6 RISK ASSESSMENT

The section presents the findings of the qualitative and quantitative risk assessments, which were conducted in accordance with the methodologies described in Sections 2.7.1 and 2.7.2 respectively. The assessments assesses the potential risk from shoreline erosion to those values and uses of the study area identified in Section 5, assuming that there is no change in the current approach to shoreline management. The risk assessment findings effectively summarise the potential impacts of shoreline erosion if a management policy of No Active Intervention (i.e. do nothing) is adopted.

The risk assessment have been conducted for all four planning horizons (2030, 2050, 2070 and 2100) in order to gain appreciation as to how the level of risk is likely to change over time.

6.1 Qualitative Risk Assessment Findings

The results of the qualitative risk assessment are summarised in Tables 6.1-6.5. The full assessments can be found in Appendix B.

The qualitative assessment highlights that the recurrent risk from storm events dominates the risk profile in the short term (2030), however, the risk from shoreline recession and SLR becomes increasingly important and dominates the risk profile in the later planning horizons (2050 and 2100). It is also important to note that the level of risk increases in future for all locations due to projected increases in storm activity, as well as SLR.

In order to identify locations subject to the highest levels of existing risk, a comparison was made between the risk ratings for storm events in the 2030 planning horizon. Management Zone 1 generally has the highest level of risk. Although the level of development in Management Zone 1 is not as high as for other areas, the lack of coastal protection works and their poor condition where they do exist, is such that freehold properties are under threat from shoreline erosion in the present day. The next highest level of risk from shoreline erosion in the present day is found in Management Zone 3. This is due to the high levels of development in this zone, and the concentration of freehold residential and commercial activities in this area. However, the highest risk to public safety in the present day would be expected to occur in Management Zone 3, not Management Zone 1. This is due to the frequent visitation and use of the area by people.

Considering other values and uses of the coastal zone, Management Zone 3 is also subject to high levels of risk due to the concentration of commercial activities including tourism, high amenity recreational activities and high rates of recreational utilisation.

Management Zone 2, Point Vernon, is generally subject to the lowest level of risk due to the presence of rock (i.e. that would limit shoreline erosion), the steep topography (that would limit SLR inundation) and the lower development densities in this area. Management Zones 1 and 5 are known to be subject to risk from shoreline erosion, and are at present experiencing erosion issues that are threatening assets. However, the lower development intensities of these areas generally result in lower levels of risk.

The qualitative risk assessment also highlights the risk to critical infrastructure, which as previously discussed, can have wider impacts beyond the area directly affected by shoreline erosion or SLR inundation. There is evidence that some critical infrastructure has already been impacted by shoreline erosion. A review of the mapping of EPAs (Figures 3.9-3.13) shows that there are some locations where the cadastral boundaries for land parcels or roads are actually located seaward of the toe of dune line. Figure 6.1 shows a telecommunications cable lying on the beach, exposed after a storm in April 2011. At the location shown in Figure 6.2, evidence of the progressive shoreline erosion can be seen by the amount of fallen trees that are shown on the beach, and also the exposed drainage infrastructure that can be seen in the background.

