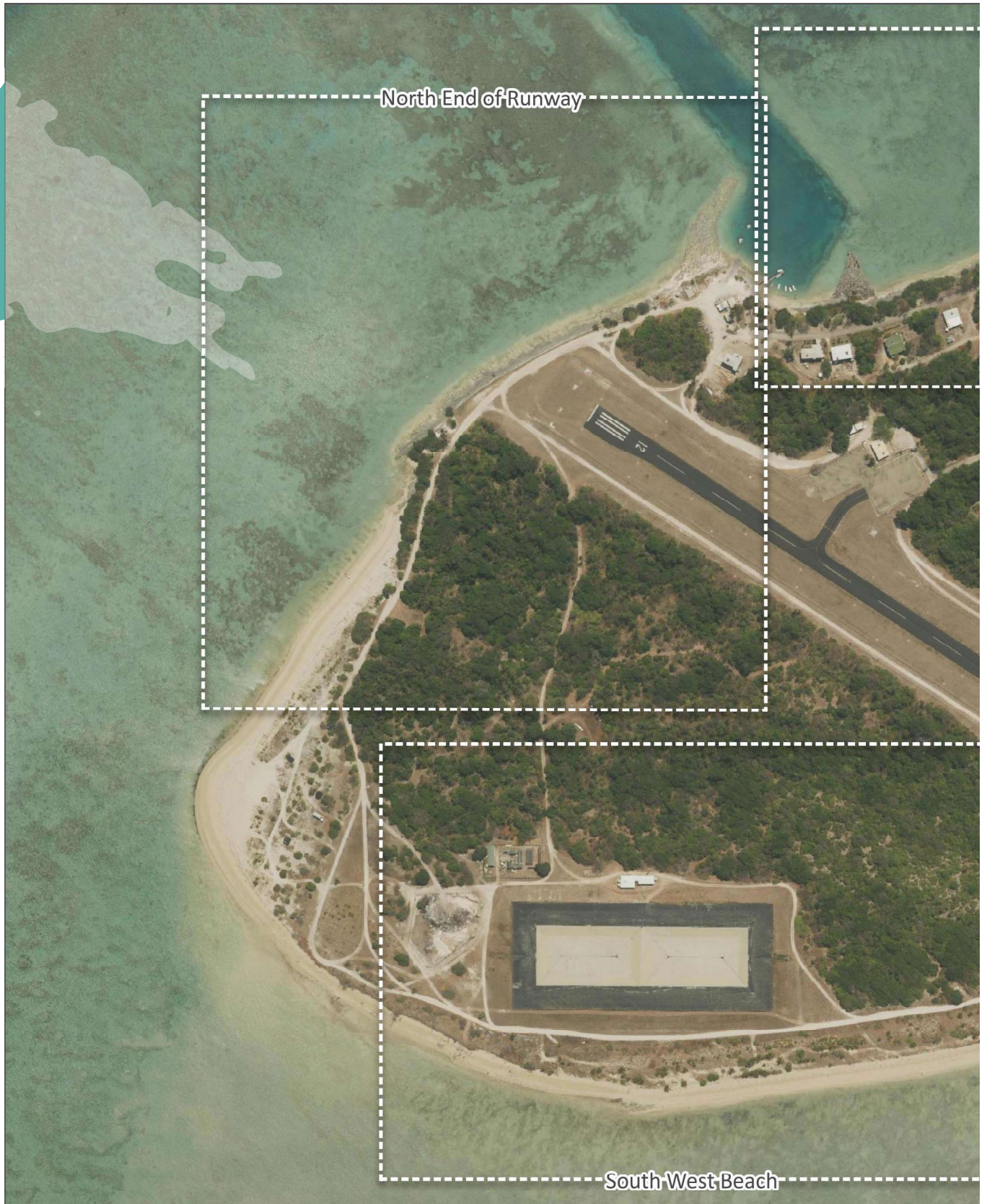
Adaptation pathways and priority actions

Key Management Areas (KMAs) have been defined based on which areas are most at risk, as well as feedback from community leaders and are mapped below. Tailored adaptation pathways for each key management area on Warraber are presented in the following pages.

Building on the outcomes of the risk assessment, adaptation response, and input from community leaders, specific priority adaptation actions have been developed to protect and enhance assets and coastal values in the Warraber community, as well as enhance community stewardship and improve decision-making. These actions are designed to progress the community along its adaptation pathways.



6. Coastal hazard adaptation actions





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EASTERN SHORELINE

Overview of assets and values at risk

- Previous studies have indicated that the eastern end of the island appears to be accreting, which had been assessed further in a long-term assessment. Young growth on the dunes suggests that the currently occurring accretion is relatively new.

