

DRAFT COASTAL ADAPTATION STRATEGY

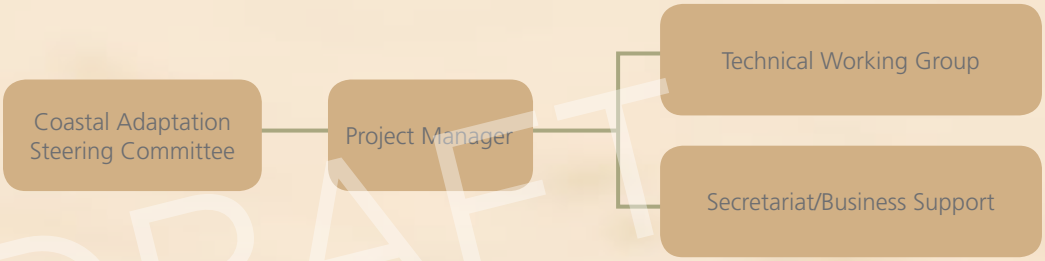
Redland CITY COUNCIL

Phase 1 – Current Hazards

Document Control

Project Governance

The development of the Coastal Adaptation Strategy is overseen by the establishment of a steering committee. The steering committee is responsible for guiding the project through the Project Manager/Technical Working Group.



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Title – Redland City Council Coastal Adaptation Strategy

Author – Tim Mitchell

Synopsis

The Redland City Council Coastal Adaptation Strategy is a robust strategic plan that addresses coastal hazards by recommending management actions that promote the long-term sustainability of the Redlands foreshore and coastal precinct.

Acknowledgements

Coastal Adaptation Steering Committee

Chair – Mayor Karen Williams

Membership – Department of Environment and Heritage Protection, Department of National Parks, Department of Fisheries, Department of Infrastructure, Local Government and Planning, Healthy Waterways and Catchments and Engineers Australia

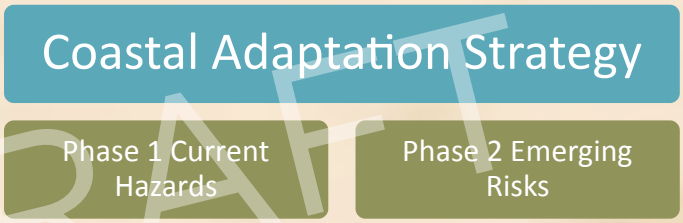
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Executive Summary

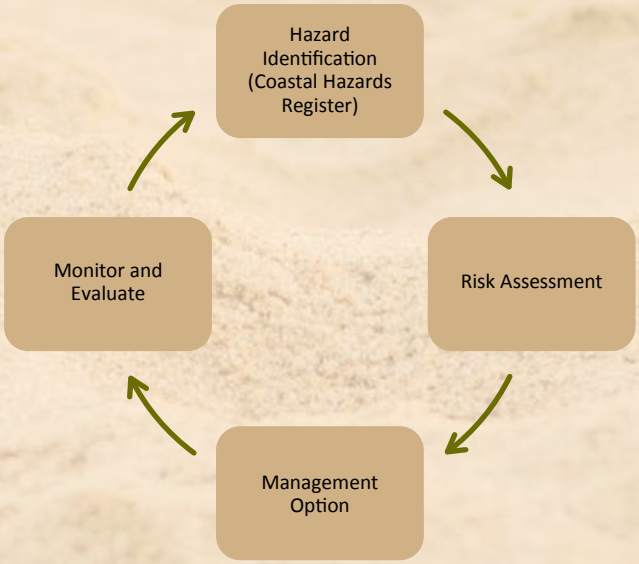
The Redland City Council Coastal Adaptation Strategy promotes the sustainable management of Redlands coastal and foreshore areas by addressing the current and future coastal hazards. To ensure the Coastal Adaptation Strategy is a robust strategic plan, it has been separated into two (2) phases. The first phase has been completed and reviews the current hazards and recommends measures to address these hazards. The next phase will address the future risks posed by coastal hazards.



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Phase 1 – Current Hazards provides a consistent and transparent approach to assessing the risk of identified hazards and recommending the most appropriate management options. The key feature of Phase 1 is the assessment and implementation framework, which outlines the process for managing identified hazard locations. This framework recognises that the foreshore is a dynamic environment and it is essential for sustainable management of the coastline that regular monitoring, assessment of hazard areas and evaluation of management options is undertaken.

The assessment framework has been created to function as a 'live' document and therefore has flexibility and adaptability, which are two essential components for effective coastal planning and management.



Phase 1 – Assessment Framework



Coastal Values

Moreton Bay is an internationally recognised wetland under the Ramsar Convention and is one of the largest estuarine bays in Australia. Wetlands provide numerous benefits in supporting habitat, species diversity and movability through the landscape. The Redlands portion of the Bay is a diverse ecosystem consisting of sandy beaches, rocky shores, coral reefs, sea grass, mangrove forests, mudflats and sandbanks.

The Redlands community has a strong connection with the islands, foreshore and waters of Moreton Bay. The settlement pattern and utilisation of the foreshore demonstrates the high value the community places on the coast. Moreton Bay Marine Park is the most visited park by domestic tourists in Queensland with 12.4 million annual visits[1].

The Moreton Bay region is the most important commercial fishery in the state and recreational fishing is also one of the most popular leisure activities in the region, providing economic and social benefits. The commercial fishery of Moreton Bay contributes approximately $24 million to the South East Queensland economy per annum from fish production sold domestically. Furthermore, it is estimated that recreational fishing contributes approximately $194.2 million annually, with 98% of this activity occurring in coastal local government areas[2].

Coastal Hazards addressed in Phase 1 of the Coastal Adaptation Strategy

Phase 1 of the Coastal Adaptation Strategy specifically addresses the areas in the city that affected by shoreline erosion.

Shoreline erosion (coastal erosion)

Shoreline erosion is the wearing away of land or the loss of sediment by wave or wind action, tidal current, wave currents and drainage, resulting in a permanent loss of land. Coastal erosion can be separated into the broad categories of short-term and long-term erosion. Short-term erosion can be defined as the natural fluctuations of a beach, while long-term erosion is the continuous change in the coastal morphology and loss of foreshore.

Hazard Identification & Assessment

Hazard locations are generally identified through the following methods:

- Visual identification by a Council officer;
- Local community notifies Council of an erosion problem;
- Declared Erosion Prone Area, in accordance with state legislation; or
- Previously known erosion hot spot being monitored.

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1 SEQC (2016) Managing Natural Assets for a Prosperous South East Queensland, South East Queensland Catchments Ltd., Brisbane

2 Growcom, Queensland Conservation Council and SEQ Catchments, (2013). Moreton Bay Priority Catchment Sediment Reduction Scheme – Return on Investment Analysis, Brisbane: Australia

Once a hazard location has been identified, it is placed on the Coastal Hazards Register, which has been established as a live database, and each hazard then undergoes the hazard assessment process. The locations that are known to be impacted by erosion are defined as "Current hazards" and there are presently forty-four (44) hazard sites identified across Redland City, highlighted below.

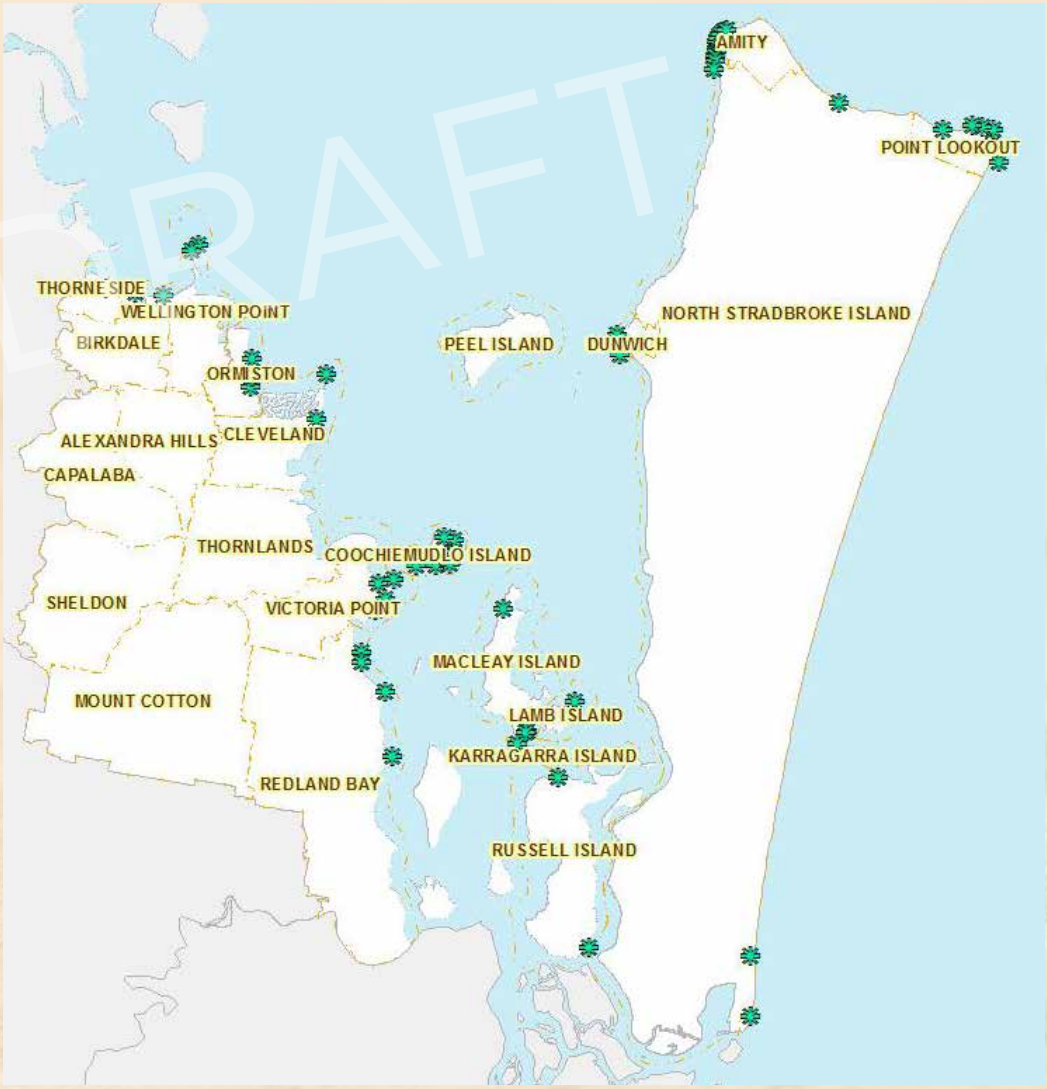


Figure: Identified Current Hazards across Redland City



Risk Rating	Location
High	Amity Point, North Stradbroke Island; Bay Street, Redland Bay; Polka Point, Dunwich.
Medium	Cleveland Point, Cleveland; Thompsons Beach, Victoria Point; North Boat Ramp, Victoria Point; Junner Street, Dunwich; Red Cliff & Golf Links Beach, Coochiemudlo Island; Main Beach, Coochiemudlo Island; Norfolk Beach, Coochiemudlo Island; Queens Esplanade, Thorneside; Bay St, Redland Bay; Esplanade, Karragarra Island; Brighton Road, Macleay Island; GJ Walter Park, Cleveland; Wilson Esplanade, Victoria Point; Aquatic Paradise Park, Birkdale; 3 Paddocks Park, Birkdale; Flinders Beach, North Stradbroke Island; Point Lookout, North Stradbroke Island; Champion Lane, Wellington Point; Main Road (Recreational Reserve), Wellington Point.
Low	Russell Terrace, Macleay Island; The Boulevard, Russell Island; Melaleuca Beach, Coochiemudlo Island; Morwong Beach, Coochiemudlo Island; Southeast Beach, Coochiemudlo Island; Northeast Beach, Coochiemudlo Island; Weinam Creek Ferry Terminal, Redland Bay; Torquay Road, Redland Bay; North Street, Redland Bay; Pelican Street, Victoria Point; Eighteen Mile Swamp, North Stradbroke Island; Jumpinpin, southern North Stradbroke Island; Jock Kennedy Park, Russell Island; Coondooroopa Drive, Macleay Island; Como Street, Ormiston; Sleath Street, Ormiston; Sweetgum Drive, Lamb Island; Empire Vista, Ormiston

A risk assessment has been developed to objectively assess a wide range of hazards and prioritise them according to the level of consequence. The risk assessment conforms to triple bottom-line principles (environment, social and economic) to assess and rate each hazard in a holistic and objective manner. The assessment process provides two key outcomes; first, a preliminary assessment is completed to determine whether an identified hazard area can be addressed through 'business as usual' processes; and, if required, the second stage is a detailed assessment to determine the level of risk posed by the identified hazard.

Summary of Risk Levels at Identified Hazard Locations

The outcome of the risk assessment for each of the identified hazards shown is summarized in the below table. In total three, (3) sites were assessed as having a high risk rating. Twenty-three (23) have a medium rating and eighteen (18) locations have a low risk rating based on the current rate of erosion.

Coastal Management Options

Taking into consideration the coastal hazards addressed in Phase 1 of the Coastal Adaptation Strategy, the coastal management options that are available are broadly defined as:

Foreshore Protection (Defend)

Protect portions of the coastal hazard area with either hard or assimilating coastal engineering structures to reduce or remove storm-tide inundation or erosion risks. Coastal defence may combine long-term strategies for defence and maintenance, including regenerative and structural options such as beach nourishment, revegetation, dune construction, dykes, sea walls, groynes and storm-tide barriers.

Monitor and Evaluate

In addition to the five types of management options outlined above, an additional option that is core to sustainable management of the foreshore is 'Monitor and Review'. Monitoring and reviewing of coastal hazards will ensure that the most effective management and adaptation options are identified and implemented, and also ensures the Coastal Adaptation Strategy is a responsive and adaptive strategic plan.

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The methods for available for Monitor and Review of hazard locations are:

Annual Inspection Program: When an identified coastal hazard has been assessed and does not pose a level of risk to justify implementing a management option, the proposed method will be to include the hazard area on a regular inspection program. It is anticipated that hazard areas will be reviewed and reassessed annually with an option to increase the number of inspections on an as-needed basis.

Surveys: The completion of surveys will generally be recommended on areas where it is necessary to understand the long-term movement of the foreshore area, such as open beaches which have been subject to consistent beach erosion. This option can also be used for bathymetric surveys to record the movement of sediment and water depth.

Desktop Monitoring: There are areas of the coastline that are remote and not easily accessible to undertake a visual inspection or survey. In these instances, it is recommended that a feasible alternative to on-site methods is to rely upon aerial photography, through desktop monitoring, to monitor the hazard location.

The management options that have been recommended for each identified hazard have been determined via a multi-criteria analysis. This method was undertaken to ensure there was a transparent decision-making process and will be used for future planning and programming of Capital and Operational Works programs.

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Recommended Management Options

Location	Management option(s)	Priority
Amity Point, North Stradbroke Island	Shoreline Erosion Management Plan	Very High
Norfolk Beach, Main Beach, Southeast Beach, Northeast Beach, Coochiemudlo Island	Monitor & Evaluate (Monitor – annual survey)	Ongoing
Melaleuca Beach, Coochiemudlo Island	Foreshore protection	Low
Morwong Beach, Coochiemudlo Island	Upgrade of road and stormwater infrastructure to mitigate the impact on the foreshore and beach	Low
	Maintain Status Quo (Monitor – annual inspection)	Ongoing
Red Cliff & Golf Links Beach, Coochiemudlo Island	Further detailed planning (geotechnical investigation)	Medium
	Monitor & Evaluate (annual inspection)	On going
Coochiemudlo Island	Further detailed planning (Shoreline Erosion Management Plan[3])	Medium
Jumpinpin, Eighteen Mile Swamp, Point Lookout	Monitor & Evaluate (desktop monitoring)	Ongoing
Cylinder Beach, South Gorge, Frenchmans Beach, Deadmans Beach, Home Beach and Flinders Beach, North Stradbroke Island	Monitor & Evaluate (annual inspection)	Ongoing
Junner Street, Dunwich	Foreshore protection	Medium
Polka Point, Dunwich	Further detailed planning	High

3 In 2014, a Shoreline Erosion Study was undertaken for Coochiemudlo which focussed primarily on the eastern beaches with a supplementary extension to the study area to include the northern and southern beaches.