Figure 6.1: Exposed Telecommunications Cable

Figure 6.2: Fallen Vegetation and Exposed Drainage Infrastructure

Table 6.1: Management Zone 1 – Burrum Heads to Eli Creek

Aspect	Source of Risk	2030	2050	2070	2100
Environmental Values					
Soils	Storm Event	20	12	12	8
	Long Term Erosion & Sea Level Rise Inundation	12	6	4	1
Intertidal & foreshore habitat	Storm Event	25	16	9	4
	Long Term Erosion & Sea Level Rise Inundation	16	9	4	1
Coastal creeks & wetlands	Storm Event	25	20	12	8
	Long Term Erosion & Sea Level Rise Inundation	16	9	6	2
Critical Infrastructure					
Roads	Storm Event	16	12	6	2
	Long Term Erosion & Sea Level Rise Inundation	16	9	6	1
Stormwater	Storm Event	12	9	6	2
	Long Term Erosion & Sea Level Rise Inundation	16	9	4	1
Potable water & sewer	Storm Event	16	12	9	4
	Long Term Erosion & Sea Level Rise Inundation	16	9	6	2
Evacuation routes	Storm Event	15	12	6	1
	Long Term Erosion & Sea Level Rise Inundation	15	12	6	1
Social Values – Recreational Access and Amenity					
Foreshore Parks	Storm Event	16	12	6	2
	Long Term Erosion & Sea Level Rise Inundation	16	12	6	2
Public access	Storm Event	16	12	6	2
	Long Term Erosion & Sea Level Rise Inundation	20	16	9	4
Recreational facilities	Storm Event	16	12	3	2
	Long Term Erosion & Sea Level Rise Inundation	20	16	12	4
Socio-Economic Values – Commercial Values					
Freehold (residential) assets	Storm Event	9	9	6	2
	Long Term Erosion & Sea Level Rise Inundation	16	12	6	2
Commercial assets	Storm Event	16	12	9	4
	Long Term Erosion & Sea Level Rise Inundation	16	12	9	4
Tourist Parks	Storm Event	9	6	4	1
	Long Term Erosion & Sea Level Rise Inundation	16	12	9	4
Social Values – Cultural Heritage, Visual Amenity, Public Health and Safety					
Public safety	Storm Event	12	8	8	8
	Long Term Erosion & Sea Level Rise Inundation	20	16	16	16
Public health/lifestyle	Storm Event	16	16	9	6
	Long Term Erosion & Sea Level Rise Inundation	12	9	4	1
Cultural heritage	Storm Event	20	16	12	6
	Long Term Erosion & Sea Level Rise Inundation	20	16	12	6
Social disruption	Storm Event	12	12	8	8
	Long Term Erosion & Sea Level Rise Inundation	16	9	4	1
Visual amenity	Storm Event	16	12	6	3
	Long Term Erosion & Sea Level Rise Inundation	16	9	4	1

Table 6.2: Management Zone 2 – Point Vernon

Aspect	Source of Risk	2030	2050	2070	2100
Environmental Values					
Soils	Storm Event	25	25	20	20
	Long Term Erosion & Sea Level Rise Inundation	20	20	12	12
Intertidal & foreshore habitat	Storm Event	20	20	12	12
	Long Term Erosion & Sea Level Rise Inundation	20	16	12	9
Coastal creeks & wetlands	Storm Event	20	20	12	8
	Long Term Erosion & Sea Level Rise Inundation	16	9	6	2
Critical Infrastructure					
Roads	Storm Event	16	12	6	2
	Long Term Erosion & Sea Level Rise Inundation	16	9	6	1
Stormwater	Storm Event	16	9	6	2
	Long Term Erosion & Sea Level Rise Inundation	16	9	4	1
Potable water & sewer	Storm Event	16	12	9	4
	Long Term Erosion & Sea Level Rise Inundation	16	9	6	2
Evacuation routes	Storm Event	15	12	6	1
	Long Term Erosion & Sea Level Rise Inundation	15	12	6	1
Social Values – Recreational Access and Amenity					
Foreshore Parks	Storm Event	16	12	6	2
	Long Term Erosion & Sea Level Rise Inundation	16	12	6	2
Public access	Storm Event	16	12	6	2
	Long Term Erosion & Sea Level Rise Inundation	20	16	9	4
Recreational facilities	Storm Event	16	12	3	2
	Long Term Erosion & Sea Level Rise Inundation	20	16	12	4
Socio-Economic Values – Commercial Values					
Freehold (residential) assets	Storm Event	20	12	6	2
	Long Term Erosion & Sea Level Rise Inundation	16	12	6	2
Commercial assets	Storm Event	16	12	9	4
	Long Term Erosion & Sea Level Rise Inundation	16	12	9	4
Social Values – Cultural Heritage, Visual Amenity, Public Health and Safety					
Public safety	Storm Event	16	16	12	12
	Long Term Erosion & Sea Level Rise Inundation	20	20	16	16
Public health/lifestyle	Storm Event	20	16	16	12
	Long Term Erosion & Sea Level Rise Inundation	20	16	16	9
Cultural heritage	Storm Event	20	16	12	6
	Long Term Erosion & Sea Level Rise Inundation	20	16	12	9
Social disruption	Storm Event	16	16	12	12
	Long Term Erosion & Sea Level Rise Inundation	20	12	6	4
Visual amenity	Storm Event	20	16	16	9
	Long Term Erosion & Sea Level Rise Inundation	20	16	16	9