Pathway description

For the eastern shoreline area of Warraber, the initial adaptation pathway involves avoiding and monitoring coastal hazards through dune management. As the community reaches trigger points, they must decide to protect or relocate assets. Bunds and levees and ground raising and drainage measures can prevent inundation, A new seawall or revetment may be constructed to protect exposed assets. As time progresses, the community should lead ongoing custodianship and monitoring with the option to revisit the option of relocating or redesigning assets. In the meantime, the community should avoid new development in hazard-prone areas



Warraber – Eastern Shoreline

		Present Day	2050	2100
— Prepare	Ongoing monitoring and review			
→ Implement	Trigger for an additional action			
⋮ Transition	Start implementing			
	Pause and review adaption actions			
	Abandon existing action and seek alternative pathway			
		Actively manage	Transition and change	Transition and change
Key management area adaptation actions and pathway				
Nature based coastal management	Dune management			
Coastal engineering	Bund, levee, ground raising and drainage			
	New seawall or revetment			
Transition	Relocate assets			
	Redesign for resilience			



NORTHERN SEAWALL

Overview of assets and values at risk

- The township is protected by a seawall extending from the barge ramp facility for approximately 270 metres. It then deteriorates into a rock wall built on unknown material for a further 175 metres. At the end of the rock wall informal attempts at erosion control have been made with tyres east of this point.
- There is funding approved for an upgrade to the seawall, however design is yet to commence.



Pathway description

For Warraber’s northern seawall area, initial actions involve maintaining and filling gaps in the existing seawall or revetments. Decisions will be made at each trigger point to determine the best course of action, which may involve upgrading the structure or developing a more detailed action plan for transitioning to a new land use. As time progresses, the community should lead ongoing custodianship and monitoring with the option to revisit the option of relocating or redesigning assets while avoiding new development in hazard-prone areas.

Warraber – Northern Seawall				Present Day	2050	2100
— Prepare	Ongoing monitoring and review	Pause and review adaption actions		Actively manage	Transition and change	Transition and change
→ Implement	Trigger for an additional action	Abandon existing action and seek alternative pathway				
⋮ Transition	Start implementing					
Key management area adaptation actions and pathway						
Nature based coastal management	Dune management					
	Coastal engineering	Maintain existing seawall				
Upgrade seawall						
Transition	Relocate assets					
	Redesign for resilience					



6. Coastal hazard adaptation actions

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SOUTH WEST BEACH

Overview of assets and values at risk

- The southwest shoreline is experiencing different wave conditions to other areas of the island, which is driving erosion of the southern coast and depositing the sand onto the western spit.
- Charts of the waters around the island show a large spit extending away from the reef flat to the west as well as the visible bank.



Pathway description

In the South West Beach area of Warraber, initial actions involve dune management, especially in the areas in front of the critical water reservoir and infrastructure. As the community reaches trigger points, bunds can be built to protect the assets from inundation and a new seawalls or revetments can be constructed to prevent erosion. As time progresses, the community should lead ongoing custodianship and monitoring with the option to revisit the option of relocating or redesigning assets.

Warraber – South West Beach				Present Day	2050	2100
— Prepare	Ongoing monitoring and review	Pause and review adaption actions		Actively manage	Transition and change	Transition and change
→ Implement	Trigger for an additional action	Abandon existing action and seek alternative pathway				
⋮ Transition	Start implementing					
Key management area adaptation actions and pathway						
Nature based coastal management		Dune management				
	Coastal engineering		Bund, levee, ground raising and drainage			
Transition			New seawall or revetment			
	Transition		Relocate assets			
Transition			Redesign for resilience			



NORTH END OF RUNWAY

Overview of assets and values at risk

- The known and planned protection works for Warraber are listed below:
 - Seawall along northern beach, extending west and east from barge landing
 - Rock groynes associated with landing
 - Rock wall in poor condition, extending from eastern seawall
 - Informal controls i.e. tyres,
- Planned upgrade to seawall has approved funding.



Pathway description

In the north end of runway area of Warraber, initial actions include maintaining existing coastal protection structures as well as dune management at the adjacent dunes to the west. As trigger points are reached, the community may adapt by constructing a new seawall extension to protect the road that provides access to the water reservoir and upgrading the existing seawalls. Decisions will be made at each trigger point to determine the best course of action, which may involve developing a more detailed action plan or relocating the road. Throughout the process, ongoing custodianship and monitoring should be maintained, avoiding new development in hazard-prone areas.