Location	Management option(s)	Priority
Queens Esplanade, Thorneside	Foreshore protection	Medium
3 Paddocks Park, Birkdale	Monitor & Evaluate (annual inspection)	Ongoing
Aquatic Paradise Park, Birkdale	Foreshore protection	Medium
Main Road (Recreational Reserve), Wellington Point	Maintain sea wall	Medium
	Foreshore protection	
	Monitor & Evaluate (annual inspection)	Ongoing
Champion Lane – Wellington Point, Sleath Street – Ormiston, Como Street – Ormiston, Empire Vista – Ormiston, GJ Walter Park – Cleveland, North Boat Ramp – Victoria Point, Pelican Street – Victoria Point, Weinam Creek Ferry Terminal – Redland Bay, Torquay Road – Redland Bay	Monitor & Evaluate (annual inspection)	Ongoing
Cleveland Point, Cleveland	Maintain sea wall	Ongoing
	Monitor & Evaluate (annual inspection)	
Thompsons Beach, Victoria Point	Foreshore protection	Medium
Wilson Esplanade, Victoria Point	Foreshore protection	Medium
Bay Street, Redland Bay	Foreshore protection	Very High
North Street, Redland Bay	Extend sea wall	Low
Brighton Road, Macleay Island	Maintain sea wall	Ongoing
Coondooroopa Drive, Macleay Island	Foreshore protection	Low
Russell Terrace, Macleay Island	Monitor & Evaluate (annual inspection)	Ongoing
Jock Kennedy Park, Russell Island	Foreshore protection	Low
Esplanade, Karragarra Island	Foreshore protection	Medium
	Foreshore protection	
Sweetgum Drive, Lamb Island	Foreshore protection	Low

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Preamble

The Redland City Council Coastal Adaptation Strategy is a robust strategic document that outlines the sustainable management of the foreshore and coastal zone of Redlands. A key component of developing the Coastal Adaptation Strategy is ensuring there is a clear vision and that objectives are defined. The establishment of a clear vision and objectives will ensure the Coastal Adaptation Strategy recommends management options that are consistent with Council's policy direction and regulatory responsibilities.

Vision

The lifestyle, heritage and unique ecosystems that exist along the coast of the mainland and island communities is valued, protected and celebrated.

Objectives

The objectives of the Coastal Adaptation Strategy are:

Sustainable management of the foreshore through integrated planning and clear direction for the future.

The impact of coastal hazards are limited through sustainable land-use planning and the creation of resilient communities.

Foreshore and coastal areas are safe for the local community and visitors.

Relationship to the Corporate Plan

The Redland City Council Corporate Plan is a key strategic document that guides how a council prioritises and delivers services, programs and facilities to its community. The key outcomes reflected in the Corporate Plan that the Coastal Adaptation Strategy addresses are:

Embracing the bay – the benefits of the unique ecosystems, visual beauty, spiritual nourishment and coastal lifestyle provided by the islands, beaches, foreshores and water catchments of Moreton Bay will be valued, protected and celebrated.

Specific 2020 Outcomes that addressed:

3.3 *Our community is ready for and adapting to changing coastlines, storm tide and severe weather.*

3.4 *Redland City's residents and visitors can easily access the foreshore and use recreation infrastructure for boating and non-boating activities.*

Wise planning and design – we will carefully manage population pressures and use land sustainably while advocating and taking steps to determine the limits of growth and carrying capacity on a local and national basis, recognising environmental sensitivities and the distinctive character, heritage and atmosphere of local communities. A well-planned network of urban, rural and bushland areas and responsive infrastructure and transport systems will support strong, healthy communities.

Specific 2020 Outcomes that addressed:

5.4 *Regional collaboration and targeted advocacy drives external funding for key infrastructure upgrades and enhanced community outcomes (Steering Group is an example of this).*

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Redlands Snapshot

Redland City Council is made up of 537sq km of mainland and coastal communities located on Moreton Bay. In total, there are eight (8) mainland suburbs with a foreshore and six (6) populated islands within Moreton Bay. Over a period of five (5) years, from 2006-2011, the Redlands population grew approximately 8.6%[4] and the expected population growth will continue to at least 2041. Based on the projected growth, it is likely this will result in an increased demand for recreational and lifestyle opportunities along the coast and foreshore, further illustrating the importance of sustainable management actions.

Table – Redland City Population Projection

Suburb	2011	2016	2021	2026	2031	2036	2041
Alexandra Hills	17,416	17,608	18,095	18,452	18,429	18,385	18,277
Birkdale*	15,009	15,482	16,133	16,855	17,080	17,465	17,780
Capalaba	17,669	17,898	18,470	19,721	20,552	21,260	21,895
Cleveland*	15,129	15,952	17,386	18,734	19,752	20,104	20,398
Ormiston*	5,867	6,207	6,584	6,996	7,199	7,331	7,439
Redland Bay*	14,127	15,510	16,815	18,535	19,538	19,702	19,833
Redland Islands*#	9,012	9,752	10,345	11,236	12,049	12,644	13,149
Sheldon – Mount Cotton	6,760	7,930	8,741	8,925	8,936	8,872	8,794
Thorneside*	3,695	3,950	4,016	4,107	4,111	4,120	4,127
Thornlands*	13,379	14,789	16,873	19,155	20,661	21,774	22,762
Victoria Point*	15,404	16,463	17,317	18,346	19,103	19,763	20,337
Wellington Point*	11,469	12,121	12,646	13,283	13,513	13,574	13,621
Total	**144,936**	**153,662**	**163,421**	**174,346**	**180,924**	**184,992**	**188,413**

*Coastal suburb

#The population of the Redlands Islands includes North Stradbroke Island, Coochiemudlo Island, Macleay Island, Karragarra Island, Lamb Island and Russell Islands

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4 Australian Bureau of Statistics (ABS) 2011 Census



Coastal Values of Moreton Bay

Ecological value

Moreton Bay is an internationally recognised wetland under the Ramsar Convention and is one of the largest estuarine bays in Australia. Wetlands provide numerous benefits in supporting habitat, species diversity and movability through the landscape. The Redlands' portion of the Bay is a diverse ecosystem consisting of sandy beaches, rocky shores, coral reefs, sea grass, mangrove forests, mudflats and sandbanks.

Moreton Bay hosts thousands of migratory birds annually and is one of Australia's top 12 shorebird habitats.



Social value

The Redlands community has a strong connection to the islands, foreshore and waters of Moreton Bay. The settlement pattern and utilisation of the foreshore demonstrates the high value the community places on the coast. Moreton Bay Marine Park is the most visited park by domestic tourists in Queensland with 12.4 million annual visits[5].

Recreational fishing is one of the most socially important leisure activities in the SEQ region and Moreton Bay Marine Park hosts a substantial number of fishing competitions each year. In 2013, there were 36,059 registered vessels in Redlands[6], which illustrates the community's value and connection to the Bay.



Economic value

The Moreton Bay region is the most important commercial fishery in the state. Recreational fishing is also one of the most popular leisure activities in the region, providing economic and social benefits. The commercial fishery of Moreton Bay contributes approximately $24 million to the SEQ economy per annum, from fish production sold domestically. Furthermore it is estimated that recreational fishing contributes approximately $194.2 million annually, and 98% of this activity is occurring in coastal local government areas[7].



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5 SEQC (2016) Managing Natural Assets for a Prosperous South East Queensland, South East Queensland Catchments Ltd., Brisbane

6 Vessel registration as of 31 July 2016 – Queensland Department of Transport and Main Roads

7 Growcom, Queensland Conservation Council and SEQ Catchments (2013). Moreton Bay Priority Catchment Sediment Reduction Scheme – Return on Investment Analysis, Brisbane: Australia



Introduction

Redland City Council has approximately 220km of mainland and island coastline within its boundaries. The shoreline extends from Tingalpa Creek south to the Logan River on the mainland. Offshore, many of the Southern Moreton Bay Islands and North Stradbroke Island, including some 50km of ocean beach, are part of the city. The Coastal Adaptation Strategy is a city-wide strategy, encompassing the entire Redland City Council coastline and foreshore.

The purpose of the Coastal Adaptation Strategy is to outline a consistent policy platform to manage coastal hazards and inform future corporate strategies, policies and local planning instruments. The strategy will identify and assess the coastal hazards in Redland City and identify potential adaptation measures. The recommended management options will be practical responses to coastal hazards and detailed in an implementation plan that will identify cost estimates, timeframes and also highlight priority actions.

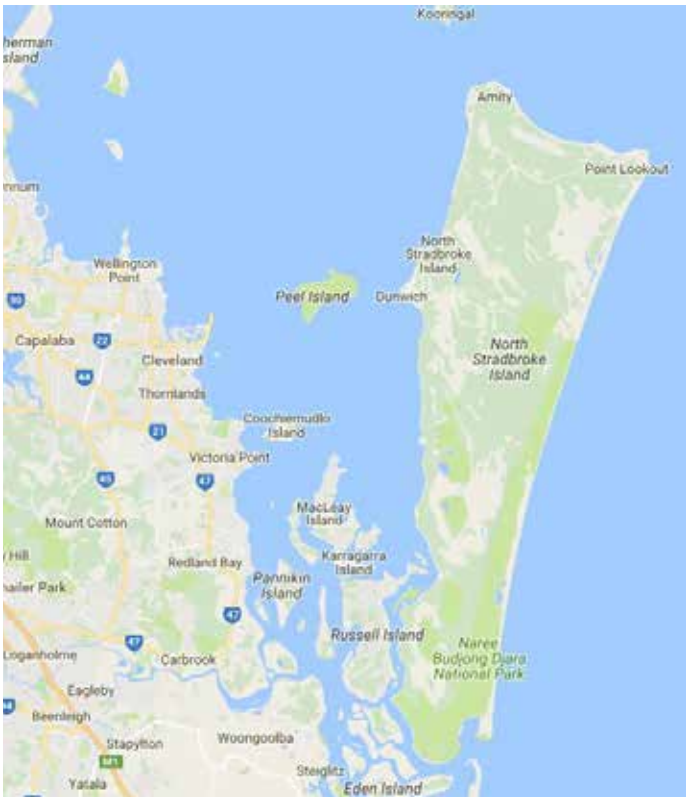


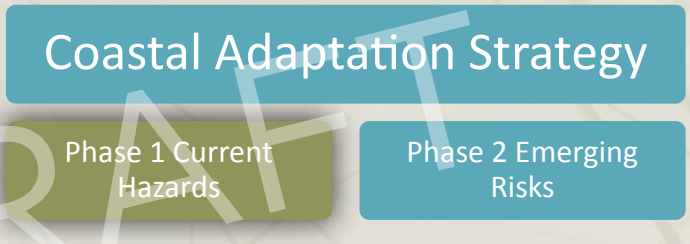
Figure: Redland City Local Government Area Coastline Extent (source: Nearmap 2016)



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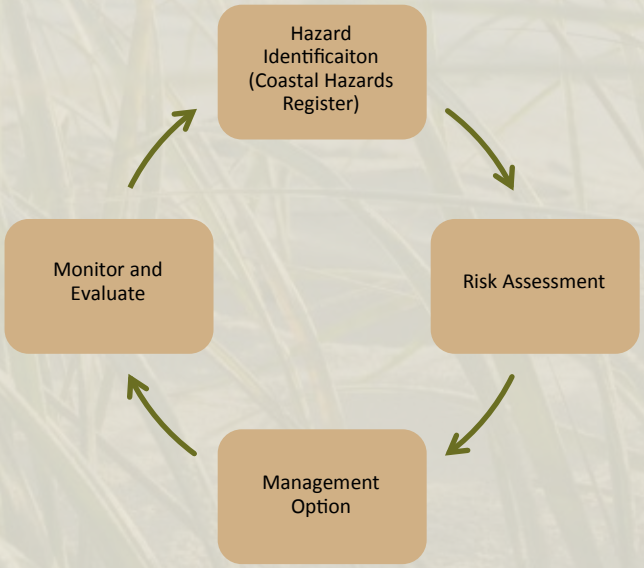


The Redlands foreshore is a dynamic environment which is constantly evolving and subject to the natural forces of wind, wave and tidal movement. These factors all contribute to shape the foreshore, impacting upon sediment movement and often resulting in loss of the foreshore through erosion and scarping. Phase 1 – Current Hazards of the Coastal Adaptation Strategy (CAS Phase 1) addresses areas within Redlands that are affected by shoreline erosion through short to medium-term management actions.



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The key feature of CAS Phase 1 is the establishment of the assessment framework that enables the consistent identification and assessment of areas experiencing erosion across the City. This framework enables a transparent and consistent decision-making process towards implementing appropriate actions to mitigate the level of risk posed by erosion. The assessment framework has been created to reflect the dynamic coastal environment by establishing a cyclical process to ensure the Coastal Adaptation Strategy is adaptive and flexible.



Phase 1 – Assessment Framework



The structure of Phase 1 has been developed to function as a 'live' document in the notion that the processes created at each stage of the project are able to be reviewed and amended regularly. This ensures that the management of coastal hazards in Phase 1 is flexible and adaptable, able to respond to the dynamic nature of the coastal environment.

The aim of Phase 1 is to implement a management plan that ensures the minimum level of risk is considered as 'tolerable'. The definition of a tolerable risk has been informed by the 'As Low As Reasonably Practicable Principle' (ALARP). For risks to be considered tolerable subject to ALARP, management options or actions need to be considered and, in this instance, long-term measures need to be identified and implemented to sufficiently manage or reduce the level of risk[8].

Broadly Acceptable – The risk is sufficiently low to require no new treatments or actions to reduce risk further. The community can freely inhabit the area without the need to implement management actions.

Tolerable – The level of risk is manageable and measures should be implemented to ensure the risk is not increased and becomes unacceptable to the community. The likelihood and consequence allows the exposure to continue but, at the same time, is high enough to require the implementation of new treatments or actions to reduce risk.

Intolerable – The level of risk is not acceptable to individuals or the community and requires specific measures and actions to reduce or eliminate risk levels. Where the level of vulnerability is deemed to be intolerable then it is recommended that further detailed planning be undertaken to determine what actions need to be implemented to reduce the vulnerability risk to an acceptable level.

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8 National Emergency Risk Assessment Guideline, 2010, p 39



What are Coastal Hazards?

Redlands has a diverse coastline ranging from sheltered bays and estuaries to open beaches which can be impacted by a range of coastal hazards. While phase 1 of the Coastal Adaptation Strategy will focus on shoreline erosion, it is important to note that the other coastal hazards are storm-tide inundation and sea level rise.

Shoreline erosion (coastal erosion)

Shoreline erosion is the wearing away of land or the loss of sediment by wave or wind action, tidal current, wave currents and drainage, resulting in a permanent loss of land. Coastal erosion can be separated into broad categories, being:

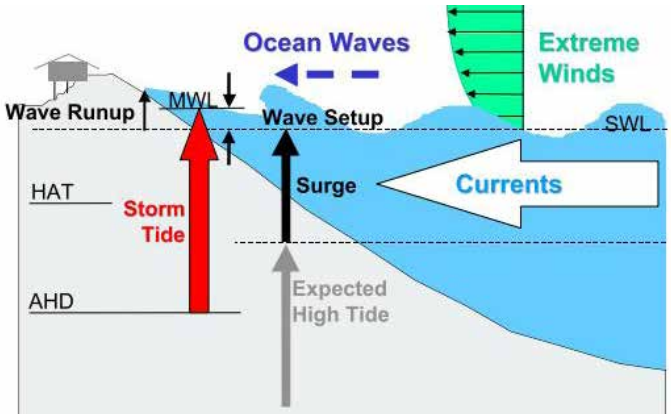
Short-term erosion

Short-term erosion is generally defined as the natural fluctuations of a beach. This type of erosion can occur in a short period of time (days) as a result of extreme weather events (e.g. tropical cyclones, east coast lows, severe storms).

Long-term erosion

Long-term erosion is the continuous loss of foreshore and is often caused by a reduction of sand or sediment being transported within a system. Long-term changes in coastal morphology are also related to geological processes, such as uplift or the reduction in land levels which can change sea levels and alter sediment transport patterns.

Storm-tide inundation



Source: Queensland Coastal Processes and Climate Change (Department of Environment and Resource Management, QLD, 2011)

Figure: Components of Storm Tide

Temporary rise in sea level also referred to as a storm surge, usually caused by strong onshore winds exerting stress on the sea surface, which causes water to accumulate against the coast.

A storm tide is the combination of a storm surge and the normal astronomical tide. A storm surge is the change in water level (increase or decrease) associated with a significant meteorological event (i.e. tropical cyclone).

Sea- level rise

Periodic or permanent tidal inundation of land due to a rise in mean sea level has the potential to exacerbate existing coastal erosion and storm-tide inundation issues.

Global temperature increase causes global sea-level rise because of thermal expansion of the oceans and the loss of land-based ice due to increased melting. There is scientific consensus that global temperatures are rising because of emissions of greenhouse gases, such as carbon dioxide and methane as a result of human activities. The Queensland Government has adopted a sea-level rise of 0.8 metres by the year 2100.

The projected sea-level rise of 0.8m by 2100 is based on the modeling and scenarios presented by the Fourth Assessment Report by the Intergovernmental Panel on Climate Change (IPCC) in 2007 and the subsequent report released in 2014 maintained this projection[9].

It is also important to note the relationships between a rise in the sea level and changes to hydrodynamic processes and siltation patterns of coast. Changes to siltation patterns and sediment movement ultimately impact the look and functionality of the coastline and foreshore. Changes in sediment movement can result in erosion or accretion occurring at different locations across the foreshore and significantly impact management strategies, costs and the sustainable use of these areas.

9 Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp

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Hazard Identification

Hazard locations are generally identified through the following methods:

- Visual identification by a Council officer;
- Local community notifies Council of an erosion problem;
- Declared Erosion Prone Area, in accordance with state legislation; or
- Previously known erosion hot spot being monitored.

An identified hazard location is recorded on the Coastal Hazards Register, developed as a live database, and will be subject to the assessment process in addition to an annual inspection program. The locations that are currently known to be impacted by erosion are defined as "Current hazards" and there are presently forty-four (44) hazard sites identified across Redland City, highlighted below (refer to Appendix 1 for set of maps).