Table 6.3: Management Zone 3 – Pialba to Urangan

Aspect	Source of Risk	2030	2050	2070	2100
Environmental Values					
Soils	Storm Event	16	12	9	6
	Long Term Erosion & Sea Level Rise Inundation	16	9	6	2
Intertidal & foreshore habitat	Storm Event	25	16	9	4
	Long Term Erosion & Sea Level Rise Inundation	16	12	6	2
Coastal creeks & wetlands	Storm Event	20	20	12	8
	Long Term Erosion & Sea Level Rise Inundation	16	9	6	2
Critical Infrastructure					
Roads	Storm Event	16	12	6	2
	Long Term Erosion & Sea Level Rise Inundation	16	9	6	1
Stormwater	Storm Event	12	9	6	2
	Long Term Erosion & Sea Level Rise Inundation	16	9	4	1
Potable water & sewer	Storm Event	16	12	9	4
	Long Term Erosion & Sea Level Rise Inundation	16	9	6	2
Gas	Storm Event	20	16	9	4
	Long Term Erosion & Sea Level Rise Inundation	20	16	9	2
Evacuation routes	Storm Event	16	12	6	1
	Long Term Erosion & Sea Level Rise Inundation	16	12	6	1
Social Values – Recreational Access and Amenity					
Foreshore Parks	Storm Event	16	12	6	2
	Long Term Erosion & Sea Level Rise Inundation	16	12	6	2
Public access	Storm Event	16	12	6	2
	Long Term Erosion & Sea Level Rise Inundation	20	16	9	4
Recreational facilities	Storm Event	16	12	3	2
	Long Term Erosion & Sea Level Rise Inundation	20	16	12	4
Socio-Economic Values – Commercial Values					
Freehold (residential) assets	Storm Event	12	9	6	2
	Long Term Erosion & Sea Level Rise Inundation	16	12	6	2
Commercial assets	Storm Event	9	9	4	1
	Long Term Erosion & Sea Level Rise Inundation	9	9	4	1
Tourist Parks	Storm Event	9	4	2	1
	Long Term Erosion & Sea Level Rise Inundation	9	4	2	1
Social Values – Cultural Heritage, Visual Amenity, Public Health and Safety					
Public safety	Storm Event	6	6	2	1
	Long Term Erosion & Sea Level Rise Inundation	16	8	9	6
Public health/lifestyle	Storm Event	12	9	6	4
	Long Term Erosion & Sea Level Rise Inundation	12	6	2	1
Cultural heritage	Storm Event	12	9	6	2
	Long Term Erosion & Sea Level Rise Inundation	12	9	4	1
Social disruption	Storm Event	9	6	4	2
	Long Term Erosion & Sea Level Rise Inundation	6	2	2	1
Visual amenity	Storm Event	16	12	6	3
	Long Term Erosion & Sea Level Rise Inundation	12	9	4	1

