

## 10 Rangaiwaea Island

### 10.1 Site description

Rangaiwaea Island is located in the southern section of Tauranga Harbour, close to the south-western end of Matakana Island. The study site is located at the southern end of the Rangaiwaea Island and consists of approximately 2 km of cliffs and 1.5 km of low-lying, unconsolidated shoreline. The site is split into 6 cells based on differences in morphology, exposure and shoreline elevation (Figure 10-1).



Figure 10-1 Location and cell extent for Rangaiwaea Island within Tauranga Harbour.

The unconsolidated east-facing shoreline (Cell 10A) is afforded protection by Matakana Island. The backshore along the sheltered shoreline gradually changes from a well-vegetated grass bank at the northern end to a low grass area with patches of salt marsh vegetation at the southern end. A high-tide sandy beach, ranging from 1 m to 3 m wide, runs along the shoreline of Cell 10A.

On the eastern corner of the island there is a sand spit feature, which indicates an accreting environment (Cell 10B) (Figure 10-2A). Along the south-facing shoreline there is another section of unconsolidated shoreline with a backshore characterised by a grass bank, approximately 1.8 m high (Cell 10C). Further towards the east is a section of south-facing cliffs that range from 10 m to 12 m high (Cell 10D) (Figure 10-2B). Most of the cliff is vegetated with small trees, however some slips have occurred, leaving a bare cliff face. On the western corner of the island, there is bare cliff face, approximately 12 m high (Cell 10E) (Figure 10-2C). Along the western side the topography gradually decreases from steep, exposed cliff to a low bank vegetated with grass and shrubs (Cell 10F) (Figure 10-2D).