Figure: Identified Current Hazards

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Table: Known Current Hazard Locations

#	Location	Suburb
1	Amity Point Township	North Stradbroke Island
2	Norfolk Beach	Coochiemudlo Island
3	Main Beach	Coochiemudlo Island
4	Southeast Beach	Coochiemudlo Island
5	Melaleuca Beach	Coochiemudlo Island
6	Northeast Beach	Coochiemudlo Island
7	Morwong Beach	Coochiemudlo Island
8	Red Cliff & Golf Links Beach	Coochiemudlo Island
9	Southern NSI – Jumpinpin	North Stradbroke Island
10	Eighteen Mile Swamp	North Stradbroke Island
11	Point Lookout – South Gorge	North Stradbroke Island
12	Point Lookout – Frenchmans Bay	North Stradbroke Island
13	Point Lookout – Deadmans Headland	North Stradbroke Island
14	Point Lookout – Deadmans Beach	North Stradbroke Island
15	Point Lookout – Cylinder Headland	North Stradbroke Island
16	Point Lookout – Home Beach	North Stradbroke Island
17	Flinders Beach	North Stradbroke Island
18	Junner Street	Dunwich
19	Polka Point	Dunwich
20	Queens Esplanade	Thorneside
21	3 Paddocks Park	Birkdale
22	Aquatic Paradise Park	Birkdale
23	Main Road (Recreational Reserve)	Wellington Point
24	Champion Lane	Wellington Point
25	Sleath Street	Ormiston
26	Como Street	Ormiston
27	Cleveland Point	Cleveland
28	GJ Walter Park	Cleveland
29	North Boat Ramp	Victoria Point
30	Thompsons Beach	Victoria Point
31	Pelican Street	Victoria Point
32	Wilson Esplanade	Victoria Point
33	Weinam Creek Ferry Terminal	Redland Bay
34	Bay Street	Redland Bay
35	Torquay Road	Redland Bay
36	North Street	Redland Bay
37	Brighton Road	Macleay Island
38	Coondooroopa Drive	Macleay Island
39	Russell Terrace	Macleay Island
40	Jock Kennedy Park	Russell Island
41	The Boulevard	Russell Island
42	Esplanade	Karragarra Island
43	Sweetgum Drive	Lamb Island
44	Empire Vista	Ormiston

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Risk Assessment

A risk assessment has been developed for the purpose of assessing and prioritising a wide range of identified hazards. The risk assessment aligns with triple bottom line principles (environment, social and economic) to assess and rate each hazard in a holistic and objective manner. The assessment process will be undertaken in four steps, with the first assessment determining whether an identified hazard area can be addressed through a 'business as usual' process or whether the more detailed second phase of the assessment process is required.

The objectives of this assessment were to develop a framework that is logical, consistent and transparent by:

- Rating the risk to the environmental, social and economic values of identified hazard areas;
- Rating the threats posed by the identified hazard areas; and
- Ranking identified hazard areas, based on level of risk.

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1. Preliminary Assessment
- Initial screening of an identified hazard area to determines the severity of erosion occurring
- Allows minor hazards to be addressed under "Business as Usual" operations

2. Hazard Assessment Matrix
- Triple Bottom Line Assessment (Environment, Social, Economic)
- Objectively assesses identified hazards
- Calculates a level of consequence for each identified hazard

3. Erosion Factor
- Multiplier factor to further refine the hazard assessment matrix
- Allows hazards of equal risk rating to be ranked

4. Risk Analysis
- Defines level of risk for each identified hazard
- Risk = Consequence (Hazard Assessment Matrix) x Erosion Factor



Step 1: Preliminary Assessment

The initial assessment of hazard areas ensures a consistent and transparent decision making process (refer to Appendix 2 for the flowchart which outlines the preliminary assessment process). The preliminary assessment is an important initial action because it will function as a first screen of identified hazards and also allow hazards to be resolved through the annual operational program or trigger requirements for further assessment and detailed planning.

Step 2: Hazard Assessment Matrix

The hazard assessment matrix has been created to provide an objective assessment of identified hazards. The matrix has been used for each identified hazard and the process of using the matrix is outlined in the following steps.

1. Attribute a score, as per the scoring method, against each specified criteria;
2. Calculate the average score for each category (environment, social and economic); and
3. Calculate the sum of each category total to determine a total score.

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Criteria		Scoring Method					
		1	2	3	4	5	Score
Environment	The loss of the foreshore area from an erosion event (m^2)	<99m^2	100m^2 – 999m^2	1,000m^2 –1,999m^2	2,000m^2 – 3,999m^2	>4,000m^2	eg. 3
	Adjoining terrestrial value (BPA 3.5); or Vegetation regulated under the *Vegetation Management Act 1999*	Minimal ecological value (i.e. cleared land, invasive species, etc.)	Low ecological value / Category X: Vegetation not regulated under the *Vegetation Management Act 1999*	Near threatened species identified / Category C: High-value regrowth vegetation	Vulnerable species identified / Category B: Remnant vegetation	Endangered or critically endangered species identified / Category A: Declared areas, offset areas or an exchange area	
	Marine Park Zoning	No Marine Park	General Use Zone	Habitat Protection Zone	Conservation Park Zone	Marine National Park Zone	
	Ramsar listed	Not Ramsar				Ramsar listed	
	Fish habitat area	Not in				Fish habitat area	
	EPBC-listed endangered ecological community	Not present				Present	
	Nature Conservation Act Species Present	No species present		Vulnerable species present		Endangered species present	
						Environment Score (Total Average)	



Criteria		Scoring Method					
		1	2	3	4	5	Score
Social	Refers to the visual quality and appreciation of the foreshore space by the public	Minimal visual amenity	Low value of visual amenity	Moderate level of visual amenity	Local Important visual amenity	Very high level of visual amenity	eg. 3
	Recreational value of the foreshore area receives	Minimal recreational value	Low recreational value to local community	Medium recreational value to local community, but low to minimal to broader community	High local recreational value to the local community and medium value to broader community	High recreational value to broader community, can be considered a recreation 'destination'	
	The presence of cultural heritage (Indigenous & European)	No cultural heritage identified	Minor cultural heritage value identified	Locally important cultural heritage value identified	Regionally important cultural heritage value identified	Significant cultural heritage site identified	
	The number of people residing in a location affected by the identified hazard	<10	10 to 19	20 to 49	50 to 99	>100	
						Social Score (Total Average)	
Economic	The total value of public infrastructure that is at risk of being impacted by the identified hazard	up to $49,999	$50,000 – $199,999	$200,000 – $499,999	$500,000 – $999,999	>$1,000,000	eg. 3
	Approximate value of property impacted by the identified hazard *Private land is determined by the Unimproved Capital Value of the property *Public land is calculated at area of land within the erosion prone area[10]	up to $49,999	$50,000 – $199,999	$200,000 – $499,999	$500,000 – $999,999	>$1,000,000	
						Economic Score (Total Average)	
						Total Score (Environment average + Social average + Economic Average)	

[10] Public land value is calculated at $/625m^2 (utilising the Costanza methodology) in relation to the portion of land affected by the shoreline erosion and to extent that is within the defined erosion prone area

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Consequence Rating

The total score calculated using the above assessment matrix will determine a consequence rating, as shown in the below table.

Consequence	Total Score
Severe	12-15
Major	9-11
Medium	6-8
Low	4-5
Minimal	3

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Step 3: Erosion Factor

The erosion factor has been included in the assessment process to further refine the ranking of the identified hazards and enables hazards with the same consequence rating to be ranked. The 'Severity of Erosion' is considered the most appropriate criteria to use as the additional component of the risk assessment in order to rank or compare each identified hazard consistently and objectively.

Table: Erosion Factor

	Scoring Criteria				
	1	**2**	**3**	**4**	**5**
Severity of Erosion	Minimal erosion occurring	Low level of erosion occurring (i.e. recession and regeneration or continual fluctuation of shoreline)	Medium level of erosion occurring (i.e. transformation of location – natural process of recession occurring in one location and progression at another)	High level of erosion occurring (i.e. permanent loss of shoreline)	Severe erosion occurring (i.e. significant permanent loss of foreshore, often resulting in sudden and significant events)



Step 4: Risk Analysis

The final step in the risk assessment framework is completing a risk analysis which enables a risk rating to be applied to each identified hazard area. The risk analysis utilised is consistent with existing methodologies[11] and allows a transport process to occur when attributing risk and ranking hazards. Typically risk is described as the frequency of a hazard occurring in relation to the consequence of the event (Risk = Likelihood x Consequence), however given the nature of the hazards being addressed (they are all presently occurring) the process to determine risk has been redefined. The method for calculating the level of risk for each identified hazard is expressed in the below equation:

Risk = Consequence Rating x Erosion Factor

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Table: Risk Matrix

		Prioritisation Score				
		1	2	3	4	5
Consequence Rating	Severe	M10	H20	H30	E40	E50
	Major	M8	M16	H24	E32	E40
	Medium	L6	M12	M18	H24	E30
	Low	L4	L8	M12	M16	H20
	Insignificant	L2	L4	L6	M8	M10

NB: Aligns with Redland City Council Risk Assessment Handbook

The following descriptions apply to the risk ratings outlined in the above matrix. It is important to note the risk ratings indicate the priority to implement a management action and that the process to determine the most appropriate management action is outlined in the Management Options and Implementation Plan.

Table: Risk Rating Description

Risk Rating	Description	Priority
E	Requires action as a priority to reduce the level of risk	Very High
H	Action needs to be undertaken to reduce the level of risk	High
M	Requires action but can be prioritised according to budget and program constraints	Medium
L	Identified hazard can be scheduled as part of regular monitor and evaluation program	Low

11 The Risk Analysis methodology is consistent with the Redland City Council Risk Assessment Handbook and AS/ISO 31000:2009 Risk Management – Principles and Guidelines



Hazard Risk Rating

The below tables provide a summary of the hazard prioritisation assessment, each hazard area presented in the below tables is ranked as per the result of the assessment process. Refer to Appendix 3 for a copy of the completed prioritisation hazard assessment.

Location	Environment Total Score	Social Total Score	Economic Total Score	Consequence Rating	Erosion Factor	Risk Rating	Comments
Amity Point Foreshore	3.33	3.25	5.00	**Major**	**5**	**E40**	Significant erosion has occurred along the Amity Point foreshore over a long period of time which has resulted in the loss of public and private property. Amity Point is a declared Erosion Prone Area under *Coastal Protection and Management Act 1995.*
Bay Street, Redland Bay	2.00	1.75	2.50	**Medium**	**5**	**E30**	Erosion occurring at this location is threatening existing infrastructure assets (including pathways, stormwater & pump station) and is creating a steep escarpment.
Polka Point, Dunwich	2.00	2.75	1.50	**Medium**	**4**	**H24**	The erosion at this location is occurring along a foreshore section that is exposing a midden.
Champion Lane, Wellington Point	2.43	2.00	3.00	**Medium**	**3**	**M18**	There is erosion occurring along the foreshore area, where there is currently a vegetated slope (approximately 11m in height) between the foreshore and private property.
Esplanade, Karragarra Island	2.43	1.25	2.50	**Medium**	**3**	**M18**	Erosion is occurring in proximity to the ferry terminal, west of an existing rock wall.
Norfolk Beach, Coochiemudlo Island	2.29	2.25	1.50	**Medium**	**3**	**M18**	Erosion occurring at beach access points, also noted that exposed locations are subject to weather events and fluctuating erosion.
Main Road (Recreational Reserve), Wellington Point	3.14	2.25	4.50	**Major**	**2**	**M16**	This location has a high infrastructure value and is a popular recreational destination for the local community and visitors.
Point Lookout – Cylinder Headland North Stradbroke Island	3.57	2.00	1.00	**Medium**	**2**	**M12**	Point Lookout Foreshore is on the Queensland Heritage Register identified as erosion prone under the *Coastal Protection and Management Act 1995.*
Point Lookout – Deadmans Headland North Stradbroke Island	3.57	2.00	1.00	**Medium**	**2**	**M12**	Point Lookout Foreshore is on the Queensland Heritage Register identified erosion prone area under the *Coastal Protection and Management Act 1995.*

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Location	Environment Total Score	Social Total Score	Economic Total Score	Consequence Rating	Erosion Factor	Risk Rating	Comments
Cleveland Point, Cleveland	2.86	2.25	3.50	**Medium**	**2**	**M12**	Cleveland Point has a high recreation value, including culturally significant landmarks. The area also has strip of residential development and a number of locally important business/commercial operations.
Thompsons Beach, Victoria Point	2.00	3.00	3.50	**Medium**	**2**	**M12**	Thompsons Beach has a high recreational value to the local community and the erosion occurring is adjacent to an existing revetment wall. NB: Thompsons Beach is subject to proposed works to construct a rock wall, beach nourishment & profiling and improve stormwater drainage to prevent further erosion and impact to foreshore area.
Junner Street, Dunwich	1.86	3.00	3.50	**Medium**	**2**	**M12**	Main transport hub between North Stradbroke Island and the mainland, vehicle barge destination point. Also the location of a European heritage site (convict-built sea wall).
Jock Kennedy Park, Russell Island	2.00	1.00	2.50	**Low**	**3**	**M12**	Shoreline is subject to consistent erosion, particularly susceptible in high tidal ranges. A temporary barrier has been erected along a portion of the foreshore.
Red Cliff & Golf Links Beach, Coochiemudlo Island	3.14	2.00	3.00	**Medium**	**2**	**M12**	Erosion is occurring along the red cliffs and adjacent beach. A number of key services (i.e. electricity, water, sewer & telecommunication) are connected to the island via this location.
Main Beach, Coochiemudlo Island	2.57	2.50	2.50	**Medium**	**2**	**M12**	High social value to local community and visitors. Key transport link/hub as the ferry and barge destination.
Point Lookout – South Gorge North Stradbroke Island	3.71	2.75	1.00	**Medium**	**2**	**M12**	Point Lookout Foreshore is on the Queensland Heritage Register.
Queens Esplanade, Thorneside	2.86	2.00	2.50	**Medium**	**2**	**M12**	Erosion has the potential to impact an existing footpath. There is a section of existing rock wall to the east of this location which is not experiencing erosion.
Brighton Road, Macleay Island	2.00	1.75	3.00	**Medium**	**2**	**M12**	Erosion is occurring in proximity to the ferry terminal.

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Location	Environment Total Score	Social Total Score	Economic Total Score	Consequence Rating	Erosion Factor	Risk Rating	Comments
GJ Walter Park, Cleveland	1.86	1.25	3.50	**Medium**	**2**	**M12**	Exposed section of beach is subject to periodic erosion, in close proximity to an existing playground. There is also an existing rock wall to the east of this location that is not experiencing similar erosion. NB: The Toondah Harbour Priority Development Area includes GJ Walter Park.
Point Lookout – Frenchmans Bay North Stradbroke Island	3.57	2.00	1.00	**Medium**	**2**	**M12**	Point Lookout Foreshore is on the Queensland Heritage Register, identified as erosion prone under the *Coastal Protection and Management Act 1995.*
Point Lookout – Home Beach North Stradbroke Island	3.57	2.00	1.00	**Medium**	**2**	**M12**	Point Lookout Foreshore is on the Queensland Heritage Register, identified as erosion prone under the *Coastal Protection and Management Act 1995.*
Point Lookout – Deadmans Beach North Stradbroke Island	3.57	2.00	1.00	**Medium**	**2**	**M12**	Point Lookout Foreshore is on the Queensland Heritage Register, identified as erosion prone under the *Coastal Protection and Management Act 1995.*
Wilson Esplanade, Victoria Point	2.00	2.00	2.50	**Medium**	**2**	**M12**	This location is subject to long-term erosion being the gradual recession of the shoreline which has the potential to compromise existing footpath and other infrastructure/ assets.
Aquatic Paradise Park, Birkdale	2.00	1.00	3.50	**Medium**	**2**	**M12**	Minor erosion occurring along the foreshore is particularly evident at beach access locations. Noted that erosion is occurring where rock walls are currently not constructed.
3 Paddocks Park, Birkdale	2.71	1.00	2.50	**Medium**	**2**	**M12**	Minor scarping of shoreline occurring where the shore is subject to low-energy high tides. Rock walls have been constructed to the west of this site to manage shoreline recession.
Flinders Beach, North Stradbroke Island	2.86	2.25	1.00	**Medium**	**2**	**M12**	Erosion occurring at exposed beach locations, in large weather events scarping of the beach can occur.
North Boat Ramp, Victoria Point	2.00	2.00	2.00	**Medium**	**2**	**M12**	Minor erosion occurring west of the existing boat ramp, where the foreshore is subject to higher tide events.