Table 6.4: Management Zone 4 – Urangan Harbour to River Heads

Aspect	Source of Risk	2030	2050	2070	2100
Environmental Values					
Soils	Storm Event	20	16	12	8
	Long Term Erosion & Sea Level Rise Inundation	12	6	6	2
Intertidal & foreshore habitat	Storm Event	25	16	9	4
	Long Term Erosion & Sea Level Rise Inundation	12	9	4	1
Coastal creeks & wetlands	Storm Event	20	20	12	8
	Long Term Erosion & Sea Level Rise Inundation	16	12	6	4
Critical Infrastructure					
Roads	Storm Event	16	12	6	2
	Long Term Erosion & Sea Level Rise Inundation	16	9	6	1
Stormwater	Storm Event	12	9	6	2
	Long Term Erosion & Sea Level Rise Inundation	16	9	4	1
Potable water & sewer	Storm Event	16	12	9	4
	Long Term Erosion & Sea Level Rise Inundation	16	9	6	2
Gas	Storm Event	20	16	9	4
	Long Term Erosion & Sea Level Rise Inundation	20	16	9	2
Evacuation routes	Storm Event	15	12	6	1
	Long Term Erosion & Sea Level Rise Inundation	15	12	6	1
Social Values – Recreational Access and Amenity					
Foreshore Parks	Storm Event	16	12	6	2
	Long Term Erosion & Sea Level Rise Inundation	20	12	9	2
Public access	Storm Event	16	12	6	2
	Long Term Erosion & Sea Level Rise Inundation	20	16	9	2
Recreational facilities	Storm Event	16	12	3	2
	Long Term Erosion & Sea Level Rise Inundation	20	16	12	2
Socio-Economic Values – Commercial Values					
Freehold (residential) assets	Storm Event	12	9	4	2
	Long Term Erosion & Sea Level Rise Inundation	16	12	4	2
Commercial assets	Storm Event	16	12	9	4
	Long Term Erosion & Sea Level Rise Inundation	16	12	9	4
Urangan Harbour	Storm Event	12	9	6	2
	Long Term Erosion & Sea Level Rise Inundation	16	12	9	2
Tourist Parks	Storm Event	12	9	6	2
	Long Term Erosion & Sea Level Rise Inundation	16	12	9	2
Social Values – Cultural Heritage, Visual Amenity, Public Health and Safety					
Public safety	Storm Event	12	12	8	8
	Long Term Erosion & Sea Level Rise Inundation	20	20	16	16
Public health/lifestyle	Storm Event	16	16	9	6
	Long Term Erosion & Sea Level Rise Inundation	16	12	6	4
Cultural heritage	Storm Event	9	9	4	2
	Long Term Erosion & Sea Level Rise Inundation	9	9	4	1
Social disruption	Storm Event	16	12	12	8
	Long Term Erosion & Sea Level Rise Inundation	16	16	9	4
Visual amenity	Storm Event	20	16	12	6
	Long Term Erosion & Sea Level Rise Inundation	16	12	9	4

Table 6.5: Management Zone 5 – Boonooroo to Tinnanbar

Aspect	Source of Risk	2030	2050	2070	2100
Environmental					
Soils	Storm Event	16	9	6	4
	Long Term Erosion & Sea Level Rise Inundation	12	9	4	1
Intertidal & foreshore habitat	Storm Event	20	12	12	6
	Long Term Erosion & Sea Level Rise Inundation	12	6	4	1
Coastal creeks & wetlands	Storm Event	16	16	12	9
	Long Term Erosion & Sea Level Rise Inundation	9	9	4	1
Critical Infrastructure					
Roads	Storm Event	20	12	6	2
	Long Term Erosion & Sea Level Rise Inundation	20	9	6	1
Evacuation routes	Storm Event	15	9	4	1
	Long Term Erosion & Sea Level Rise Inundation	15	9	4	1
Social Values – Recreational Access and Amenity					
Foreshore parks	Storm Event	16	12	6	2
	Long Term Erosion & Sea Level Rise Inundation	20	16	9	2
Public access	Storm Event	16	12	6	2
	Long Term Erosion & Sea Level Rise Inundation	20	16	9	2
Recreational facilities	Storm Event	16	12	6	4
	Long Term Erosion & Sea Level Rise Inundation	20	16	12	2
Socio-Economic Values – Commercial Values					
Freehold (residential) assets	Storm Event	12	12	4	2
	Long Term Erosion & Sea Level Rise Inundation	16	12	4	2
Commercial assets	Storm Event	20	12	9	6
	Long Term Erosion & Sea Level Rise Inundation	20	16	9	6
Tourist parks	Storm Event	9	9	6	4
	Long Term Erosion & Sea Level Rise Inundation	12	9	6	2
Social Values – Cultural Heritage, Visual Amenity, Public Health and Safety					
Public safety	Storm Event	16	16	12	12
	Long Term Erosion & Sea Level Rise Inundation	20	20	16	16
Public health/lifestyle	Storm Event	16	16	9	6
	Long Term Erosion & Sea Level Rise Inundation	16	9	4	1
Cultural heritage	Storm Event	9	9	4	2
	Long Term Erosion & Sea Level Rise Inundation	9	6	2	1
Social disruption	Storm Event	12	12	6	3
	Long Term Erosion & Sea Level Rise Inundation	16	9	4	1
Visual amenity	Storm Event	16	16	6	3
	Long Term Erosion & Sea Level Rise Inundation	16	9	6	2