Warraber – North End of Runway				Present Day	2050	2100
— Prepare	Ongoing monitoring and review	Pause and review adaption actions		Actively manage	Transition and change	Transition and change
→ Implement	Trigger for an additional action	Abandon existing action and seek alternative pathway				
⋮ Transition	Start implementing					
Key management area adaptation actions and pathway						
Nature based coastal management	Dune management					
Coastal engineering	Upgrade and maintain existing seawall					
	New seawall or revetment					
Transition	Relocate assets					
	Redesign for resilience					



6. Coastal hazard adaptation actions

Warraber Community Action Plan		Indicative cost
1. Council-wide initiatives to enhance custodianship (Priority actions to be implemented within 10 years, and ongoing)		
1.1. Community stewardship		
Warraber1.1a	See Council wide actions. Consider how these actions can be effectively used in Warraber.	
1.2. Education and knowledge sharing		
Warraber1.2a	See Council wide actions. Consider how these actions can be effectively used in Warraber.	
1.3. Monitoring		
Warraber1.3a	See Council wide actions. Consider how these actions can be effectively used in Warraber.	
2. Planning updates (Priority actions to be implemented within 10 years, and ongoing)		
2.1. Land use planning		
Warraber2.1a	See Council wide actions. Consider how these actions can be effectively used in Warraber.	
Warraber2.1b	Develop a "Priority Asset Relocation and Redesign Strategy" involving significant community consultation and input. This should identify potential new settlement zone on Poruma where a staged relocation of assets can occur. This plan should explore the opportunity for a "Floating Community", or an "Above Water Community".	\$\$
2.2. Disaster planning		
Warraber2.2a	See Council wide actions. Consider how these actions can be effectively used in Warraber.	



Warraber Community Action Plan		Indicative cost
3. Resilient built environment (Priority actions to be implemented within 10 years, and ongoing)		
3.1. Maintaining and improving infrastructure		
Warraber3.1a	See Council wide actions. Consider how these actions can be effectively used in Warraber.	
Warraber3.1b	Consider relocation or redesign for resilience of buildings (in line with the Resilient Housing and Development Guidelines and Designs from action C3.1c) exposed to hazards in all KMAs.	\$\$
4. Nature based coastal management (see adaptation pathways for timing)		
4.1 Dune, mangrove and reef protection and enhancement		
Warraber4.1a	Identify degraded dunes in all Key Management Areas. Protect and enhance them using local knowledge and Zaget Torateti, including the use of native dune plants, and other stabilising vegetation. Manage access for an appropriate time period to allow vegetation to establish.	\$
4.2 Living shorelines		
Warraber4.2a	Explore feasibility of an artificial reef to enhance fringing reef resilience, bolstering natural sediment supply and dissipating wave energy.	\$\$
4.3 Beach nourishment		
Warraber4.3a	Monitor beach profiles around the island and consider sand backpassing in the Eastern Shoreline KMA or beach nourishment to enhance degraded dunes in front of key assets. Supplement with dune restoration and access management, see action Warraber4.1a	\$\$
5. Coastal engineering (see adaptation pathways for timing)		
5.3 Last line of defence structures		
Warraber5.3a	Continue to monitor and maintain existing coastal protection structures and develop plan to upgrade where needed.	\$\$
Warraber5.3a	As part of the adaptation pathway in the North End of Runway and South West Beach KMAs, consider the construction of a coastal protection structure to protect the water reservoir and its access road. This action should not occur before Warraber3.1b, Warraber4.1a and Warraber4.3a are considered.	\$\$\$
5.4 Structures to minimise flooding		
Warraber5.4a	Consider construction of a bund around the south east of the island.	\$\$\$



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Adaptation theme	Adaptation option	Action ID	2023 Priority strategic actions (completed within 5 – 10 years)	Indicative cost	Timing	Priority
1. Council-wide initiatives to enhance custodianship	1.1. Community stewardship	C1.1a	Establish a coastal resilience officer position within Council who will have responsibility over implementing the Zenadth Kes CHAS. This position will support Council's Climate Change Adaptation and Environment Committee and work closely with communities, across council and with other state and commonwealth agencies, streamlining and facilitating collaboration and effective implementation of adaptation actions.	\$\$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.1. Community stewardship	C1.1b	Seek co-funding/resources for further initiatives through grants and stakeholder partnerships.	\$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.1. Community stewardship	C1.1d	Promote coastal custodianship in the youth and future generations with community coast care events. These should weave in cultural knowledge and the idea of Zagat Torateti. They can also include art, communication, and science programs focused on coastal resilience.	\$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.1. Community stewardship	C1.1e	Establish and implement a dune and foreshore protection and maintenance program incorporating Zagat Torateti, access management, and community education. Support local communities in implementing this program.	\$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.1. Community stewardship	C1.1f	Develop a dune and wetland vegetation seed bank for vegetation restoration efforts, involving Traditional Owners, Indigenous Land and Sea Rangers and schools.	\$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.2. Education and knowledge sharing	C1.2a	Develop a Zenadth Kes CHAS - Communication and Engagement Strategy. This will support Council in working with communities to raise awareness of and implement their Community Adaptation Plans. This will use creative and innovative communication channels, leveraging emerging community leaders and content creators. It will outline the appropriate level and protocols of engagement and consultation needed for a range of adaptation actions. Ideally, this communication and engagement strategy should not stand alone but be integrated with Council's existing engagement policies and practices so that its relevance for all current and future development and supporting community resilience is continuously acknowledged.	\$	Ongoing	High