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Location	Environment Total Score	Social Total Score	Economic Total Score	Consequence Rating	Erosion Factor	Risk Rating	Comments
Russell Terrace, Macleay Island	2.29	1.25	1.50	**Low**	**3**	**M12**	Erosion occurring at this site is east of the Macleay Island ferry terminal and causing scarping in front of a private property.
The Boulevard, Russell Island	2.00	2.00	1.00	**Low**	**3**	**M12**	This area on the south-eastern foreshore of Russell Island has a high recreation value to the local community as a recreational fishing and sailing area.
Southern NSI – Jumpinpin, North Stradbroke Island	3.86	1.00	1.00	**Low**	**2**	**L8**	Southern North Stradbroke Island has high ecological value, identified as erosion prone under the *Coastal Protection and Management Act 1995*.
Melaleuca Beach, Coochiemudlo Island	2.71	2.00	1.00	**Low**	**2**	**L8**	Erosion occurring periodically along foreshore, in particular beach access points and exposed locations.
Weinam Creek Ferry Terminal, Redland Bay	1.57	1.50	2.50	**Low**	**2**	**L8**	Weinam Creek Ferry Terminal is part of the identified Priority Development Area (PDA) for Weinam Creek.
Southeast Beach, Coochiemudlo Island	2.29	2.00	1.00	**Low**	**2**	**L8**	A fluctuating shoreline, where exposed locations are subject to weather events, particularly from the south-east. Consistent with short-term erosion process.
Pelican Street, Victoria Point	2.00	1.75	1.50	**Low**	**2**	**L8**	Minor erosion occurring along foreshore, this area is more exposed to onshore winds. Note there are existing rock walls along sections of the foreshore.
Eighteen Mile Swamp, North Stradbroke Island	3.14	1.00	1.00	**Low**	**2**	**L8**	Southern North Stradbroke Island has high ecological value, identified as erosion prone under the *Coastal Protection and Management Act 1995*.
Coondooroopa Drive, Macleay Island	1.86	1.50	1.50	**Low**	**2**	**L8**	Erosion occurring periodically, in higher tide events particularly during prevailing northerly winds. Note that private defence structures which currently exist either side of allotment is suspected of increasing the impact of erosion.
Sleath Street, Ormiston	2.57	1.25	1.00	**Low**	**2**	**L8**	Minor erosion occurring adjacent to an existing revetment wall.
Northeast Beach, Coochiemudlo Island	2.29	1.50	1.00	**Low**	**2**	**L8**	Parts of the shoreline are subject to receding at exposed locations during weather events.

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Location	Environment Total Score	Social Total Score	Economic Total Score	Consequence Rating	Erosion Factor	Risk Rating	Comments
Como Street, Ormiston	2.86	1.50	1.00	**Low**	**1**	**L4**	Minor erosion is occurring on a small portion of the foreshore. This area features a significant amount of vegetation and mangrove habitat that is not currently at a high level of risk of being lost to erosion.
Morwong Beach, Coochiemudlo Island	2.57	1.75	1.00	**Low**	**1**	**L4**	Periodic erosion occurring at beach access locations associated with weather events and uncontrolled overland flow.
Empire Vista, Ormiston	2.57	1.25	1.00	**Low**	**1**	**L4**	Low level of erosion caused by tidal action is occurring in proximity to existing vegetation.
North Street, Redland Bay	2.00	1.50	1.50	**Low**	**1**	**L4**	Minor erosion is occurring north of an existing rock wall. It is noted that this portion of the foreshore is affected for short periods during high tide events.
Torquay Road, Redland Bay	2.14	1.00	1.00	**Low**	**1**	**L4**	Minor erosion occurring at the end of the sealed section of Torquay Road, evidence of this location being utilised as an unofficial access point to Moreton Bay.
Sweetgum Drive, Lamb Island	2.00	1.00	1.00	**Low**	**1**	**L4**	Location of a closed landfill site where it is expected that works will need to be undertaken to cap the site to ensure landfill leachate does not enter Moreton Bay.

NB: Point Lookout Foreshore is on the Queensland Heritage Register

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Coastal Management Options

Legislative Context

There are a number of legislative acts, comprising the three tiers of government (Federal, State and Local), that are applicable to coastal management. From a local government perspective, the provisions that guide and regulate coastal development and management are primarily within the local government planning scheme (Redland City Plan).

The Redland City Plan guides land-use decisions and accommodates the growth that will occur in a balanced, well-designed way. The aim of the plan is to support the environmental, social and economic needs of the community and help maintain their lifestyle and safety. The Redland City Plan reflects state interests within its provisions to ensure consistency between state and local planning. The plan also contains the following features:

Identify the strategic outcomes;

Include measures to facilitate the strategic outcomes; and

Coordinate and integrate community, state and regional interests.

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State Guidelines and Policies

Guidelines for Preparing a Coastal Hazard Adaptation Strategy 2012

The Coastal Hazard Adaptation Strategy Guideline has been developed to assist local governments in preparing and implementing a coastal adaptation strategy. The guideline defines the underlying principles, minimum standards and leading practice required by the Department of Environment and Heritage in preparing a coastal hazards adaptation strategy.

State Planning Policy 2016

The State Planning Policy (SPP) presents a set of principles that guide land-use planning and development assessment in Queensland. The SPP outlines the assessment requirements for all State Interests and has been created to replace all other (separate) State Planning Policies. A State Interest is defined under the *Sustainable Planning Act 2009* as:

An interest that the Minister considers affects an economic or environmental interest of the state or a part of the state, including sustainable development, or

An interest that the Minister considers affects the interest of ensuring there is an efficient, effective and accountable planning and development assessment system.

There are three State Interests under the SPP that is relevant to coastal management.

State Interest	Description
Coastal environment	The coastal environment is protected and enhanced, while supporting opportunities for coastal-dependent development, compatible urban form, and safe public access along the coast.
Natural hazards, risk and resilience (including coastal erosion	State's interest in natural hazards seeks to ensure natural hazards are properly considered in all levels of the planning system, community resilience is increased, and hazards are avoided or the risks are mitigated to an acceptable or tolerable level.
Biodiversity	Matters of environmental significance are valued and protected, and the health and resilience of biodiversity is maintained or enhanced to support ecological integrity.

Legislation (Acts)

The following table provides a summary of current legislation that is relevant to coastal protection and management.

Legislation	Purpose of legislation and relevance to Coastal Management
Environmental Protection and Biodiversity Act 1999 (Commonwealth)	Provides an additional legislative layer for flora and fauna identified as being of national environmental significance. The *EPBC Act 1999* is the Australian Government's central piece of environmental legislation. It provides the legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage as 'matters of national environmental significance'. The objectives of the EPBC Act are to: • Provide for the protection of the environment, especially matters of national environmental significance • Conserve Australian biodiversity • Provide a streamlines national environmental assessment and approvals process • Enhance the protection and management of important natural and cultural places • Control the international movement of plans and animals (wildlife), wildlife specimens and products made or derived from wildlife • Promote ecologically sustainable development through the conservation and ecologically sustainable use of Australia's biodiversity
Native Title Act 1993 (Commonwealth)	The Australian Government has acted to protect the rights of all of its citizens, and in particular its indigenous peoples, by recognising international standards for the protection of universal human rights and fundamental freedoms through: a) The ratification of the International Convention on the Elimination of All Forms of Racial Discrimination and other standard-settings instruments such as the International Covenants on Economic, Social and Cultural Rights and on Civil and Political Rights; and b) The acceptance of the Universal Declaration of Human Rights; and c) The enactment of legislation such as the *Racial Discrimination Act 1975* and the *Australian Human Rights Commission Act 1986.* The *Native Title Act 1993* recognises and protects native title. It provides that native title cannot be extinguished contrary to the Act. The main objectives of this Act are: • To provide for the recognition and protection of native title; • To establish ways in which future dealings affecting native title may proceed and to set standards for those dealings; and • To establish a mechanism for determining claims to native title; and • To provide, or permit, the validation of past acts, and intermediate period acts, invalidated because of the existence of native title.

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Legislation	Purpose of legislation and relevance to Coastal Management
Aboriginal Cultural Heritage Act 2003	The main purpose of this Act is to provide effective recognition, protection and conservation of Aboriginal cultural heritage. The fundamental principles that underlie the Act's main purpose are – a) The recognition, protection and conservation of Aboriginal cultural heritage should be based on respect for Aboriginal knowledge, cultural and traditional practices; b) Aboriginal people should be recognised as the primary guardians, keepers and knowledge holders of Aboriginal cultural heritage; c) It is important to respect, preserve and maintain knowledge, innovations and practices of Aboriginal communities and to promote understanding of Aboriginal cultural heritage; d) Activities involved in recognition, protection and conservation of Aboriginal cultural heritage are important because they allow Aboriginal people to reaffirm their obligations to 'law and country'; e) There is a need to establish timely and efficient processes for the management of activities that may harm Aboriginal cultural heritage. For achieving effective recognition, protection and conservation of Aboriginal cultural heritage, this Act provides for the following – a) Recognising Aboriginal ownership of Aboriginal human remains wherever held; b) Recognising Aboriginal ownership of Aboriginal cultural heritage of a secret or scared nature held in State collections; c) Recognising Aboriginal ownership of Aboriginal cultural heritage that is lawfully taken away from an area by an Aboriginal party for the area; d) Establishing a duty of care for activities that may harm Aboriginal cultural heritage; e) Establishing powers of protection, investigation and enforcement; f) Establishing a database and a register for recording Aboriginal cultural heritage; g) Ensuring Aboriginal people are involved in processes for managing the recognition, protection and conservation of Aboriginal cultural heritage; h) Establishing a process for the comprehensive study of Aboriginal cultural heritage; i) Establishing a process for the timely and efficient management of activities to avoid or minimise harm to Aboriginal cultural heritage.

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Legislation	Purpose of legislation and relevance to Coastal Management
Coastal Protection and Management Act 1995	The main objects of this Act are to – a) Provide for the protection, conservation, rehabilitation and management of the coastal zone, including its resources and biological diversity; and b) Have regard to the goal, core objectives and guiding principles of the National Strategy for Ecologically Sustainable Development in the use of the coastal zone; and c) Ensure decisions about land use and development safeguard life and property from the threat of coastal hazards; and d) Encourage the enhancement of knowledge of coastal resources and the effect of human activities on the coastal zone. The objects of this Act are achieved by coordinated and integrated planning and decision making, involving, among other things, the following – **Coastal zone** – defining the coastal zone, which is the area to which the Act applies. **Coastal plan** – preparing a coastal plan that: • Identifies coastal resources • States policies for coastal management • Is developed in consultation with the public • Has regard to the Aboriginal tradition of Aboriginal people and Island custom of Torres Strait Islanders **Coastal Management Districts** – declaring coastal management districts in the coastal zone as areas requiring special development controls and management practices **Erosion prone areas** – declaring erosion prone areas in the coastal zone as areas where particular development requirements are applied **Use of other legislation** – using other relevant legislation where practicable to achieve the objects of this Act **Monitoring, reporting and review** – requiring the chief executive to prepare and publish a report on the state of coastal zone on a regular basis. Management of coastal development by: • Coastal Management Districts • Tidal Works Management of coastal resources and activities by: • Coastal Management Plan • Shoreline Erosion Management Plans • Local Area Management Plans

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Legislation	Purpose of legislation and relevance to Coastal Management
Sustainable Planning Act 2009	The purpose of this Act is to seek to achieve ecological sustainability by – a) Managing the process by which development takes place, including ensuring the process is accountable, effective and efficient and delivers sustainable outcomes; b) Managing the effects of development on the environment, including managing the use of premises; and c) Continuing the coordination and integration of planning at the local, regional and State levels. Advancing the Act's purpose includes – a) Ensuring decision-making processes – i. Are accountable, coordinated, effective and efficient; and ii. Take account of short and long-term environmental effects of development at local, regional, State and wider levels, including, for example, the effects of development on climate change; iii. Apply the precautionary principle; and iv. Seek to provide for equity between present and future generations; and b) Ensuring the sustainable use of renewable natural resources and the prudent use of non-renewable natural resources by, for example, considering alternative to the use of non-renewable natural resources; and c) Avoiding, if practicable, or otherwise lessening, adverse environmental effects of development, including, for example – i. Climate change and urban congestion; and ii. Adverse effects on human health; and d) Considering housing choice and diversity, and economic diversity; and e) Supplying infrastructure in a coordinated, efficient and orderly way, including encouraging urban development in areas where adequate infrastructure exists or can be provided efficiently; and f) Applying standards of amenity, conservation, energy, health and safety in the built environment that are cost-effective and for the public benefit; and g) Providing opportunities for community involvement in decision making.
Planning Act 2016 (will supersede the *Sustainable Planning Act 2009)*	An Act providing for an efficient, effective, transport, effective, coordinated and accountable system of land use planning and development assessment to facilitate the achievement of ecological sustainability.
Sustainable Planning Regulation 2009	Details referral agencies and triggers (jurisdictional responsibilities) for types of development. Provides additional information that is pertinent to the *Sustainable Planning Act 2009* regarding prescribed matters, applicable codes, laws and policies.
Land Act 1994	Manage land, to which the Act applies (all land including land whether permanently or from time to time covered by water subject to tidal influence), for benefit of the people of Queensland by having regard to the following principles: • Sustainability • Evaluation • Development • Community purpose • Protection • Consultation • Administration
Environmental Protection Act 1994	Regulates environmental relevant activities, including release of emissions on land, air or water and noise.
Vegetation Management Act 1999	The purpose of the *Vegetation Management Act* is to regulate the clearing of vegetation to preserve regional ecosystems and areas of high-value conservation, ensure clearing does not cause land degradation, maintain or increase biodiversity and allow for ecologically sustainable land use.

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Legislation	Purpose of legislation and relevance to Coastal Management
Fisheries Act 1994	Provides for the sustainable use, conservation and enhancement of the community's fisheries resources and fish habitats by applying and balancing the principles of ecologically sustainable development and promote ecologically sustainable development.
Nature Conservation Act 1992	The object of the *Nature Conservation Act* is the conservation of nature while allowing the involvement of Indigenous people in the management of protected areas in which they have an interest under the Aboriginal tradition or island custom.
Marine Parks Act 2004	The main purpose of this Act is to provide for conservation of the marine environment. This is achieved through – • Marine park declarations; • Establishment of zones, designated areas, zoning plans and management plans; • Cooperative involvement of public authorities, other interested groups or persons, including Aboriginal and Torres Strait Islander communities; • Coordinated approach with other environment conservation legislation; • Recognition of the cultural, economic, environmental and social relationships between marine parks and other areas; • Application of the precaution principle in the decision- making process.
Survey and Mapping Infrastructure Act 2003	The purpose of the *Survey and Mapping Infrastructure Act 2003* are to provide for the following – • Developing, maintaining and improving the State survey and mapping infrastructure; • Maintaining and improving cadastral boundaries throughout the State and information held by the department about the boundaries; • Coordinating and integrating survey and mapping information; • Improving public access to survey and mapping information; • Defining administrative areas, and describing and working out administrative area boundaries. Part 7 Tidal and non-tidal boundaries and associated matters outline the provisions for surveying properties which have a tidal boundary. This piece of legislation has the unintended consequence to Council (responsible for managing foreshore zone), because the tidal boundary of properties may be subject to change and parcels of land that were previously under private ownership have the potential to revert to unallocated state land and subsequently become Council's responsibility to manage.
Disaster Management Act 2003	The objective of this Act is to help communities: • Mitigate the potential adverse effects of an event; • Prepare for managing the effects of an event; • Effectively respond to, and recover from, a disaster or an emergency situation; and • To provide for effective disaster manager for the State.
Recreation Areas Management Act 2006	Regulates establishment, maintenance and use of recreational areas.
Waste Reduction and Recycling Act 2011	Provides regulatory regime for management of litter and illegal dumping.
Coastal Management Plan 2014	The Coastal Management Plan is a non-regulatory policy document created to provide guidance for the management of coastal land.

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Potential Management Options

There is a broad range of coastal management options available to address coastal hazards. These management options can be broadly defined as:

- Foreshore Protection (Defend),
- Accommodate,
- Retreat,
- Maintain the status quo, and
- Repurpose.

Foreshore Protection

Protect portions of the coastal hazard area with either hard or assimilating coastal engineering structures to reduce or remove storm-tide inundation or erosion risks. Coastal defence may combine long-term strategies for defence and maintenance, including regenerative and structural options such as beach nourishment, revegetation, dune construction, dykes, sea walls, groynes and storm-tide barriers.

Defending private properties

Foreshore property owners are able to undertake private foreshore works, such as constructing a sea wall, in order to defend their property. As a local government authority, Redland City Council would be responsible for assessing such proposals in accordance with the provisions of the *Sustainable Planning Act 2009*.

It is important to note that any shoreline erosion management strategy, including private works, needs to consider the risks, including the effectiveness of proposed and existing works, and ensuring no increase to coastal hazard risk for adjacent areas.

Prescribed tidal works

Tidal works is relevant work undertaken on land that is in, on, or above land under tidal water, or land that will, or may be, under tidal water because of development on or near the land, and work that is an integral part of the relevant work, wherever located. Tidal works include the construction or demolition of a basin, boat ramp, breakwater, bridge, dam, dock, dockyard, embankment, groyne, jetty, pipeline, pontoon, powerline, sea wall, slip, small-craft facility, training wall or wharf, and works in tidal water necessarily associated with the construction or demolition.

Prescribed tidal works are tidal works that are completely or partly within a local government tidal area and includes parts of the structure that extends onto land above the high water mark.