6.2 Quantitative Risk Assessment Findings

Cadastral Lots at Risk from Shoreline Erosion

The findings of the quantitative risk assessment are presented in full in Appendix G and summarised in Table 6.6. The analysis provides a reasonable indication of number and types of cadastral lots at risk from erosion in the study area.

The quantitative risk assessment shows that a large number of cadastral lots (1,131) fall within or intersect with the 2030 EPAs, 976 of which are freehold land. This represents an approximate land value of $346.5 million.

The Management Zone with the highest density of cadastral lots falling within the 2030 EPAs is Management Zone 5 at 23.2 lots per km of shoreline, followed by Management Zone 1 with 21.9 lots per km shoreline. This would suggest that the highest level of risk from shoreline erosion in the short term is in these two Management Zones. Based on analysis of the median residential property values, the total value of land (of all tenures) at risk is $114.3 million for Management Zone 1 and $114.4 million for Management Zone 5. The proportion of freehold cadastral lots falling within the 2030 EPAs for these two Management Zones is lower than for the other three Management Zones, at 92% each, noting however, that not all the lots that intersect the 2030 EPA are developed and therefore the actual land value likely differs from that calculated.

The number of cadastral lots falling within the EPAs increases over time (Table 6.6) and the level of risk increases. By 2100, there are 2,741 cadastral lots falling within the EPA with an approximate land value of $878.0 million. Based on the number of cadastral lots intersecting the 2100 EPAs, the highest level risk is in Management Zones 1 and 3, with 822 and 749 cadastral lots potentially impacted at an approximate land value of $273.1 million and $253.5 million (respectively). However, it is likely that a higher proportion of the affected cadastral lots are developed in Management Zone 3 compared to Management Zone 1, and therefore the actual land value is likely highest in Management Zone 3. In addition, the density of cadastral lots per km of shoreline is highest in Management Zone 3 (at 90 lots per km of coastline compared to 51 lots per km for Management Zone 1). Based on these figures, the potential value of those lots falling within the 2100 EPA in Management Zone 3 is $ 30.5 million per km shoreline (present day land value), almost double that for Management Zone 1 (at $16.8 million). Based on this analysis, it is likely that a greater economic cost:benefit could be achieved for any coastal protection works implemented in Management Zone 3 (noting that this does not consider any of the other assessment criteria in Section 2.8.3).

An analysis of the average distance of the seaward lot boundary from the seaward extent of the 2030 EPA was undertaken for all freehold cadastral lots was conducted using the Matlab software program. In the Hervey Bay area, the seaward boundary of the EPA is defined by the toe of dune line, whereas in the Great Sandy Strait area it is defined by the present day HAT. The average distance of the seaward boundaries of the freehold lots from the toe of dune line is 63.7 m in Hervey Bay, whereas the average distance from the HAT line is 30.1 m in the Great Sandy Strait. On initial inspection this finding suggests that the freehold lots in Management Zones 4 and 5 are generally at a higher level of risk than for Management Zones 1-3, however, this may not be the case in reality. In some instances, the freehold cadastral lots project into the ocean, beyond the seaward boundary of the EPAs. This translates to a negative value in Matlab – that is, if the seaward freehold lot boundary projects 50 m into the sea beyond the EPA boundary, the distance from the seaward EPA boundary generated by Matlab is -50 m. There are a number of freehold lots that project beyond the present day shoreline and into the ocean in the Great Sandy Strait area, and this may be biasing the analyses by driving down the average. Furthermore, the development intensities are higher and the freehold lot sizes generally smaller in Management Zones 1-3, whereas the freehold lots are generally larger in Management Zones 4 and 5. This suggests that there is a higher likelihood that any structures on the freehold lots would be at risk in Management Zones 1-3, irrespective of the greater average distance from the seaward EPA boundary.