Adaptation theme	Adaptation option	Action ID	2023 Priority strategic actions (completed within 5 – 10 years)	Indicative cost	Timing	Priority
1. Council-wide initiatives to enhance custodianship	1.2. Education and knowledge sharing	C1.2b	Develop locally and culturally appropriate educational materials about coastal processes, climate change, monitoring and adaptation with a focus on nature based management and innovative and island-appropriate design and development. Integrate these materials into the implementation of the Zenadth Kes CHAS - Communication and Engagement Strategy (action C1.2a).	\$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.2. Education and knowledge sharing	C1.2c	Work with organisations like the TSRA, CSIRO, Universities, Non-Profits, and the Torres Strait Climate Centre of Excellence to support further research and innovation into coastal hazard and climate change adaptation.	\$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.2. Education and knowledge sharing	C1.2d	Continue to advance partnerships and collaboration with Traditional Owners to further consider needs and aspirations for Aboriginal and Torres Strait Islander People in coastal hazard adaptation.	\$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.2. Education and knowledge sharing	C1.2e	Promote cross-sector partnerships and initiatives to enhance resilience and strategic adaptation for transport infrastructure, including boating infrastructure.	\$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.3. Monitoring	C1.3a	Develop a tailored integrated monitoring and reporting program to inform future adaptation. Incorporates actions C1.3b-h.	\$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.3. Monitoring	C1.3b	Undertake drone survey (elevation and aerial imagery) monitoring of beaches.	\$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.3. Monitoring	C1.3c	Undertake underwater coral reef surveys to map the extent and condition. Explore the use of photogrammetry to create detailed 3D models of reefs.	\$\$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.3. Monitoring	C1.3d	Establish a network of water level gauges throughout the TSIRC regions. Train community members to operate and maintain them.	\$\$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.3. Monitoring	C1.3e	Undertake regular coastal protection structure condition assessments.	\$	Ongoing	High

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Adaptation theme	Adaptation option	Action ID	2023 Priority strategic actions (completed within 5 – 10 years)	Indicative cost	Timing	Priority
1. Council-wide initiatives to enhance custodianship	1.3. Monitoring	C1.3f	Establish a monitoring program for sites of cultural significance that measures indicators such as spiritual/social value, archaeological value, physical condition, and protection of sites.	\$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.3. Monitoring	C1.3g	Establish a system of Citizen Science photo monitoring points (CoastSnap, Fluker Post or similar) at beaches in the area.	\$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.3. Monitoring	C1.3h	Create a platform/process with Council for monitoring data storage and management	\$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.3. Monitoring	C1.3i	Undertake detailed sediment supply and transport studies for coral cay islands and lagoons.	\$\$	Within 5 years	Medium
1. Council-wide initiatives to enhance custodianship	1.3. Monitoring	C1.3j	Review and further examine the sediment dynamics around TSIRC communities and the shoreline including: <ul style="list-style-type: none"> · Geomorphic assessment · Hydrodynamic modelling · Shoreline Erosion Management Plan. Linked to C1.3i	\$	Ongoing	High
2. Planning updates	2.1. Land use planning	C2.1a	Submit updated Erosion Prone Area layers to State Government for formal update to the existing State-wide mapping.	\$	Immediate	High
2. Planning updates	2.1. Land use planning	C2.1b	Use the updated Erosion Prone Area and storm tide mapping and outcomes of the Zenadth Kes CHAS in current and future Planning Scheme and Master Plan updates to inform decisions on development areas and strategic land use planning.	\$	Ongoing	High
2. Planning updates	2.1. Land use planning	C2.1c	Consider implications (within Council) of the Strategy for future development approvals and conditions, including: <ul style="list-style-type: none"> · Approval conditions for lots of undeveloped land, and · Implications for future development approvals and conditions. 	\$	Ongoing	High
2. Planning updates	2.2. Disaster management	C2.2a	Use the updated Erosion Prone Area and storm tide mapping, risk assessment and economic implications to update the TSIRC Local Disaster Management Plan. Ensure local community input is used to inform the updated plan.	\$	Within 5 years	Medium
2. Planning updates	2.2. Disaster management	C2.2b	Review the long-term adequacy of evacuation and shelter facilities and evacuation routes, including evacuation by land and sea.	\$	Ongoing	High