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Accommodate

Maintain the current levels of use within the coastal hazard areas and raise the tolerance to periodic storm-tide inundation or erosion events by means of innovative designs for buildings and infrastructure (e.g. elevating, strengthening or change in use). This includes actions that will reduce the impacts from coastal hazards to an acceptable level of risk. Works are placed into two categories, being:

I. Works that will allow the current use to continue; or

II. Physical works and legislative amendments that provide for more appropriate future use of the land that can tolerate a higher level of risk (i.e. changing zoning of land from residential to open space) or operational works to raise the height of developable land above the height of potential sea level rise.

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Retreat

Retreat entails implementing actions to withdraw from the coastal hazard impacts through relocation or abandonment. This option involves removing vulnerable uses from the identified coastal hazard and this can be achieved by relocating the community (i.e. land swap arrangement) or abandoning the area (e.g. buy-back mechanism or rezoning of land to a more suitable use).

Maintain Status Quo

In the process of assessing the suitability of the above management options, "maintaining the status quo" should also be considered. Maintaining the status quo allows for the continuation of the existing use in an area but prevent any further intensification of those areas.

The decision to maintain status quo demonstrates a clear intention that intensification of development will not occur in identified areas, but without creating a community expectation that a particular action (defend, accommodate or retreat) will be undertaken at a future date. If supported by public education on the risks associated with coastal hazards, it enables the community to understand and better prepare.

This option may be appropriate where there is a low level of infrastructure or assets and further intensification is unlikely to occur. Or, in locations where other management options, such as defence or retreat, are not cost effective or technically feasible.

Repurpose

This management option focuses on strategic planning as a mechanism to regulate future land uses. This option evaluates the vulnerability of land impacted by coastal hazards to determine whether the land can be reused for an alternative purpose. The decision to repurpose an identified area could be a result of managing community expectations of an already popular destination. Key elements that need to be considered when determining an area for repurpose is:

- The vulnerability to coastal hazards
- Current level of development and population
- Possibility to achieve desired outcomes through land use criteria
- Projected population growth and presence of critical infrastructure and services

Monitor and Evaluate

Monitoring and evaluating coastal hazards will ensure that the most effective management and adaptation options are identified and implemented and also ensures the coastal adaptation strategy is a responsive and adaptive strategic plan.

The methods for available for Monitor and Review of hazard locations are:

- **Annual Inspection Program:** When an identified coastal hazard has been assessed and does not pose a level of risk to justify implementing a management option, the proposed method will be to include the hazard area on a regular inspection program. It is anticipated that hazard areas will be reviewed and reassessed annually with an option to increase the number of inspections on an as-needed basis.
- **Surveys:** The completion of surveys will generally be recommended on areas where it is necessary to understand the long-term movement of the foreshore area, such as open beaches which have been subject to consistent beach erosion. This option can also be used for bathymetric surveys to record the movement of sediment and water depth.
- **Desktop monitoring:** There are areas of the coastline that are remote and not easily accessible to undertake a visual inspection or survey. In these instances, it is recommended that a feasible alternative to on-site methods is to rely on aerial photography, through desktop monitoring, to monitor the hazard location.

Monitor and Evaluate is an essential component of the assessment framework and is recommended to be implemented as part of the ongoing management of coastal hazards.



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Management Options Analysis

To ensure the most appropriate management option is recommended it is important a robust assessment is undertaken for each potential management option. A multi-criteria analysis (MCA) is recognised as an effective assessment technique to determine the suitability of potential management options. It is also a cost-effective method of refining a range of identified options which can then be tested further via a Cost Benefit Analysis or other assessment tools. The strength of using a MCA for this project is that it can compare qualitative and quantitative data which is generally quite difficult to assess. Refer to Appendix 4 for a detailed copy of the management option analysis.

Assessment Criteria

The criteria developed for this assessment is based on triple bottom line principles and ensure a robust and objective assessment process. The methodology for the assessment is based on the implementation of the identified management option.

- **Effectiveness:** Considers how effective a potential management option will be at addressing the identified coastal hazard.
- **Value for money:** The implementation and life-cycle cost of a potential management option in relation to how effective the option will be at addressing the identified hazard.
- **Environmental Impacts:** This assessment category refers to how a potential management option, if implemented, will impact the local environment. The environmental aspects included in this consideration are the diversity and ecological significance of the identified hazard location, including terrestrial and marine flora and fauna that inhabit or are known to exist in the local area.
- **Social Impacts:** Takes into consideration how a potential management option impacts the social and recreational impacts, cultural heritage and community values of the specific area.

Scoring scale

The scoring methodology utilised for the multi-criteria is as follows:

- (1) unacceptable to poor outcome,
- (2) poor to neutral,
- (3) neutral to modest, and
- (4) acceptable to excellent

The intent of the scoring scale is that the higher the score, the more suitable or appropriate the outcome of the particular option.

Potential Management Options Analysis

The information presented in the below table compares the weighted score with the total average score from the multi-criteria assessment of potential management options. For a complete copy of the multi-criteria analysis refer to Appendix 4.

A key part of the assessment process is determining the cost for each potential management option. The implementation of specific management options will require detailed design to determine the actual construction costs, however estimated costs have been used as a guide for this assessment.

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Table: Management Option Cost Estimates

Management Option		Estimated costs (2016$)	Comments
Monitor and Evaluate	Annual survey (1st year)	$7,000	The estimated planning cost to undertake a survey for the first time at a site. This cost includes establishing the survey site, including the placement of control and monitoring points for future work, labour and travel costs.
	Annual survey (2nd year+)	$3,500	A lower cost for ongoing surveys due to the survey site being established.
	Inspection program	Internal cost	An inspection program will be established incorporating all known hazard locations based on the coastal hazards register. The coastal hazard register will also be maintained as a live database and subject to updating when new hazard locations are identified. Part of the inspection process will include the re-assessment of each hazard location in accordance with the developed Risk Assessment framework. An annual inspection program will be completed through existing operational capacity of the Infrastructure & Operations department. The estimated cost for completing the inspection program annually is approximately $26,000, calculated at 0.5 FTE of a Technical Officers role.
	Desktop Monitoring	Internal Cost	There are portions of the Redlands City coastline that are not easily accessible to be feasibly included as part of an annual inspection program. In instances where an annual inspection or survey is not an appropriate option, it is considered that desktop monitoring through aerial surveys is a suitable alternative.
Foreshore Protection	Hard structure (rock sea wall, revetment wall, geo-fabric, Seabee wall or rock groyne)	Mainland: $687 – $2,531/m Island: $1,378 – $3,038/m	The planning cost estimate outlined is the range for constructing a sea wall based on the height and location and also includes planning requirements, permits and approvals, project construction on-costs, supply and construction of rock armour and geotextile. The rate for constructing a sea wall is site specific with the main variances being the required height and location in the city.
	Beach nourishment	$70/m^3	This is a conservative estimate for the sourcing, transporting and placement of sand to a location within the city.
	Re-vegetation	$17m^2	Cost estimate includes weed control, mulch or matting, supply plants, labour, tree guards, watering and ongoing maintenance.
Further Detailed Planning	Further detailed planning	Site specific	Recognises the need for further detailed planning to determine the most appropriate management option. The type of detailed planning that can be undertaken includes Shoreline Erosion Management Plans (SEMPs) or Coastal Process Studies. A planning cost estimate will be applied to this option dependent on the location and extent of planning required.
Maintain Status Quo	Sea wall (maintain existing structure)	1% of construction cost	Over the design life of a sea wall it is general practice to allocate 1% of its construction cost for annual maintenance.

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Table: Summary of Management Option Analysis

Location	Management Options		Planning Cost Estimate (2016$)	MCA Score
	Management Option	Description		
Amity Point, North Stradbroke Island	Further detailed planning	Shoreline Erosion Management Plan	$150,000	
Norfolk Beach, Coochiemudlo Island	Monitor & Evaluate	Annual survey	$3,500 – 7,000	3.0
	Foreshore Protection	Beach nourishment	$70/m^3	2.5
		Hard structure	$1,378 – $3,038/m	2.0
	Further detailed planning	Refinement of Shoreline Erosion Study to a Shoreline Erosion Management Plan	$50,000	3.0
Main Beach, Coochiemudlo Island	Monitor & Evaluate	Annual inspection	Internal cost	3.5
	Further detailed planning	Refinement of Shoreline Erosion Study to a Shoreline Erosion Management Plan	$50,000	3.0
	Foreshore Protection	Beach nourishment	$70/m^3	3.0
Southeast Beach, Coochiemudlo Island	Monitor & Evaluate	Annual survey	$3,500 – 7,000	3.5
	Foreshore Protection	Dune re-vegetation	$17/m^2	3.0
		Beach nourishment	$70/m^3	3.25
	Further detailed planning	Refinement of Shoreline Erosion Study to a Shoreline Erosion Management Plan	$50,000	3.0
Melaleuca Beach, Coochiemudlo Island	Foreshore Protection	Beach nourishment	$70/m^3	3.0
		Hard structure	$1,378 – $3,038/m	2.25
		Dune re-vegetation	$17/m^2	3.0
	Monitor & Evaluate	Annual survey	$3,500 – 7,000	3.25
	Further detailed planning	Refinement of Shoreline Erosion Study to a Shoreline Erosion Management Plan	$50,000	3.0
Northeast Beach, Coochiemudlo Island	Foreshore Protection	Beach nourishment	$70/m^3	2.25
		Hard structure	$1,378 – $3,038/m	2.0
	Monitor & Evaluate	Annual survey	$3,500 – 7,000	3.0
	Further detailed planning	Refinement of Shoreline Erosion Study to a Shoreline Erosion Management Plan	$50,000	3.0

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Location	Management Options		Planning Cost Estimate (2016$)	MCA Score
	Management Option	Description		
Morwong Beach, Coochiemudlo Island	Upgrade stormwater infrastructure	Improve overland flow path to prevent erosion to beach	$35,000	2.75
	Foreshore Protection	Beach nourishment	$70/m^3	2.75
	Further detailed planning	Refinement of Shoreline Erosion Study to a Shoreline Erosion Management Plan	$50,000	3.0
	Monitor & Evaluate	Annual inspection	Internal cost	3.75
Red Cliff & Golf Links Beach, Coochiemudlo Island	Foreshore Protection	Hard structure	$1,378 – $3,038/m	3.0
		Beach nourishment	$70/m^3	2.75
	Further detailed planning	Refinement of Shoreline Erosion Study to a Shoreline Erosion Management Plan	$50,000	3.0
		Geotechnical investigation	$150,000	3.0
	Monitor & Evaluate	Annual inspection	Internal cost	3.5
Southern NSI – Jumpinpin, North Stradbroke Island	Foreshore Protection	Beach nourishment	$70/m^3	2.25
	Monitor & Evaluate	Desktop monitoring	Internal cost	3.5
Eighteen Mile Swamp, North Stradbroke Island	Foreshore Protection	Beach nourishment	$70/m^3	1.75
	Monitor & Evaluate	Desktop monitoring	Internal cost	3.5
Point Lookout – South Gorge, North Stradbroke Island	Foreshore Protection	Beach nourishment	$70/m^3	1.75
	Monitor & Evaluate	Annual inspection	Internal cost	3.5
Point Lookout – Frenchmans Bay, North Stradbroke Island	Foreshore Protection	Beach nourishment	$70/m^3	1.75
		Hard structure	$1,378 – $3,038/m	2.25
	Monitor & Evaluate	Annual inspection	Internal cost	3.75

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Location	Management Options		Planning Cost Estimate (2016$)	MCA Score
	Management Option	Description		
Point Lookout – Deadmans Headland, North Stradbroke Island	Foreshore Protection	Beach nourishment	$70/m^3	2.25
		Hard structure	$1,378 – $3,038/m	1.75
	Monitor & Evaluate	Annual inspection	Internal cost	3.5
Point Lookout – Deadmans Beach, North Stradbroke Island	Foreshore Protection	Beach nourishment	$70/m^3	2.25
		Hard structure	$1,378 – $3,038/m	1.75
	Monitor & Evaluate	Annual inspection	Internal cost	3.5
Point Lookout – Cylinder Headland, North Stradbroke Island	Foreshore Protection	Beach nourishment	$70/m^3	2.25
	Monitor & Evaluate	Annual inspection	Internal cost	3.75
Point Lookout – Home Beach, North Stradbroke Island	Foreshore Protection	Beach nourishment	$70/m^3	2
		Hard structure	$1,378 – $3,038/m	1.75
	Monitor & Evaluate	Annual inspection	Internal cost	3.5
Flinders Beach, North Stradbroke Island	Foreshore Protection	Beach nourishment	$70/m^3	2.0
		Hard structure	$1,378 – $3,038/m	1.75
		Dune revegetation	$17/m^2	3
	Monitor & Evaluate	Annual inspection	Internal cost	3.5
Junner Street, Dunwich	Foreshore Protection	Hard structure	$1,378 – $3,038/m	3.25
	Monitor & Evaluate	Annual inspection	Internal cost	3.0
Polka Point, Dunwich	Monitor & Evaluate	Annual inspection	Internal cost	2.75
	Foreshore Protection	Revegetation	$17/m^2	2.75
		Hard structure	$1,378 – $3,038/m	3.0
		Beach nourishment	$70/m^3	3.0
	Further detailed planning	Investigative work	$30,000	3.5

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Location	Management Options		Planning Cost Estimate (2016$)	MCA Score
	Management Option	Description		
Queens Esplanade, Thorneside	Foreshore Protection	Beach nourishment	$70/m^3	3.0
		Hard structure	$1,378 – $3,038/m	3.25
	Monitor & Evaluate	Annual inspection	Internal cost	3.0
3 Paddocks Park, Birkdale	Foreshore Protection	Beach nourishment	$70/m^3	2.25
		Foreshore revegetation	$17/m^2	2.75
		Hard structure	$1,378 – $3,038/m	3.25
	Monitor & Evaluate	Annual inspection	Internal cost	3.5
Aquatic Paradise Park, Birkdale	Foreshore Protection	Beach nourishment	$70/m^3	3.0
		Bank stabilisation/vegetative work	$17/m^2	2.5
	Monitor & Evaluate	Annual inspection	Internal cost	3.5
Main Road (Recreational Reserve), Wellington Point	Maintain Status Quo	Maintain sea wall	Subject to detailed design	3.25
	Foreshore Protection	Beach nourishment	$70/m^3	3.25
	Monitor & Evaluate	Annual inspection	Internal cost	3.5
Champion Lane, Wellington Point	Foreshore Protection	Hard structure	$1,378 – $3,038/m	2.75
		Beach nourishment	$70/m^3	2.75
		Revegetation	$17/m^2	2.75
	Monitor & Evaluate	Annual inspection	Internal cost	3.0
Sleath Street, Ormiston	Foreshore Protection	Revegetation	$17/m^2	3.0
	Monitor & Evaluate	Annual inspection	Internal cost	3.5
Como Street, Ormiston	Foreshore Protection	Revegetation	$17/m^2	3.0
		Hard structure	$1,378 – $3,038/m	2.5
	Monitor & Evaluate	Annual inspection	Internal cost	3.5

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Location	Management Options		Planning Cost Estimate (2016$)	MCA Score
	Management Option	Description		
Cleveland Point, Cleveland	Maintain Status Quo	Maintain sea wall	Subject to detailed design	3.5
	Monitor & Evaluate	Annual inspection	Internal cost	3.5
GJ Walter Park, Cleveland	Foreshore Protection	Hard structure	$1,378 – $3,038/m	2.5
	Monitor & Evaluate	Monitor progress of Toondah Harbour PDA	Internal cost	3.75
North Boat Ramp, Victoria Point	Foreshore Protection	Revegetate foreshore	$17/m^2	3.0
		Hard structure	$1,378 – $3,038/m	3.0
	Monitor & Evaluate	Annual inspection	Internal cost	3.5
Thompson Street, Victoria Point	Foreshore Protection	Sea wall and beach nourishment	$2M	3.5
	Monitor & Evaluate	Annual inspection	Internal cost	3.5
Pelican Street, Victoria Point	Foreshore Protection	Beach nourishment	$70/m^3	2.75
		Hard structure	$1,378 – $3,038/m	2.5
	Monitor & Evaluate	Annual inspection	Internal cost	3.25
Wilson Esplanade, Victoria Point	Monitor & Evaluate	Annual inspection	Internal cost	3.5
	Foreshore Protection	Hard structure	$1,378 – $3,038/m	3.25
		Beach nourishment	$70/m^3	3.75
Weinam Creek Ferry Terminal, Redland Bay	Maintain Status Quo	Maintain sea wall	Subject to detailed design	3.0
	Monitor & Evaluate	Annual inspection	Internal cost	3.5
Bay Street, Redland Bay	Foreshore Protection	Hard structure	$1,378 – $3,038/m	3.25
		Beach nourishment	$70/m3	2.5
	Monitor & Evaluate	Annual inspection	Internal cost	3.25

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Location	Management Options		Planning Cost Estimate (2016$)	MCA Score
	Management Option	Description		
Torquay Road, Redland Bay	Foreshore Protection	Hard structure	$1,378 – $3,038/m	2.25
	Monitor & Evaluate	Annual inspection	Internal cost	3.5
North Street, Redland Bay	Foreshore Protection	Hard structure	$1,378 – $3,038/m	3.25
		Beach nourishment	$70/m^3	3.0
	Monitor & Evaluate	Annual inspection	Internal cost	3.5
Brighton Road, Macleay Island	Maintain Status Quo	Maintain sea wall	Subject to detailed design	3.25
	Monitor & Evaluate	Annual inspection	Internal cost	3.5
Coondooroopa Drive, Macleay Island	Foreshore Protection	Hard structure	$1,378 – $3,038/m	3.25
		Beach nourishment	$70/m^3	3.0
	Monitor & Evaluate	Annual inspection	Internal cost	3.25
Russell Terrace, Macleay Island	Foreshore Protection	Hard structure	$1,378 – $3,038/m	2.25
	Monitor & Evaluate	Annual inspection	Internal cost	3.5
Jock Kennedy Park, Russell Island	Monitor & Evaluate	Annual inspection	Internal cost	3.0
	Foreshore Protection	Hard structure	$1,378 – $3,038/m	3.0
		Revegetate	$17/m^2	3.5
The Boulevard, Russell Island	Monitor & Evaluate	Annual inspection	Internal cost	3.0
	Foreshore Protection	Hard structure	$1,378 – $3,038/m	2.75
Esplanade, Karragarra Island	Foreshore Protection	Hard structure	$1,378 – $3,038/m	3.25
		Beach nourishment	$70/m^3	2.75
	Monitor & Evaluate	Annual inspection	Internal cost	3.0

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Location	Management Options		Planning Cost Estimate (2016$)	MCA Score
	Management Option	Description		
Sweetgum Drive, Lamb Island	Foreshore Protection	Cap closed landfill site	$15,000	3.25
	Monitor & Evaluate	Annual inspection	Internal cost	3.0
Empire Vista, Ormiston	Foreshore Protection	Hard structure	$90,000	2.25
		Revegetate	$17/m^2	2.0
	Monitor & Evaluate	Annual inspection	Internal cost	3.0

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Management Plan

The multi–criteria analysis has identified appropriate management option(s) for each hazard. The next step is to develop specific criteria that will prioritise the identified management options and assist in the development of a recommended management options program.