In terms of public open space areas in the Fraser Coast LGA, many are concentrated on the foreshore and are therefore vulnerable to shoreline erosion. The Management Zone with the highest proportion of public lots (i.e. all tenures other than freehold) falling within the 2030 EPAs is Zone 2 (73% of all cadastral lots) – this is likely due to both the steep topography and the presence of rock at this location, whereby freehold lands at higher elevations do not fall within the 2030 EPAs. Management Zone 3 has the next highest proportion of public lots falling within the 2030 EPAs (38% of all cadastral lots), likely due to the concentration of recreational activities in this area.

Further discussion on the impacts of shoreline erosion on foreshore parks is provided below.

Foreshore Parks at Risk from Shoreline Erosion

The location of foreshore parks has been mapped in Figures 5.10-5.11 based on a GIS layer provided by FCRC. The foreshore parks fall almost entirely within the 2030 EPAs. FCRC provided information on the areal extent of the foreshore parks and their approximate value based primarily on the Hervey Bay Priority Infrastructure Plan (PIP), except for values of Leased Areas and Tourist Parks, which were provided to FCRC by another party. For values derived from the Hervey Bay PIP, these are informed by land values and the embellishment costs associated with the park (i.e. due to the provision and maintenance of recreational facilities and amenities). These values have been reproduced in Table 6.7.

According to FCRC there are 433.8 ha of foreshore parks in the study area, which have a value of $22.25 million based on their embellishment costs. The largest areas of foreshore parks at risk from shoreline erosion are located within Management Zone 1 (202.10 ha), however, because these parks are generally lower in recreational amenity, undeveloped and/or for nature-based recreation, their associated value is not as high as for other Management Zones. Despite the fact that it has the smallest area of parkland, the highest value associated with foreshore parks is in Management Zone 3 at $11.09 million. This is due to the high value of developed parkland, leased areas and tourist parks.

This analysis highlights that there are significant areas of foreshore parks at risk from erosion. These parks provide recreational access and amenity for the community at large, and are also of benefit for the local economy. In addition, many of these parks have been embellished by FCRC, and the loss of any of these embellishments due to erosion would represent a significant cost to FCRC.