Adaptation theme	Adaptation option	Action ID	2023 Priority strategic actions (completed within 5 – 10 years)	Indicative cost	Timing	Priority
3. Resilient built infrastructure	3.1. Increasing infrastructure resilience	C3.1a	Review at-risk infrastructure (from CHAS data outputs) and embed risks into current asset management plans/Master Plan (this could include 'betterment' at critical asset refurbishment/renewals points).	\$	Ongoing	High
3. Resilient built infrastructure	3.1. Increasing infrastructure resilience	C3.1b	Review access road renewals and upgrades (prioritisation), and upgrade design requirements and timing of upgrades.	\$	Ongoing	High
3. Resilient built infrastructure	3.1. Increasing infrastructure resilience	C3.1c	Produce "Resilient Housing and Development Guidelines and Designs" tailored to the Torres Strait Islands. This should cater to all island types. Community knowledge holders, elders and leaders should be heavily consulted for this process.	\$\$	Ongoing	High
3. Resilient built infrastructure	3.1. Increasing infrastructure resilience	C3.1d	Consult with utility providers on future services and upgrades, and implications of coastal hazard areas.	\$	Ongoing	High
3. Resilient built infrastructure	3.1. Increasing infrastructure resilience	C3.1e	Audit stormwater assets in areas subject to erosion and inundation, and develop plan to upgrade in line with refurbishment/renewals points.	\$\$	Ongoing	High
3. Resilient built infrastructure	3.2. Relocate infrastructure	C3.2a	Develop "Priority Asset Relocation and Redesign Guidelines" to assist communities in developing island specific relocation strategies. Community knowledge holders, Elders, other leaders and young people should be heavily consulted for this process. Factors to consider include: Approvals Native Title Hazards Master Plan Town Planning	\$	Immediate	High

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4. Nature-based coastal management	4.1. Dune, mangrove and reef protection and enhancement	C4.1a	Support local communities in re-establishing, rehabilitating, or protecting coastal dunes	\$	Ongoing	High
4. Nature-based coastal management	4.1. Dune, mangrove and reef protection and enhancement	C4.1b	Support local communities in re-establishing, rehabilitating, or protecting mangroves	\$	Ongoing	High
4. Nature-based coastal management	4.1. Dune, mangrove and reef protection and enhancement	C4.1c	Support local communities in re-establishing, rehabilitating, or protecting coral reefs	\$	Ongoing	High
4. Nature-based coastal management	4.1. Dune, mangrove and reef protection and enhancement	C4.1d	Scope the feasibility and priority locations for natural reef enhancement activities, requiring comprehensive knowledge of the latest scientific findings and methodologies to ensure effective implementation and multiple benefit outcomes.	\$\$	Within 5 years	Medium
4. Nature-based coastal management	4.2. Living shorelines	C4.2a	Develop a detailed "Living Shorelines Design and Implementation Plan" to prioritise and support the communities where a living shoreline has been determined as a feasible option.	\$\$	Within 5 years	Medium
4. Nature-based coastal management	4.2. Living shorelines	C4.2b	Develop a detailed "Artificial Reef Design and Implementation Plan" to prioritise and support the communities where an artificial reef has been determined as a feasible option.	\$\$	Within 5 years	Medium
4. Nature-based coastal management	4.3. Beach nourishment	C4.3a	Develop a detailed "Beach Nourishment Design and Implementation Plan" to prioritise and support the communities where beach nourishment or sand management has been determined as a feasible option.	\$\$	Within 5 years	Medium

Adaptation theme	Adaptation option	Action ID	2023 Priority strategic actions (completed within 5 – 10 years)	Indicative cost	Timing	Priority
5. Coastal engineering	5.1. Structures to reduce coastal hazards	C5.1a	Continue to implement the Seawall Project.	\$\$\$	Ongoing	High
5. Coastal engineering	5.1. Structures to reduce coastal hazards	C5.1b	Continue to monitor and maintain existing coastal and flood protection structures.	\$\$\$	Ongoing	High
5. Coastal engineering	5.1. Structures to reduce coastal hazards	C5.1c	Audit coastal and flood protection assets, and develop plan to upgrade where needed.	\$	Ongoing	High