The below table has been created to illustrate the link between the risk rating determined in the risk assessment process and appropriate timeframes for recommended management options. The timeframes for each option have been attributed in accordance with the level of risk and reflect the 10–year Capital Works program. Note, management options recommending an inspection or survey are expected to be completed annually.

Table: Implementation Timeframes

Risk Rating	Priority	Timeframe
E30 – E50	Very High – hazards with the highest priority that require actions	0–3 years (2016–2019)
H20 – H30	High – hazards with a high priority that need to be addressed in the short term	3–5 years (2019–2021)
M8 – M18	Medium – hazards that require an action in the medium term	5– 9 years (2021 – 2026)
L2 – L8	Low – hazards that are considered to be of low consequence	10+ years (2026+)

Monitor and Evaluate: Where the recommended management action is to monitor and evaluate the identified hazard, it indicates that it has not yet triggered the requirement for intervention and will be subject to an annual inspection program.

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Recommended Management Options

The recommended management options presented in the below represent the outcome of an economic analysis and multi–criteria assessment. In some instances more than one management is identified. In these instances, the management option(s) reflect the diversity of the hazard site and recommend a flexible approach for managing the current hazard. A high–level cost estimate and a priority have been included to assist in the planning and delivery of recommend actions.

Location	Conse-quence rating	Erosion Factor	Risk Rating	Recommended Management Option(s)	Priority	Planning cost estimate* (2016$)
Amity Point	Major	5	E40	Shoreline Erosion Management Plan	Very High	$150,000
Norfolk Beach, Coochiemudlo Island	Medium	3	M18	Monitor – annual survey	Ongoing	$3,000
Main Beach, Coochiemudlo Island	Medium	2	M12	Monitor – annual inspection	Ongoing	Internal Cost
Southeast Beach, Coochiemudlo Island	Low	2	L8	Monitor – annual survey	Ongoing	$3,000
Melaleuca Beach, Coochiemudlo Island	Low	2	L8	Foreshore Protection – beach nourishment	Low	$70/m^3
Northeast Beach, Coochiemudlo Island	Low	2	L8	Monitor – annual survey	Ongoing	$3,000
Morwong Beach, Coochiemudlo Island	Low	1	L4	Upgrade of road and stormwater infrastructure to mitigate the impact upon the foreshore and beach	Low	$35,000
				Monitor – annual Inspection	Ongoing	Internal cost
Red Cliff & Golf Links Beach, Coochiemudlo Island	Medium	2	M12	Geotechnical investigation	Medium	$150,000
				Monitor – annual Inspection	Ongoing	Internal cost
Coochiemudlo Island				Further detailed planning – To refine the existing Shoreline Erosion Study to a Shoreline Erosion Management Plan[12].	Medium	$50,000 – SEMP
Southern NSI – Jumpinpin, North Stradbroke Island	Low	2	L8	Monitor – desktop monitoring	Ongoing	Internal cost
Eighteen Mile Swamp, North Stradbroke Island	Low	2	L8	Monitor– desktop monitoring	Ongoing	Internal cost
Point Lookout – South Gorge, North Stradbroke Island	Medium	2	M12	Monitor – annual inspection	Medium	Internal cost
Point Lookout – Frenchmans Bay, North Stradbroke Island	Medium	2	M12	Monitor – annual inspection	Medium	Internal cost
Point Lookout – Deadmans Headland, North Stradbroke Island	Medium	2	M18	Monitor – annual inspection	Medium	Internal cost

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[12] In 2014 a Shoreline Erosion Study was undertaken for Coochiemudlo which focussed primarily on the eastern beaches with a supplementary extension to the study area to include the northern and southern beaches. With a number of hazard locations identified on Coochiemudlo Island, it is reasonable to create a SEMP, based on existing work, to manage the identified hazards. See page 54.

Location	Conse-quence rating	Erosion Factor	Risk Rating	Recommended Management Option(s)	Priority	Planning cost estimate* (2016$)
Point Lookout – Deadmans Beach, North Stradbroke Island	Medium	2	M12	Monitor – annual inspection	Medium	Internal cost
Point Lookout – Cylinder Headland, North Stradbroke Island	Medium	2	M18	Monitor – Annual inspection	Medium	Internal cost
Point Lookout – Home Beach, North Stradbroke Island	Medium	2	M12	Monitor – Annual inspection	Medium	Internal cost
Flinders Beach, North Stradbroke Island	Medium	2	M12	Monitor – annual inspection	On going	Internal cost
Junner Street, Dunwich	Medium	2	M12	Foreshore Protection – hard structure	Medium	$1,378 – $3,038/m
Polka Point, Dunwich	Medium	4	H24	Further detailed planning	High	$30,000
Queens Esplanade, Thorneside	Medium	2	M12	Foreshore Protection – hard structure	Medium	$1,378 – $3,038/m
3 Paddocks Park, Birkdale	Medium	2	M12	Monitor – annual inspection	Ongoing	Internal cost
Aquatic Paradise Park, Birkdale	Medium	2	M12	Foreshore Protection – hard structure	Medium	$1,378 – $3,038/m
Main Road (Recreational Reserve), Wellington Point	Major	2	M16	Maintain sea wall	Medium	Subject to detailed design
				Foreshore Protection – beach nourishment		$70/m3
				Monitor – annual inspection	Ongoing	Internal cost
Champion Lane, Wellington Point	Medium	2	M18	Monitor – annual inspection	Ongoing	Internal cost
Sleath Street, Ormiston	Low	2	L8	Monitor – annual inspection	Ongoing	Internal cost
Como Street, Ormiston	Low	1	L4	Monitor – annual inspection	Ongoing	Internal cost
Cleveland Point, Cleveland	Medium	2	M12	Maintain sea wall	Medium	Subject to detailed design
				Monitor – annual inspection	Ongoing	Internal cost
GJ Walter Park, Cleveland	Medium	2	M12	Monitor progress of Toondah Harbour PDA	Ongoing	Internal cost
North Boat Ramp, Victoria Point	Medium	2	M12	Monitor – annual inspection	Ongoing	Internal cost
Thompsons Beach, Victoria Point	Medium	2	M12	Foreshore Protection – hard structure	Medium	$1,378 – $3,038/m
Pelican Street, Victoria Point	Low	2	L8	Monitor – annual inspection	Low	Internal cost
Wilson Esplanade, Victoria Point	Medium	2	M12	Foreshore Protection – hard structure	Medium	$1,378 – $3,038/m

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Location	Conse-quence rating	Erosion Factor	Risk Rating	Recommended Management Option(s)	Priority	Planning cost estimate* (2016$)
Weinam Creek Ferry Terminal, Redland Bay	Low	2	L8	Monitor – annual inspection	Low	Internal cost
Bay Street, Redland Bay	Medium	5	E30	Foreshore Protection – hard structure	Very High	$1,378 – $3,038/m
Torquay Road, Redland Bay	Low	1	L4	Monitor – annual inspection	Ongoing	Internal cost
North Street, Redland Bay	Low	1	L4	Foreshore Protection – hard structure	Low	$1,378 – $3,038/m
Brighton Road, Macleay Island	Medium	2	M12	Maintain sea wall	Medium	Subject to detailed design
Coondooroopa Drive, Macleay Island	Low	2	L8	Foreshore Protection – hard structure	Low	$1,378 – $3,038/m
Russell Terrace, Macleay Island	Low	3	M12	Monitor – annual inspection	Ongoing	Internal cost
Jock Kennedy Park, Russell Island	Low	3	M12	Foreshore Protection – revegetate foreshore	Medium	$17/m2
The Boulevard, Russell Island	Low	3	M12	Monitor – annual inspection	Ongoing	Internal cost
Esplanade, Karragarra Island	Medium	3	M18	Foreshore Protection – hard structure	Medium	$1,378 – $3,038/m
Sweetgum Drive, Lamb Island	Low	1	L4	Cap closed landfill site	Low	$15,000
Empire Vista	Low	1	L4	Monitor – annual inspection	Low	Internal cost

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Phase 2 – Emerging Risks: Overview

The next key deliverable of the Coastal Adaptation Strategy is Phase 2 – Emerging Risks. Phase 2 – Emerging Risks will address the coastal hazards that pose 'future risks' to Redlands' coast and foreshore over a longer planning period. The coastal hazards that will be addressed are sea-level rise, storm-tide inundation and erosion-prone areas with a focus on the level of risk towards existing local communities and the relationship between land-use planning and projected growth across the city.

The aim of this phase is to understand the level of risk and vulnerability of critical assets, property and the community from long-term coastal hazards and recommend actions that manage the risk to an acceptable level. Similar to Phase 1, the methodology to complete Phase 2 will be a risk-based approach and a suite of potential management options will be assessed to determine the most suitable actions.

In addition to the key deliverables of this project, a critical element to successfully deliver the project is community consultation and engagement. The aim of the planned consultation process is to engage the community through a conversation that recognises local knowledge, identifies local values and includes science-based scenario planning. The consultation process is a staged approach that will build upon the good faith and trust generated from these conversations. The desired outcome of the consultation and engagement will be to prepare an approach to coastal management that is effectively planned on a continuous process of adaptation to climate change and that preserves options for future generations.

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Conclusion

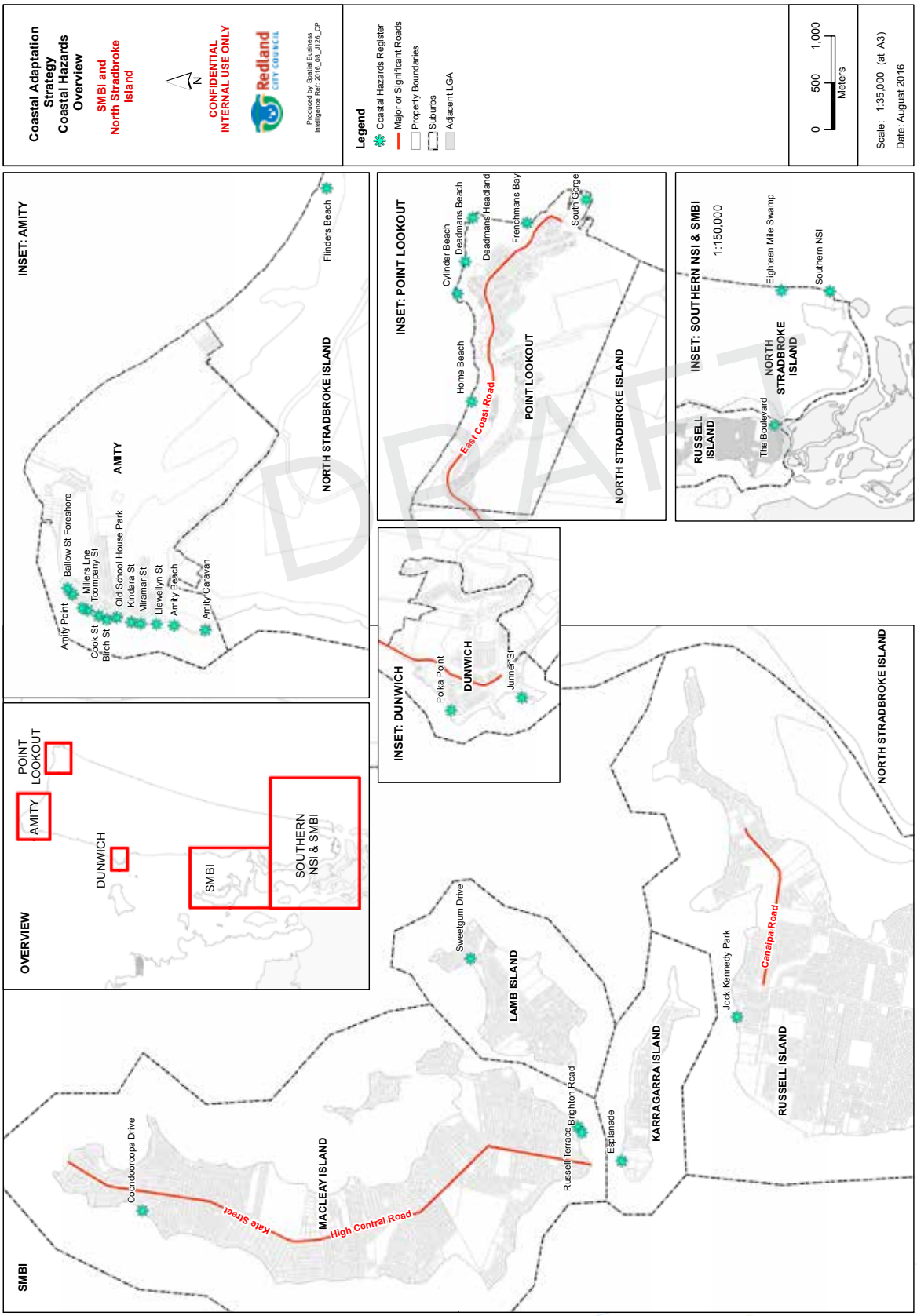
The Coastal Adaptation Strategy: Phase 1 Current Hazard outlines an adaptive and flexible framework for the assessment and management of locations affected by shoreline erosion throughout the City. The assessment framework has been established to be a consistent and repeatable process to determine the level of risk for each identified hazard. The framework also guides the requirement for further assessment to determine the level of risk of an identified hazard location. This was a particularly important aspect due to the dynamic nature of coastal hazards and the wide range of coastal environments that exist within Redland City.

