39 Kaimaumau

39.1 Description and geomorphology

The site is 1.2 km long and is located on the east coast of North Cape inside the Rangaunu Harbour. Figure 39.1 shows the site and its division into two coastal cells for assessing coastal erosion hazards. Photos of the site showing key features are presented in Figure 39.2.

Land at Kaimaumau is low-lying and comprised of moderately cemented sand that was deposited as sand dunes in the mid-Pleistocene. The coastal edge is defined by a near vertical cliff with an elevation between 3-4 m RL. Visible evidence of coastal erosion is present along the extent of the site, with mass failure blocks breaking off in places, chunks of rock sitting at the toe and undercut caves up to 6 m deep in places. A 0.2-0.4 m thick soil layer is present on the surface of sandstone cliff and exposed shell deposits indicate potential midden sites. The coast has a triangle shape with the northern section facing east and the southern section facing SSE. Mangroves are present either side of the site, but no mangroves are present in front of the township.

The location of Kaimaumau inside the Rangaunu Harbour shelters the site from open ocean wave energy. The site is exposed to local wind generated waves inside the harbour, with a fetch distance of approximately 5 km on to the east and south limiting exposure to southerly and easterly wind. Local waves are also depth limited, with large sections of the harbour exposed at low tide, wind wave generation and interaction with the cliff is limited to higher tide stages.

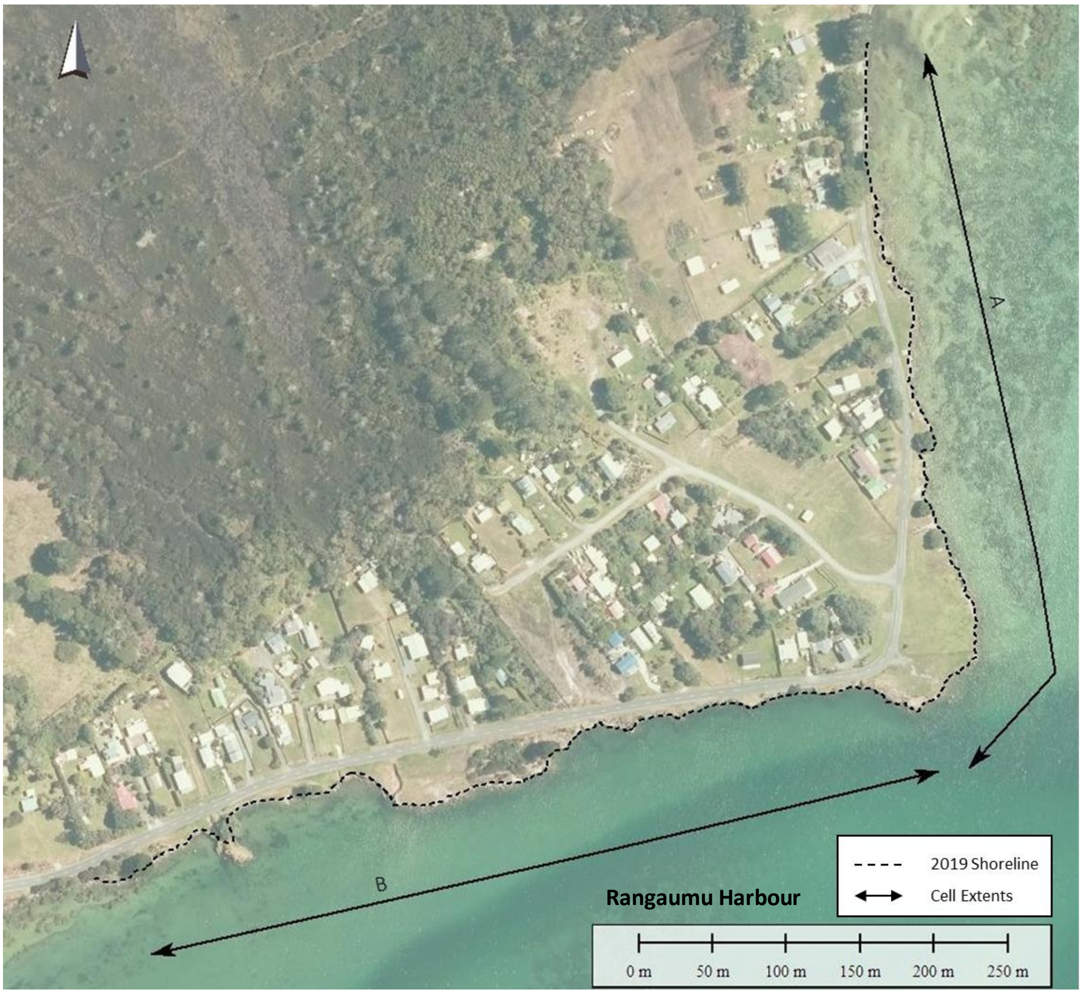


Figure 39.1: Map showing 2019 shoreline position and cell extents with background aerial imagery from 2014.