*Table 6.6: Quantitative Risk Assessment Summary**

	2030	2050	2070	2100
Zone 1 16.25 km shoreline approx.	356 cadastral lots or 21.9 lots per km shoreline; approx. value $114.3M or $7.03M per km shoreline.	511 cadastral lots or 31.4 lots per km shoreline; approx. value $168.6M or $10.4M per km shoreline.	729 cadastral lots or 44.9 lots per km shoreline; approx. value $242.6M or $14.9M per km shoreline.	822 cadastral lots or 51.0 lots per km shoreline; approx. value $273.1M or $16.8M per km shoreline.
Zone 2 8.99 km shoreline approx.	22 cadastral lots or 2.5 lots per km shoreline; approx. value $6.9M or $0.8M per km shoreline.	28 cadastral lots or 3.1 lots per km shoreline; approx. value $8.6M or $0.9M per km shoreline.	34 cadastral lots or 3.8 lots per km shoreline; approx. value $10.7M or $1.2M per km shoreline.	117 cadastral lots or 13.0 lots per km shoreline; approx. value $38.7M or $7.4M per km shoreline.
Zone 3 8.32 km shoreline approx.	80 cadastral lots or 9.6 lots per km shoreline; approx. value $27.0M or $3.2M per km shoreline.	291 cadastral lots or 34.9 lots per km shoreline; approx. value $104.1M or $12.5M per km shoreline.	473 cadastral lots or 56.9 lots per km shoreline; approx. value $162.7M or $19.6M per km shoreline.	749 l cadastral lots or 90.0 lots per km shoreline; approx. value $253.5M or $30.5M per km shoreline.
Zone 4 22.20 km shoreline approx.	245 cadastral lots or 11.0 lots per km shoreline; approx. value $83.9M or $3.8M per km shoreline.	253 cadastral lots or 11.4 lots per km shoreline; approx. value $86.6M or $3.9M per km shoreline.	270 cadastral lots or 12.2 lots per km shoreline; approx. value $92.4M or $4.2M per km shoreline.	412 cadastral lots or 19.0 lots per km shoreline; approx. value $141.4M or $6.4M per km shoreline.
Zone 5 18.44 km shoreline approx.	428 cadastral lots or 23.2 lots per km shoreline; approx. value $114.4M or $6.2M per km shoreline.	481 cadastral lots or 26.1 lots per km shoreline; approx. value $129.6M or $7.0M per km shoreline.	641 cadastral lots or 34.8 lots per km shoreline; approx. value $171.3M or $9.3M per km shoreline.	846 cadastral lots or 44 lots per km shoreline; approx. value $368M or $10.6M per km shoreline.
Total	*1,131 cadastral lots* *$346.5M*	*1,564 cadastral lots* *$467.5M*	*2,147 cadastral lots* *$679.7M*	*2,946 cadastral lots* *$932.8M*

**Further details are provided in Appendix G.*

Table 6.7: Foreshore Parks (source: FCRC)

Parkland Setting (after HBCC, 2007)	Management Zone 1	Management Zone 2	Management Zone 3	Management Zone 4	Management Zone 5	*Total per Study Area*
Undeveloped Parkland (un-costed value)	9.07 ha	29.14 ha	-	13.96 ha	-	*52.17 ha*
Nature-based Recreation ($130,000 per ha)	7.52 ha $977,600	-	2.72 ha $353,600	11.8 ha $1,534,000	-	*22.04 ha* *$2,865,200*
Semi-developed Parkland	2.55 ha $601,800	4.83 ha $1,183,350	8.22 ha $2,055,000	9.32 ha $825,000	12.77 ha $1,143,000	*37.69 ha* *$5,808,150*
Developed Parkland	2.30 ha $575,000	4.23 ha $1,184,400	13.89 ha $5,764,350	1.13 ha $282,500	3.75 ha $575,000	*25.3 ha* *$8,381,250*
Natural Dune & Foreshore ($100,000 per ha, Zones 2 and 3 only)	179.52 ha	9.58 ha $958,000	11.84 ha $1,184,000	11.30 ha	76.49 ha	*288.73 ha* *$2,142,000*
Leased Areas ($320 per m^2)	-	0.27 ha $864,000	0.07 ha $233,600	-	-	*0.34 ha* *$1,097,600*
Tourist Park	1.14 ha $456,000	-	6.39 ha $1,500,000	-	-	*7.53 ha* *$1,956,000*
Total per Management Zone	*202.10 ha* *$2,610,400*	*48,.05 ha* *$4,189,750*	*43.13 ha* *$11,090,550*	*47.51 ha* *$2,641,500*	*93.01 ha* *$1,718,000*	*433.8 ha* *$22,250,200*

Critical Infrastructure at Risk from Shoreline Erosion

Figures 5.3-5.7 and Appendix G provide an indication of critical infrastructure at risk from shoreline erosion. There is a significant amount of critical infrastructure at risk within the 2030 EPAs, and this increases over time as more infrastructure intersects the 2050, 2070 and 2100 EPAs. This critical infrastructure is managed by a range of organisations, including FCRC and other service providers. There would likely be significant costs associated with the loss or damage of any critical infrastructure for these organisations. Depending on the vulnerability of any pieces of infrastructure from erosion, it may be cheaper in the long term to relocate the infrastructure to less vulnerable locations than conduct repairs. This is particularly relevant for those locations where infrastructure has already been lost or exposed to shoreline erosion (see examples in Figures 6.1-6.2). The loss of any critical infrastructure and associated service disruptions would also have negative impacts for public safety and social disruption, which may extend beyond the footprint of the EPA.