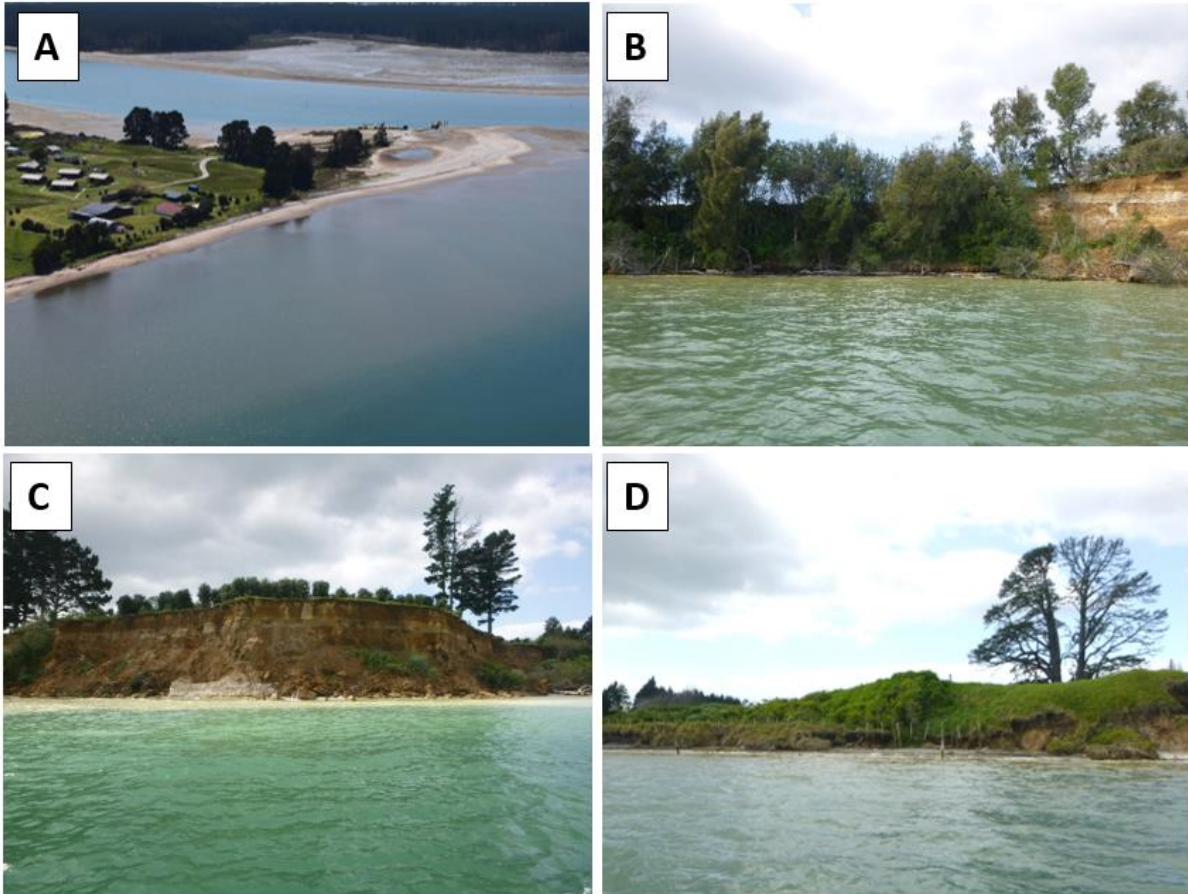


Figure 10-2 Site photos for Rangaiwaea Island. (A) Unconsolidated shoreline and spit (Cell 10B), (B) south-facing cliffs (Cell 10D), (C) west-facing cliffs (Cell 10E), (D) low, west-facing cliff (Cell 10F).

## 10.2 Geology

The geological map of the area<sup>11</sup> indicates that the site comprises:

- Matua Subgroup: Poorly to moderately sorted gravel with minor sand and silt underlying terraces; includes minor fan deposits and loess.
- Holocene river deposits: Alluvial gravel, sand, silt, mud and clay, with local peat.

Field observations of cliff exposures include interbedded ash layers at the top of the cliffs and reworked ignimbrites at the base of the cliffs.

The existing slope angles in this area are between 3° to 20° along unconsolidated areas, and between 12° to 55° in areas of banks or cliffs. The range of stable slope angles for Rangaiwaea Island shown in Table 10-1 below.

The failure types observed around Rangaiwaea Island were typically shallow surface failures. The likelihood of deep seated movement is low to moderate.

## 10.3 Coastal processes

Rangaiwaea Island has varying levels of exposure. The east-facing shoreline (10A) is relatively sheltered from harbour waves, with a fetch less than 1 km across from Matakana Island. Due to the

<sup>11</sup> Leonard, G.S.; Begg, J.G.; Wilson, C.J.N. (compilers) 2010: *Geology of the Rotorua area*. Institute of Geological & Nuclear Sciences 1:250,000 geological map 5. 1 sheet + 102 p. Lower Hutt, New Zealand. GNS Science.

proximity of Hunter's Creek (approximately 120 m towards the east) tidal currents potentially have some impact on the shoreline. Sediment accumulation around the sand spit on the corner of Rangaiwaea Island indicates that there is littoral drift from the north towards the south. Regression analysis, based on historic shorelines since 1994, shows the long term erosion rates within Cell 10A range from -0.07 to -0.19 m/yr. Based on a 1 km fetch from the east, the theoretical significant wave height is estimated to be 0.4 m. Based on model results the short term storm cut is estimated to range from 1 to 3 m.

The south-facing shoreline is more exposed to wind waves and tidal currents. Sediment accretion around the sand spit and an increase in erosion towards the west indicates that there is littoral drift towards the east. The littoral drift is likely to be driven by strong ebb currents and prevailing westerly winds. Regression analysis indicates that long term erosion rates within Cell 10B range from -0.05 to -0.4 m/yr. Based on a 4 km fetch from the southeast, the theoretical significant wave height is estimated to be 1 m. Based on model results the short term storm cut is estimated to range from 3 to 8 m.

Wave undercutting is evident along the grass bank within Cell 10C. The regression analysis indicates that the erosion rate at this site is high (up to -1 m/yr). The exposed cliffs at the western end of the shoreline (Cell 10D) also show evidence of recent erosion. The cliffs are closely situated to the Western Channel and there is a relatively large fetch from the south (approximately 4.5 km). Therefore, wind waves and tidal currents are likely to continually remove slip debris and contribute to the shoreline erosion. Long term erosion rates are estimated to be between -0.15 to -0.4 m/yr for Cell 10C.

The west-facing shoreline is also an exposed site, with the maximum fetch approximately 14 km towards the northwest. Field observations indicate that coastal processes are actively eroding the bank. The regression analysis shows long term erosion rates ranging from -0.15 to -0.4 m/yr within Cell 10F. Due to the similar exposure and field observations it is assumed that long term erosion rates are similar for Cells 10D and 10E (Table 10-1).

Due to the high exposure to large fetches, the SLR response factors range from 0.2 to 0.4 for the consolidated cells (Cells 10D, 10E, 10F).