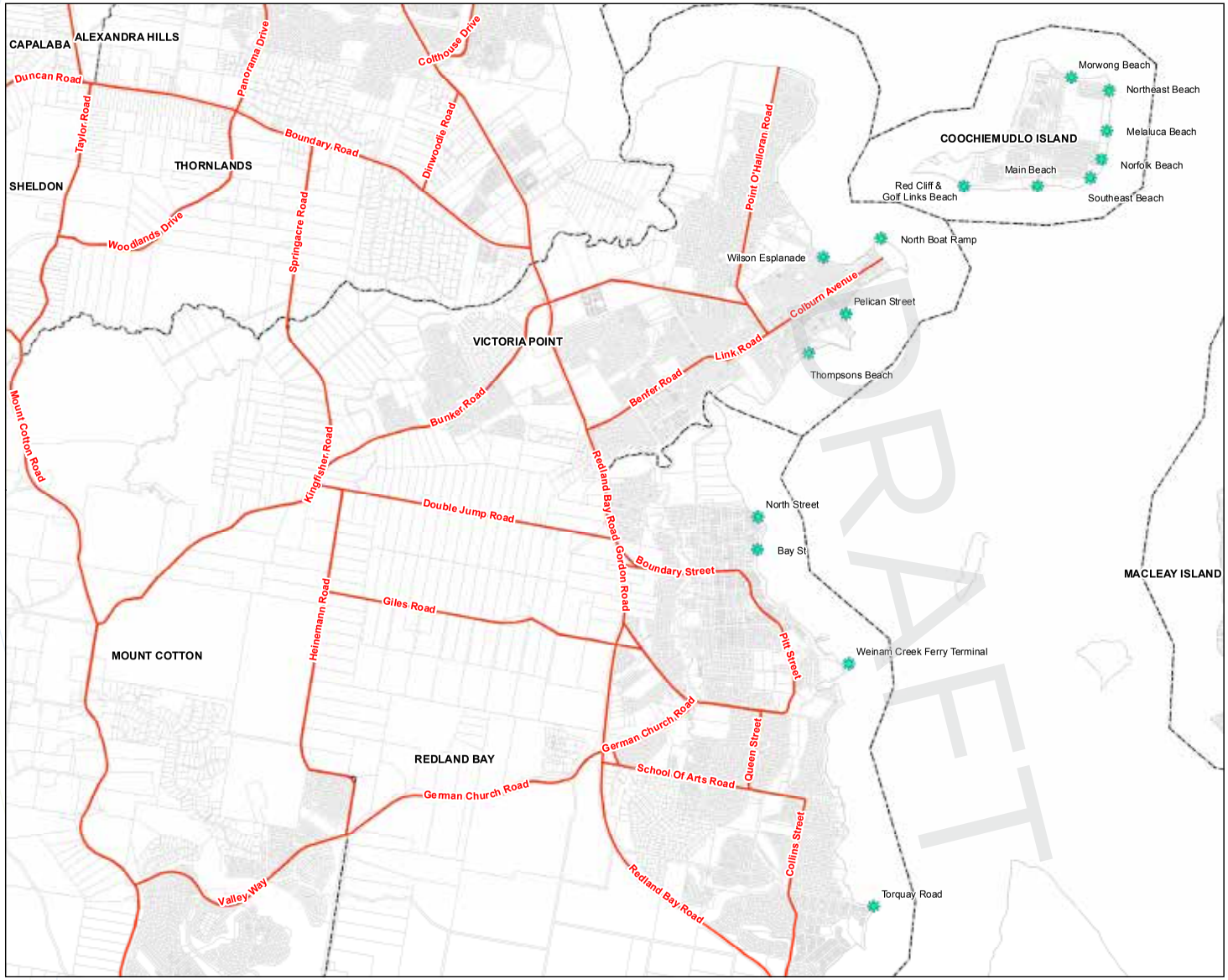
The completion of Phase 1 encourages sustainable management of the foreshore and coastal precinct by providing a consistent and transparent methodology for assessing and prioritising identified hazard areas. The assessment methodology will assist network planners and asset managers in the planning and programming of works programs and also developing specific business cases to undertake management actions.

In addition to the recommended management options in the Management Plan it is proposed that review and re-assessment of all identified coastal hazards be undertaken as part of the annual inspection program (Monitor and Evaluate). Constant monitoring of locations will assist in defining trigger points for when direct intervention is required through management actions to lower the risk level. The inspection program to monitor and evaluate known hazards is a critical element of the Coastal Adaptation Strategy Phase 1: Current Hazards and is inherent in an adaptive and flexible strategy.

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Appendix 1 – Current Hazard Maps





Coastal Adaptation Strategy Coastal Hazards Overview

Southern Mainland

N

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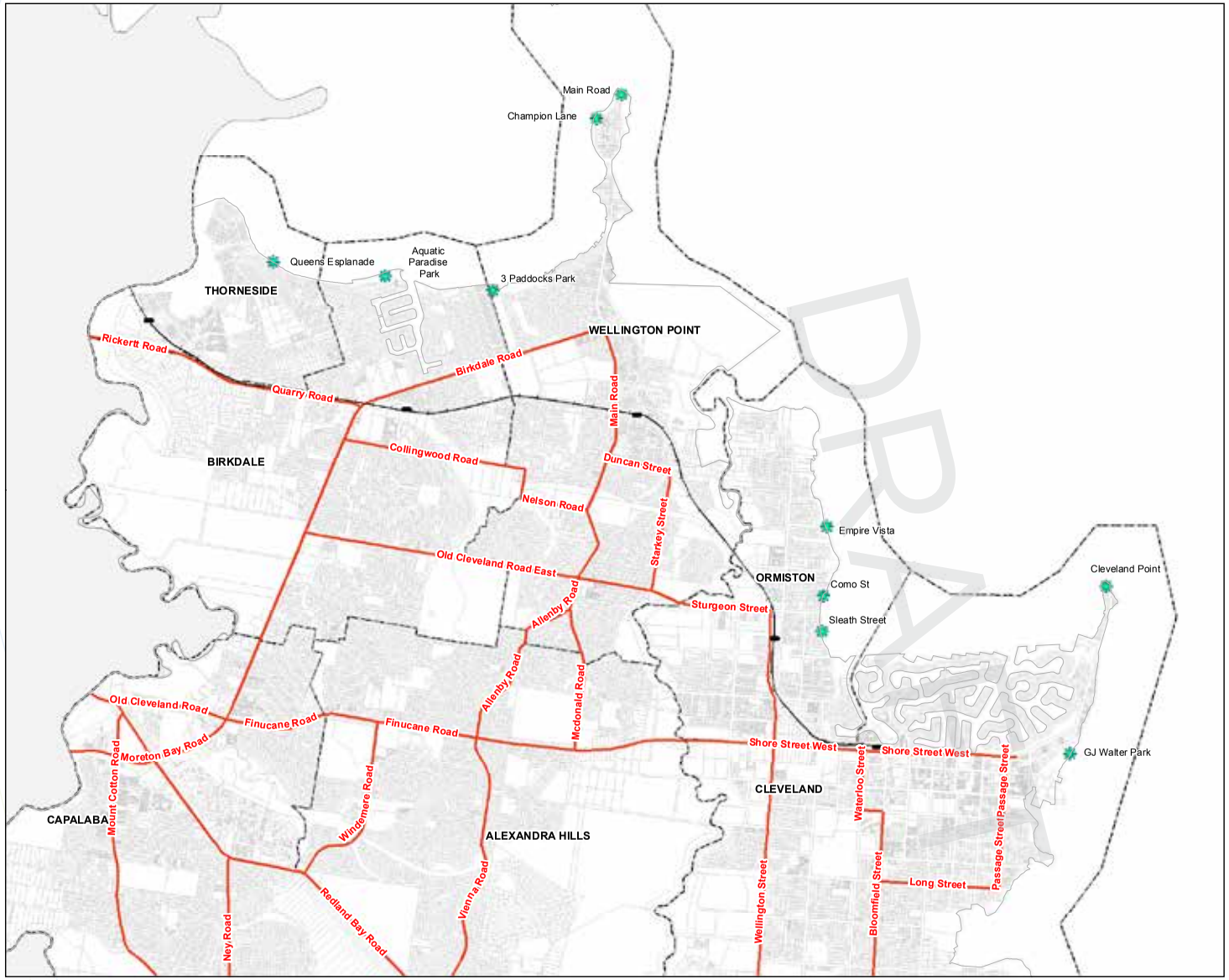
Produced by Spatial Business Intelligence Ref: 2016_08_J126_CP

Legend

- Coastal Hazards Register
- Major or Significant Roads
- Property Boundaries
- Suburbs
- Adjacent LGA

0 500 1,000
Meters

Scale: 1:35,000 (at A3)
Date: August 2016



Coastal Adaptation Strategy
Coastal Hazards Overview

Northern Mainland

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Produced by Spatial Business Intelligence Ref: 2016_11_J159_CP

Legend

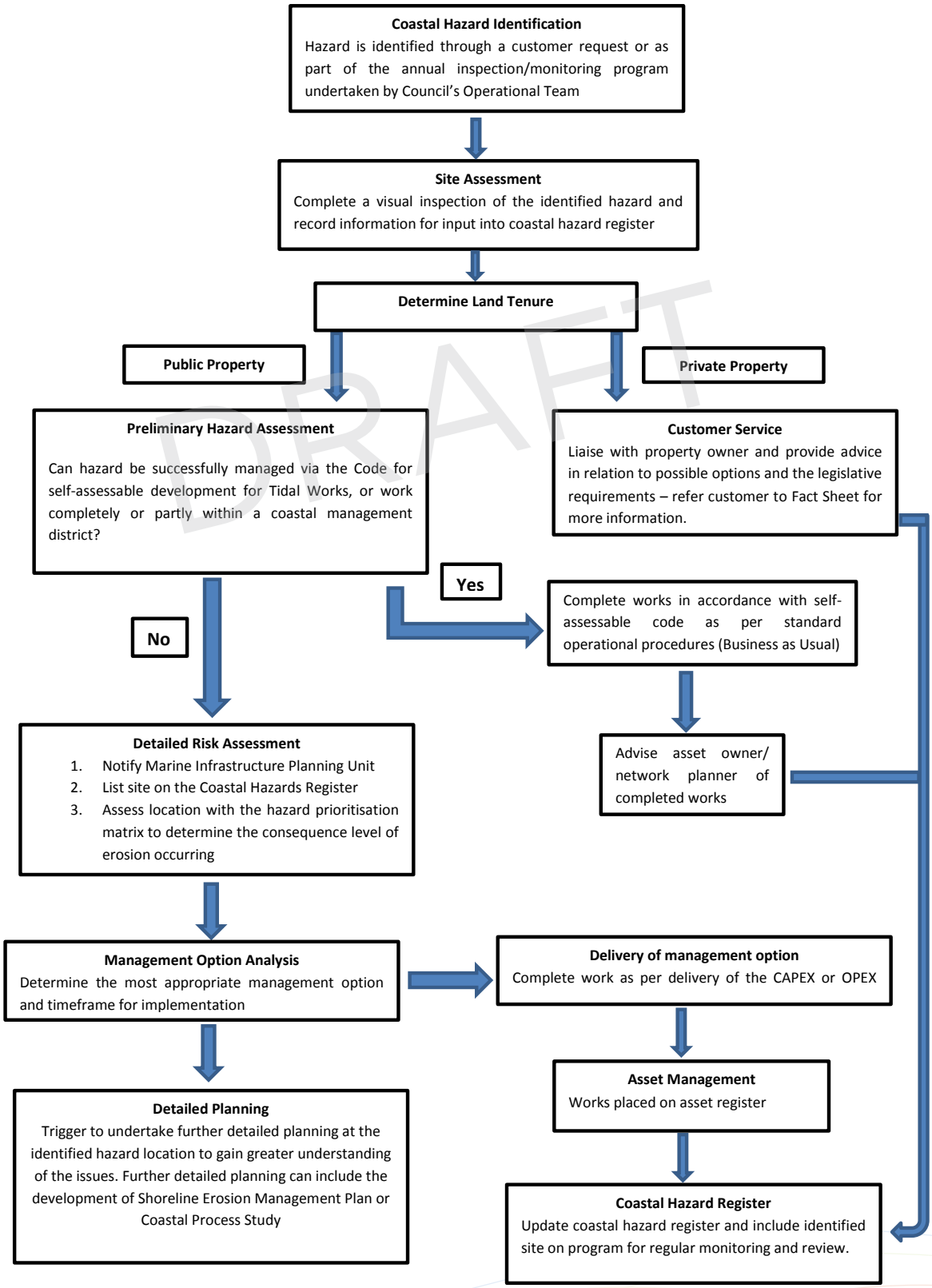
- Coastal Hazards Register
- Major or Significant Roads
- Property Boundaries
- Suburbs
- Adjacent LGA

0 500 1,000
Meters

Scale: 1:35,000 (at A3)
Date: November 2016

Appendix 2 – Hazard Identification Process

Coastal Hazard Identification & Assessment Process



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Appendix 3 – Hazard Assessment Matrix

#	Location	Suburb	ENVIRONMENT							
			Foreshore	Ecological Value					Nature Conservation Act	
			Amount of land at direct risk of erosion (at current rate)	Adjoining terrestrial value (BPA 3.5) & VMA regulated vegetation	Marine Park Zoning	Ramsar	Fish Habitat Area	EPBC listed endangered ecological community	Nature Conservation Act Species Present	Total (average)
1	AMITY POINT		5	1	4	5	1	1	5	3.14
2	Norfolk Beach	Coochiemudlo Island	2	1	3	5	1	1	3	2.29
3	Main Beach	Coochiemudlo Island	4	1	3	5	1	1	3	2.57
4	Southeast Beach	Coochiemudlo Island	2	1	3	5	1	1	3	2.29
5	Melaleuca Beach	Coochiemudlo Island	2	4	3	5	1	1	3	2.71
6	Northeast Beach	Coochiemudlo Island	2	1	3	5	1	1	3	2.29
7	Morwong Beach	Coochiemudlo Island	2	1	3	5	1	3	3	2.57
8	Red Cliff & Golf Links Beach	Coochiemudlo Island	3	4	3	5	1	3	3	3.14
9	Southern NSI – Jumpinpin	North Stradbroke Island	5	2	4	5	1	5	5	3.86
10	Eighteen Mile Swamp	North Stradbroke Island	5	2	3	5	1	1	5	3.14
11	Point Lookout – South Gorge	North Stradbroke Island	3	3	4	5	1	5	5	3.71
12	Point Lookout – Frenchmans Bay	North Stradbroke Island	3	2	4	5	1	5	5	3.57
13	Point Lookout – Deadmans Headland	North Stradbroke Island	2	3	4	5	1	5	5	3.57
14	Point Lookout – Deadmans Beach	North Stradbroke Island	3	2	4	5	1	5	5	3.57
15	Point Lookout – Cylinder Headland	North Stradbroke Island	2	3	4	5	1	5	5	3.57
16	Point Lookout – Home Beach	North Stradbroke Island	4	2	3	5	1	5	5	3.57
17	Flinders Beach	North Stradbroke Island	5	4	3	5	1	1	1	2.86
18	Junner Street	Dunwich	2	1	2	1	1	3	3	1.86
19	Polka Point	Dunwich	2	1	3	1	1	3	3	2.00
20	Queens Esplanade	Thorneside	2	2	3	5	1	5	2	2.86
21	3 Paddocks Park	Birkdale	2	2	3	5	1	5	1	2.71
22	Aquatic Paradise Park	Birkdale	1	2	3	5	1	1	1	2.00
23	Main Road	Wellington Point	2	5	3	5	1	5	1	3.14
24	Champion Lane	Wellington Point	2	4	3	5	1	1	1	2.43
25	Sleath Street	Ormiston	1	2	3	5	1	3	3	2.57
26	Como Street	Ormiston	1	4	3	5	1	3	3	2.86

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SOCIAL					ECONOMIC						
Visual Amenity	Recreation	Cultural heritage	Population		Infrastructure value ($)	Property value ($)					
Public viewing locations seen landscapes view corridors	Loss of recreation use	listed Aboriginal heritage, European heritage sites	The number of properties directly affected by the identified hazard	Total (average)	Value of public infrastructure	Unimproved land value	Total (average)	Total average score	Consequence Rating	Erosion Factor	Risk Rating
4	3	3	3	3.25	5	5	5.00	11.39	Major	5	E40
3	2	3	1	2.25	2	1	1.50	6.04	Medium	3	M18
3	3	3	1	2.50	4	1	2.50	7.57	Medium	2	M12
2	2	3	1	2.00	1	1	1.00	5.29	Low	2	L8
3	2	2	1	2.00	1	1	1.00	5.71	Low	2	L8
2	2	1	1	1.50	1	1	1.00	4.79	Low	2	L8
2	2	2	1	1.75	1	1	1.00	5.32	Low	1	L4
3	1	3	1	2.00	5	1	3.00	8.14	Medium	2	M12
1	1	1	1	1.00	1	1	1.00	5.86	Low	2	L8
1	1	1	1	1.00	1	1	1.00	5.14	Low	2	L8
3	4	3	1	2.75	1	1	1.00	7.46	Medium	2	M12
2	2	3	1	2.00	1	1	1.00	6.57	Medium	2	M12
2	2	3	1	2.00	1	1	1.00	6.57	Medium	2	M12
2	2	3	1	2.00	1	1	1.00	6.57	Medium	2	M12
2	2	3	1	2.00	1	1	1.00	6.57	Medium	2	M12
2	2	3	1	2.00	1	1	1.00	6.57	Medium	2	M12
3	4	1	1	2.25	1	1	1.00	6.11	Medium	2	M12
4	2	5	1	3.00	5	2	3.50	8.36	Medium	2	M12
4	1	5	1	2.75	1	2	1.50	6.25	Medium	4	H24
3	3	1	1	2.00	2	3	2.50	7.36	Medium	2	M12
1	1	1	1	1.00	2	3	2.50	6.21	Medium	2	M12
1	1	1	1	1.00	2	5	3.50	6.50	Medium	2	M12
3	3	2	1	2.25	4	5	4.50	9.89	Major	2	M16
4	2	1	1	2.00	1	5	3.00	7.43	Medium	2	M18
1	1	2	1	1.25	1	1	1.00	4.82	Low	2	L8
2	1	2	1	1.50	1	1	1.00	5.36	Low	1	L4