6.3 Discussion on Risk

The risk assessments undertaken provide an indicator of both the level of risk from shoreline erosion, and how the level of risk changes over time. Key findings of the assessments are that:

- The overall level of risk varies when comparing erosion from storm events (which can occur at any time) and long term erosion (which occurs gradually). In the short term, storm erosion dominates the risk profile, while long term erosion dominates the risk profile for the longer planning horizons.
- Those areas subject to higher levels of existing/short term risk from shoreline erosion include Management Zones 1 and 3.
- Management Zone 3 is subject to higher levels of future risk from shoreline erosion. This assumes that the present day patterns of development does not change.
- It is important to also note that the frequency of different events occurring will also impact on the risk profile. For example, it is anticipated that there would be a higher level of risk in the future due to more frequent intense storm events and more frequent and deeper tidal inundation due to SLR. This has been considered in the qualitative risk assessment only. The risk assessments did not consider the frequency, duration or depth of storm tide inundation or catchment flooding.
- Management Zone 3 is subject to the highest overall level of risk due to its vulnerability to shoreline erosion and the concentration of development in this area, giving rise to a considerable level of risk to public safety, critical infrastructure, foreshore parks, freehold land and commercial activities within this area.
- The potential cost of shoreline erosion to the community may be significant, due to losses of built assets. This does not take into account any multipliers or indirect economic impacts that may result, or the environmental economics associated with losing any ecological resources located in the EPAs.

The Australian Government recently released a report on the *Climate Change Risks to Coastal Buildings and Infrastructure* (DCCEE, 2011), a supplement to the *First Pass National Assessment of Climate Change Risks to Australia's Coasts* (DCC, 2009). The report adopts a SLR projection of 1.1m (high emissions scenario for 2100) and estimates that for the Australian coastline there is more than $226 billion in commercial, industrial, road, rail and residential assets that may be exposed to tidal inundation and erosion hazard. Their analysis of all LGAs in Queensland identifies between 167 and 213 commercial buildings are at risk within the Fraser Coast LGA, the third highest number of exposed commercial buildings for all Australian LGAs. In addition, Fraser Coast LGA has the highest level of risk to roads, with between 352 and 475 km of roads at risk (DCCEE, 2011). Differences in the results presented herein as compared with that adopted by DCCEE (2011) are likely due to different methodologies used, where different SLR levels were adopted and tidal inundation due to SLR was included in the analyses presented in DCCEE (2011).

In light of these valuations, the preliminary indicative estimates of land values at risk from erosion presented in Section 6.2 appear reasonable. There is a large amount of land, critical infrastructure and foreshore parks at risk from shoreline erosion and the potential cost to both the private and public sectors is likely to be significant. This represents a key driver for strategic planning, particularly as it relates to asset management and planning, land use planning, and climate change adaptation. The findings of this report should be used to inform FCRC's strategic planning.

It is also important to note that the assessments presented herein are based on estimates of erosion that incorporate a degree of uncertainty, hence the adoption of a safety factor of 0.4 in the EPA estimation methodology (Section 2.4.1). The actual rate of long term change may differ from that currently predicted. In addition, the EPAs represent net trends in shoreline position over decades, whereas there may also be shorter term fluctuations in shoreline position within these planning horizons, resulting in high variation in the actual level of risk over periods of months or years. It is thought that the EPA methodology is sufficiently conservative to account for most of these potential sources of variation. However, it is recommended that on the ground monitoring be undertaken and trigger levels developed, at which point an appropriate management response can be initiated. For example, the trigger may be: where the erosion scarp advances within 10 m of the face of a building, temporary erosion protection works in the form of sandbags are implemented while a longer term management strategy is formulated.