#### **10.4 Local considerations**

There are currently no erosion protection structures along the Rangaiwaea shoreline. A pontoon structure is located at the end of the sand spit (Cell 10A).

#### **10.5 Adopted component values**

Adopted component values are presented within Table 10-1. The short term values are equal to zero for the consolidated cells as short term erosion is not applicable for consolidated shorelines (see section 4.6.2 in main report).

**Table 10-1 Adopted component values for cells around Rangaiwaea Island.**

Site		10. Rangaiwaea Island					
Cell		10A	10B	10C	10D	10E	10F
Cell centre (NZTM)	E	1875632	1875693	1875357	1874686	1874111	1874022
	N	5830235	5829890	5829763	5829583	5829806	5830260
Morphology		Unconsolidated	Unconsolidated	Unconsolidated	Consolidated	Consolidated	Consolidated
Geology		Sands	Sands	Sands	Matua Subgroup	Matua Subgroup	Matua Subgroup
Exposure (average fetch/direction)		1 km (E)	3 km (SE)	3 km (SE)	3 km (S)	4 km (SW)	2.5 km (W)
State		Natural	Natural	Natural	Natural	Natural	Natural
Short-term (m)	Min	1	3	3	0	0	0
	Mode	2	6	6	0	0	0
	Max	3	8	8	0	0	0
Dune/Cliff elevation (m above toe or scarp)	Min	0.5	0	1	11	11	7
	Mode	1	2	1.5	12	12	7.5
	Max	2	3	2	14	14	8
Stable angle (deg)	Min	30	30	30	24	24	24
	Mode	32	32	32	26	26	26
	Max	34	34	34	55	55	50
Long-term (m/yr)	Min	-0.19	-0.4	-1	-0.4	-0.4	-0.4
	Mode	-0.13	-0.2	-0.7	-0.27	-0.27	-0.27
	Max	-0.07	-0.05	-0.4	-0.15	-0.15	-0.15
Closure slope (beaches)/SLR response factor (cliffs)	Min	0.05	0.08	0.08	0.2	0.2	0.2
	Mode	0.1	0.1	0.1	0.3	0.3	0.3
	Max	0.2	0.12	0.12	0.4	0.4	0.4

## 10.6 Coastal erosion hazard assessment

Coastal erosion hazard distances for Rangaiwea Island are presented within Table 10-2 and an overview map in Figure 10-4. Histograms of individual components and resultant erosion hazard distances using a Monte Carlo technique are shown in Appendix B. For the purpose of this assessment all coastal erosion protection structures have been ignored (refer to main report Section 4.5.4).

The current P<sub>66%</sub> erosion hazard for the unconsolidated shoreline around Rangaiwea ranges from -5 m on the east-facing shoreline to -16 m on the south-facing shoreline.

Due to the large historic erosion rates within Cell 10C, the future P<sub>5%</sub> for 1.6 m SLR in 2130 is -125 m, representing the largest potential erosion value across all of the harbour sites.

Although the cliffs are not retreating as rapidly as the unconsolidated shoreline within Cell 10C, the erosion values are still relatively high, with the current P<sub>66%</sub> erosion hazard ranging from -14 m to -18 m, and the future P<sub>5%</sub> erosion hazard for 1.6 m SLR in 2130 ranging from -89 m to -96 m.

**Table 10-2 Coastal erosion hazard widths (m) for current, 2080 and 2130 timeframes.**

Site	Cell	Timeframe	SLR (m)	Probability of Exceedance						
				Min	P <sub>66%</sub>	P <sub>50%</sub>	P <sub>5%</sub>	P <sub>1%</sub>	Max	
Rangaiwea	10A	Current	0.03	-3	-5	-5	-6	-6	-7	
		50yr (2080)	0.12	-7	-11	-11	-14	-15	-16	
			0.2	-7	-11	-12	-15	-16	-17	
			0.4	-8	-13	-14	-17	-18	-21	
			0.6	-10	-15	-16	-19	-21	-24	
		100yr (2130)	0.22	-10	-17	-18	-23	-24	-25	
			0.6	-13	-20	-21	-26	-28	-32	
			0.8	-14	-22	-23	-29	-31	-36	
			1.25	-17	-26	-27	-34	-37	-44	
		1.6	-19	-28	-30	-39	-43	-51		
		10B	Current	0.03	-5	-10	-10	-13	-14	-15
			50yr (2080)	0.12	-8	-19	-21	-29	-32	-35
	0.2			-9	-20	-22	-30	-32	-36	
	0.4			-11	-22	-24	-32	-34	-38	
	0.6			-13	-24	-26	-34	-36	-41	
	100yr (2130)		0.22	-11	-28	-31	-46	-50	-54	
			0.6	-15	-32	-35	-50	-54	-58	
			0.8	-17	-34	-37	-52	-56	-60	
			1.25	-22	-38	-42	-57	-61	-65	
	1.6		-25	-42	-45	-60	-64	-69		
	10C		Current	0.03	-11	-16	-17	-21	-22	-24