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#	Location	Suburb	ENVIRONMENT							
			Foreshore	Ecological Value					Nature Conservation Act	Total (average)
			Amount of land at direct risk of erosion (at current rate)	Adjoining terrestrial value (BPA 3.5) & VMA regulated vegetation	Marine Park Zoning	Ramsar	Fish Habitat Area	EPBC listed endangered ecological community	Nature Conservation Act Species Present	
27	Cleveland Point	Cleveland	2	1	3	5	1	5	3	2.86
28	GJ Walter Park	Cleveland	1	1	3	5	1	1	1	1.86
29	North Boat Ramp	Victoria Point	2	1	3	5	1	1	1	2.00
30	Thompsons Beach	Victoria Point	2	1	3	5	1	1	1	2.00
31	Pelican Street	Victoria Point	2	1	3	5	1	1	1	2.00
32	Wilson Esplanade	Victoria Point	2	1	3	5	1	1	1	2.00
33	Weinam Creek Ferry Terminal	Redland Bay	2	1	2	1	1	1	3	1.57
34	Bay St	Redland Bay	2	1	3	5	1	1	1	2.00
35	Torquay Road	Redland Bay	2	2	3	5	1	1	1	2.14
36	North Street	Redland Bay	1	2	3	5	1	1	1	2.00
37	Brighton Road	Macleay Island	2	1	3	5	1	1	1	2.00
38	Coondooroopa Drive	Macleay Island	1	1	3	5	1	1	1	1.86
39	Russell Terrace	Macleay Island	1	4	3	5	1	1	1	2.29
40	Jock Kennedy Park	Russell Island	2	1	3	5	1	1	1	2.00
41	The Boulevard	Russell Island	2	1	3	5	1	1	1	2.00
42	Esplanade	Karragarra Island	2	4	3	5	1	1	1	2.43
43	Sweetgum Drive	Lamb Island	1	2	3	5	1	1	1	2.00
44	Empire Vista	Ormiston	1	2	3	5	1	3	3	2.57

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SOCIAL					ECONOMIC						
Visual Amenity	Recreation	Cultural heritage	Population		Infrastructure value ($)	Property value ($)					
Public viewing locations seen landscapes view corridors	Loss of recreation use	listed Aboriginal heritage, European heritage sites	The number of properties directly affected by the identified hazard	Total (average)	Value of public infrastructure	Unimproved land value	Total (average)	Total average score	Consequence Rating	Erosion Factor	Risk Rating
3	3	2	1	2.25	3	4	3.50	8.61	Medium	1	L5
1	1	2	1	1.25	2	5	3.50	6.61	Medium	1	L6
3	1	3	1	2.00	3	1	2.00	6.00	Medium	1	L7
4	4	3	1	3.00	3	4	3.50	8.50	Medium	1	L8
2	1	3	1	1.75	2	1	1.50	5.25	Low	1	L9
2	2	3	1	2.00	2	3	2.50	6.50	Medium	1	L10
2	2	1	1	1.50	4	1	2.50	5.57	Low	1	L11
2	3	1	1	1.75	3	2	2.50	6.25	Medium	1	L12
1	1	1	1	1.00	1	1	1.00	4.14	Low	1	L13
2	2	1	1	1.50	2	1	1.50	5.00	Low	1	L14
2	3	1	1	1.75	5	1	3.00	6.75	Medium	1	L15
2	2	1	1	1.50	2	1	1.50	4.86	Low	1	L16
2	1	1	1	1.25	1	2	1.50	5.04	Low	1	L17
1	1	1	1	1.00	2	3	2.50	5.50	Low	1	L18
2	3	2	1	2.00	1	1	1.00	5.00	Low	1	L19
2	1	1	1	1.25	4	1	2.50	6.18	Medium	1	L20
1	1	1	1	1.00	1	1	1.00	4.00	Low	1	L21
1	1	2	1	1.25	1	1	1	4.82	Low	1	L4

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Appendix 4 – Management Option Analysis

Location	Rating	Erosion Factor	Management Options	Cost Estimate ($)	Effec-tive-ness	Value For Money	Environ-mental Impacts	Social Impacts	Total	Weighted Score
Amity Point	E40	5	SEMP (underway)	$150,000						
Norfolk Beach, Coochiemudlo Island	M18	3	Monitor – annual survey	$3500 – 7000	2	4	4	2	3	3
			Beach nourishment	$70/m³	3	2	3	2	2.5	2.5
			Further detailed planning – refinement of SES to a SEMP	$50,000	3	3	3	3	3	3
			Hard structure	$1,378 – $3,038/m	3	1	2	2	2	2
Main Beach, Coochiemudlo Island	M12	2	Beach nourishment	$70/m³	3	3	3	3	3	3
			Further detailed planning – refinement of SES to a SEMP	$50,000	3	3	3	3	3	3
			Monitor – annual inspection	$3500 – 7000	3	4	4	3	3.5	3.5
Southeast Beach, Coochiemudlo Island	L8	2	Monitor – annual survey	$3500 – 7000	3	4	4	3	3.5	3.5
			Dune revegetation	$17/m²	2	4	3	3	3	3
			Further detailed planning – refinement of SES to a SEMP	$50,000	3	3	3	3	3	3
			Beach nourishment	$70/m³	4	3	3	3	3.25	3.3
Melaleuca Beach, Coochiemudlo Island	L8	2	Beach nourishment	$70/m³	3	3	3	3	3	3
			Hard structure	$1,378 – $3,038/m	4	1	2	2	2.25	2.3
			Dune revegetation	$17/m²	3	3	3	3	3	3
			Further detailed planning – refinement of SES to a SEMP	$50,000	3	3	3	3	3	3
			Monitor – annual survey	$3500 – 7000	2	4	4	3	3.25	3.2
Northeast Beach, Coochiemudlo Island	L8	2	Rock groyne to extend 'control point'	$1,378 – $3,038/m	4	1	1	2	2	2.1
			Further detailed planning – refinement of SES to a SEMP	$50,000	3	3	3	3	3	3
			Beach nourishment	$70/m³	2	2	3	2	2.25	2.2
			Monitor – annual survey	$3500 – 7000	1	4	4	3	3	2.9
			Hard structure	$1,378 – $3,038/m	4	1	1	2	2	2.1

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Location	Rating	Erosion Factor	Management Options	Cost Estimate ($)	Effec-tive-ness	Value For Money	Environ-mental Impacts	Social Impacts	Total	Weighted Score
Morwong Beach, Coochiemudlo Island	L4	1	Upgrade stormwater infrastructure – Improve overland flow path to prevent erosion to beach	$35,000	3	3	2	3	2.75	2.8
			Further detailed planning – refinement of SES to a SEMP	$50,000	3	3	3	3	3	3
			Beach nourishment	$70/m^3	2	3	3	3	2.75	2.7
			Monitor – annual Inspection	Internal cost	3	4	4	4	3.75	3.7
Red Cliff & Golf Links Beach, Coochiemudlo Island	M12	2	Hard structure	$1,378 – $3,038/m	4	3	2	3	3	3.1
			Beach nourishment	$70/m^3	3	2	3	3	2.75	2.7
			Further detailed planning – refinement of SES to a SEMP	$50,000	3	3	3	3	3	3
			Geotechnical investigation	$150,000	3	3	3	3	3	3
			Monitor – annual Inspection	Internal cost	3	4	4	3	3.5	3.5
Southern NSI – Jumpinpin, North Stradbroke Island	L8	2	Beach nourishment	$70/m^3	1	1	3	4	2.25	2
			Monitor – annual Inspection	Internal cost	3	4	4	3	3.5	3.5
Eighteen Mile Swamp, North Stradbroke Island	L8	2	Beach nourishment	$70/m^3	1	1	3	2	1.75	1.6
			Monitor – annual Inspection	Internal cost	3	4	4	3	3.5	3.5
Point Lookout – South Gorge, North Stradbroke Island	M12	2	Beach nourishment	$70/m^3	1	1	3	2	1.75	1.6
			Monitor – annual Inspection	Internal cost	3	4	4	3	3.5	3.5
Point Lookout – Frenchmans Bay, North Stradbroke Island	M12	2	Beach nourishment	$70/m^3	1	1	3	2	1.75	1.6
			Hard structure	$1,378 – $3,038/m	4	1	2	2	2.25	2.3
			Monitor – annual Inspection	Internal cost	3	4	4	4	3.75	3.7
Point Lookout – Deadmans Headland, North Stradbroke Island	M18	2	Beach nourishment	$70/m^3	1	1	3	4	2.25	2
			Hard structure	$1,378 – $3,038/m	3	1	2	1	1.75	1.8
			Monitor – annual inspection	Internal cost	3	4	4	3	3.5	3.5
Point Lookout – Deadmans Beach, North Stradbroke Island	M12	2	Beach nourishment	$70/m^3	3	1	3	2	2.25	2.2
			Hard structure	$1,378 – $3,038/m	3	1	2	1	1.75	1.8
			Monitor – annual inspection	Internal cost	3	4	4	3	3.5	3.5

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Location	Rating	Erosion Factor	Management Options	Cost Estimate ($)	Effec-tive-ness	Value For Money	Environ-mental Impacts	Social Impacts	Total	Weighted Score
Point Lookout – Cylinder Headland, North Stradbroke Island	M18	2	Beach nourishment	$70/m^3	3	1	3	2	2.25	2.2
			Monitor – annual inspection	Internal cost	3	4	4	4	3.75	3.7
Point Lookout – Home Beach, North Stradbroke Island	M12	2	Beach nourishment	$70/m^3	1	1	3	3	2	1.8
			Hard structure	$1,378 – $3,038/m	3	1	2	1	1.75	1.8
			Monitor – annual inspection	Internal cost	3	4	4	3	3.5	3.5
Flinders Beach, North Stradbroke Island	M12	2	Beach nourishment	$70/m^3	1	1	3	3	2	1.8
			Hard structure	$1,378 – $3,038/m	3	1	2	1	1.75	1.8
			Monitor – annual inspection	Internal cost	3	4	4	3	3.5	3.5
			Dune revegetation	$17/m^2	3	3	3	3	3	3
Junner Street, Dunwich	M12	2	Hard structure	$1,378 – $3,038/m	4	4	2	3	3.25	3.4
			Monitor – Annual Inspection	Internal cost	1	4	4	3	3	2.9
Polka Point Dunwich	H24	4	Bank stabilisation (vegetative works)	$17/m^2	3	2	3	3	2.75	2.7
			Monitor – annual inspection	Internal cost	3	4	3	1	2.75	2.9
			Hard structure	$1,378 – $3,038/m	4	3	2	3	3	3.1
			Further detailed planning	$50,000	3	4	4	3	3.5	3.5
			Beach nourishment	$70/m^3	4	2	3	3	3	3
Queens Esplanade, Thorneside	M12	2	Beach nourishment	$70/m^3	3	3	3	3	3	3
			Hard structure	$1,378 – $3,038/m	4	4	2	3	3.25	3.4
			Monitor – Annual Inspection	Internal cost	2	4	3	3	3	3
3 Paddocks Park, Birkdale	M12	2	Hard Structure	$1,378 – $3,038/m	4	2	2	2	2.5	2.6
			Beach nourishment	$70/m^3	2	2	2	3	2.25	2.2
			Foreshore revegetation	$17/m^2	2	3	3	3	2.75	2.7
			Monitor – annual inspection	Internal cost	3	4	4	3	3.5	3.5
Aquatic Paradise Park, Birkdale	M12	2	Hard structure	$1,378 – $3,038/m	4	4	2	3	3.25	3.4
			Beach nourishment	$70/m^3	3	3	3	3	3	3
			Bank stabilisation/vegetative work	$17/m^2	2	2	3	3	2.5	2.4
			Monitor – annual inspection	Internal cost	3	4	4	3	3.5	3.5

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Location	Rating	Erosion Factor	Management Options	Cost Estimate ($)	Effec-tive-ness	Value For Money	Environ-mental Impacts	Social Impacts	Total	Weighted Score
Main Road, Wellington Point	M16	2	Maintain sea wall	1% construction cost	4	3	3	3	3.25	3.3
			Beach nourishment	$70/m^3	4	3	3	3	3.25	3.3
			Monitor – annual inspection	Internal cost	3	4	4	3	3.5	3.5
Champion Lane, Wellington Point	M18	2	Hard structure	$1,378 – $3,038/m	4	1	3	3	2.75	2.7
			Beach nourishment	$70/m^3	2	3	3	3	2.75	2.7
			Revegetation	$17/m^2	2	3	3	3	2.75	2.7
			Monitor – annual inspection	Internal cost	1	4	4	3	3	2.9
Sleath Street, Ormiston	L8	2	Revegetation	$17/m^2	2	3	4	3	3	2.9
			Monitor – annual inspection	Internal cost	3	4	4	3	3.5	3.5
Como Street, Ormiston	L4	1	Revegetation	$17/m^2	2	3	4	3	3	2.9
			Monitor – annual inspection	Internal cost	3	4	4	3	3.5	3.5
			Hard structure	$1,378 – $3,038/m	4	1	3	2	2.5	2.5
Cleveland Point, Cleveland	M12	2	Maintain sea wall	1% construction cost	4	4	3	3	3.5	3.6
			Monitor – annual inspection	Internal cost	3	4	4	3	3.5	3.5
GJ Walter Park, Cleveland	M12	2	Hard structure	$1,378 – $3,038/m	4	1	2	3	2.5	2.5
			Monitor progress of Toondah Harbour PDA	Internal cost	3	4	4	4	3.75	3.7
North Boat Ramp, Victoria Point	M12	2	Revegetate foreshore	$17/m^2	2	3	4	3	3	2.9
			Hard structure	$1,378 – $3,038/m	4	4	2	2	3	3.2
			Monitor – annual inspection	Internal cost	3	4	4	3	3.5	3.5
Thompson Street, Victoria Point	M12	2	Project – sea wall and beach nourishment	$2M	4	4	3	3	3.5	3.6
			Monitor – annual inspection	Internal cost	3	4	4	3	3.5	3.5
Pelican Street, Victoria Point	L8	2	Beach nourishment and profiling	$70/m^3	3	2	3	3	2.75	2.7
			Hard structure	$1,378 – $3,038/m	4	1	2	3	2.5	2.5
			Monitor – annual inspection	Internal cost	3	3	4	3	3.25	3.2

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Location	Rating	Erosion Factor	Management Options	Cost Estimate ($)	Effec-tive-ness	Value For Money	Environ-mental Impacts	Social Impacts	Total	Weighted Score
Wilson Esplanade, Victoria Point	M12	2	Monitor – annual inspection	Internal cost	3	4	4	3	3.5	3.5
			Hard structure	$1,378 – $3,038/m	4	4	2	3	3.25	3.4
			Beach nourishment	$70/m^3	4	4	3	4	3.75	3.8
Weinam Creek Ferry Terminal, Redland Bay	L8	2	Maintain sea wall	1% construction cost	4	3	2	3	3	3.1
			Monitor – annual inspection	Internal cost	3	4	3	4	3.5	3.5
Bay Street, Redland Bay	E30	5	Hard structure	$1,378 – $3,038/m	4	4	2	3	3.25	3.4
			Beach nourishment	$70/m^3	2	2	3	3	2.5	2.4
			Monitor – annual inspection	Internal cost	3	4	4	2	3.25	3.3
Torquay Road, Redland Bay	L4	1	Hard structure	$1,378 – $3,038/m	4	1	2	2	2.25	2.3
			Monitor – annual inspection	Internal cost	3	4	4	3	3.5	3.5
North Street, Redland Bay	L4	1	Hard structure	$1,378 – $3,038/m	4	3	2	4	3.25	3.3
			Monitor – annual inspection	Internal cost	3	4	4	3	3.5	3.5
			Beach nourishment	$70/m^3	2	3	3	4	3	2.9
Brighton Road, Macleay Island	M12	2	Maintain sea wall	1% construction cost	4	4	2	3	3.25	3.4
			Monitor – annual inspection	Internal cost	3	4	4	3	3.5	3.5
Coondooroopa Drive, Macleay Island	L8	2	Hard structure	$1,378 – $3,038/m	4	4	2	3	3.25	3.4
			Beach nourishment	$70/m^3	3	3	3	3	3	3
			Monitor – annual inspection	Internal cost	3	4	4	2	3.25	3.3
Russell Terrace, Macleay Island	M12	3	Hard structure	$1,378 – $3,038/m	4	1	2	2	2.25	2.3
			Monitor – annual inspection	Internal cost	3	4	4	3	3.5	3.5
Jock Kennedy Park, Russell Island	L3	3	Revegetate foreshore	$17/m^2	3	4	4	3	3.5	3.5
			Monitor – annual inspection	Internal cost	3	4	3	2	3	3.1
			Hard structure	$1,378 – $3,038/m	4	3	2	3	3	3.1

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Location	Rating	Erosion Factor	Management Options	Cost Estimate ($)	Effec-tive-ness	Value For Money	Environ-mental Impacts	Social Impacts	Total	Weighted Score
The Boulevard, Russell Island	M12	3	Monitor – annual inspection	Internal cost	3	4	3	2	3	3.1
			Hard structure	$1,378 – $3,038/m	4	2	2	3	2.75	2.8
Esplanade, Karragarra Island	M18	3	Hard structure	$1,378 – $3,038/m	4	4	2	3	3.25	3.4
			Beach nourishment	$70/m^3	3	3	2	3	2.75	2.8
			Monitor – Annual Inspection	Internal cost	3	2	4	3	3	2.9
Sweetgum Drive, Lamb Island	L4	1	Cap closed landfill site	$15,000	4	3	3	3	3.25	3.3
			Monitor – annual inspection	Internal cost	3	4	2	3	3	3.1
Empire Vista, Ormiston	L4	1	Hard structure	$1,378 – $3,038/m	4	1	2	2	2.25	2.3
			Foreshore protection	$17/m^2	3	1	2	2	2	2
			Monitor – annual inspection	Internal cost	2	4	3	3	3	3

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