Site	Cell	Timeframe	SLR (m)	Probability of Exceedance						
				Min	P <sub>66%</sub>	P <sub>50%</sub>	P <sub>5%</sub>	P <sub>1%</sub>	Max	
Rangaiwaea Island		50yr (2080)	0.12	-32	-49	-52	-66	-69	-74	
			0.2	-32	-50	-53	-67	-70	-74	
			0.4	-35	-52	-55	-69	-72	-76	
			0.6	-36	-54	-57	-71	-74	-78	
		100yr (2130)	0.22	-52	-82	-87	-111	-117	-122	
			0.6	-56	-85	-91	-115	-121	-126	
			0.8	-58	-87	-93	-117	-123	-127	
			1.25	-62	-92	-98	-121	-128	-132	
		10D	Current	0.03	-11	-18	-21	-30	-32	-36
			50yr (2080)	0.12	-18	-32	-34	-45	-48	-55
				0.2	-20	-35	-37	-48	-52	-58
				0.4	-23	-39	-42	-54	-58	-64
	0.6			-24	-42	-46	-58	-63	-70	
	100yr (2130)		0.22	-28	-45	-48	-61	-66	-73	
			0.6	-34	-55	-60	-75	-81	-90	
			0.8	-35	-59	-63	-80	-87	-97	
			1.25	-38	-65	-70	-90	-98	-110	
	10E		Current	0.03	-11	-18	-21	-30	-32	-35
			50yr (2080)	0.12	-19	-32	-34	-45	-48	-53
				0.2	-21	-35	-37	-48	-52	-57
		0.4		-24	-39	-42	-54	-59	-65	
		0.6		-25	-42	-45	-58	-63	-70	
		100yr (2130)	0.22	-27	-45	-48	-61	-66	-72	
			0.6	-33	-55	-59	-75	-81	-90	
			0.8	-35	-59	-63	-81	-87	-97	
			1.25	-39	-65	-70	-90	-98	-110	
		10F	Current	0.03	-9	-14	-15	-20	-21	-23
			50yr (2080)	0.12	-17	-27	-29	-36	-38	-42
				0.2	-19	-30	-32	-40	-42	-46
	0.4			-21	-34	-36	-46	-49	-54	
	0.6			-22	-37	-40	-50	-55	-61	
	100yr (2130)		0.22	-25	-40	-43	-53	-57	-61	
			0.6	-31	-50	-54	-68	-73	-80	
			0.8	-32	-53	-57	-73	-79	-88	
			1.25	-35	-59	-64	-83	-90	-101	
					1.6	-37	-63	-68	-89	-97

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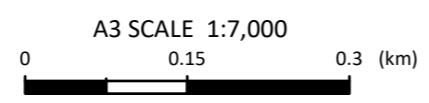


**LEGEND**

- Cell Extent
- Baseline (2014-2017)
- No current erosion (refer to future MHWS)
- Critical structures
- 2030 (current) - P66%
- 2030 (current) - P5%
- 2080 - 0.4m SLR - P66%
- 2080 - 0.6m SLR - P66%
- 2080 - 0.6m SLR - P5%
- 2130 - 0.8m SLR - P66%
- 2130 - 1.25m SLR - P66%
- 2130 - 1.25m SLR - P5%
- 2130 - 1.6m SLR - P5%
- Future MHWS7 - 1.6m SLR

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Notes: Aerial photograph sourced from the LINZ Data Service (dated 2015)



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 105 Carlton Gore Rd, Newmarket, Auckland  
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DRAWN	RHAU	Dec.18
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ARCFILE	CEHA Overview2.mxd	
SCALE (AT A3 SIZE)	1:7,000	
PROJECT No.	1001628.1000	

**Tauranga Harbour Coastal Erosion Assessment**  
 Erosion Hazard Overview  
 Site 10: Rangaiwaea Island

FIGURE No. Figure 10-4

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