Figure 39.2: Photos from Kaimaumau site visit on 22/01/2020.

39.2 Local considerations

The main road (only access to Kaimaumau town) runs close to the coastal edge for the whole site and is located within a few metres of the eroding cliff in some locations. No dwellings or private property are located on the seaward side of the road. A reserve and carpark are located at promontory at the centre of the site. According to a local resident, the coast at this point was located significantly further seaward (tens of meters) some 40 years ago. In contrast, the shoreline position at the south end of the site has not changed significantly according to a resident who has lived there for 10 years, although there has been continuing evidence of erosion during that time. Local residents attempted to manage cliff erosion by covering the cliff crest and face in tree clippings and garden waste. A section of road at the north end of the site where the bank height is lower is protected by informal rock armour.

39.3 Component values

The site has a uniform geomorphology and was split into two cells based on coastal orientation and a difference in historic shoreline change. Cell A is located at the north end, facing to the northeast and extends for 500 m, including the central reserve and park area. Cell B faces southeast and extends for 680 m.

Both cells are composed of the same underlying sand geology and have similar cliff heights of around 3 m from toe to crest and in consistent values for the stable angle and sea level rise response were adopted based on the method outlined in T+T (2020) Section 4.6.

Historic shoreline change analysis support observations that the coast is eroding, and identify a higher rate of erosion at the north end (Cell A) compared to the southern end. These findings are consistent with observations of local residents and suggest that the debris talus at the cliff toe acts as a buffer to erosion during regular wave attack. The adopted long-term rates are based on DSAS analysis and are adjusted to remove possible influence of slips causing artificial accretion. The geomorphic nature of the cliff coastline at Kaimaumau means that erosion is a one-way process that is not balanced by accretion. Therefore, only negative long-term values were adopted.

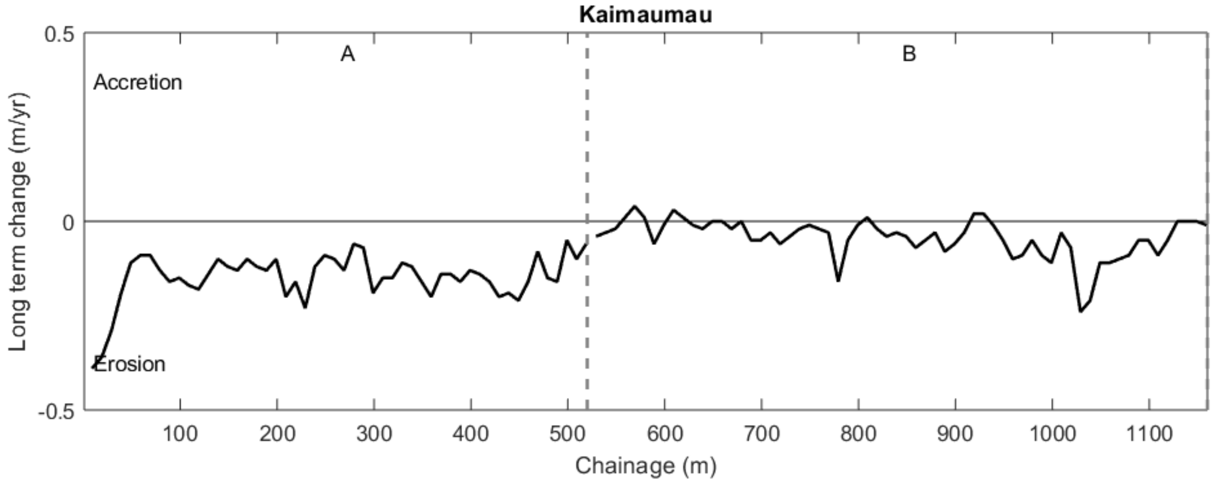


Figure 39.3: Rate of long-term shoreline change along the site showing each cell.

Table 39.1: Component values for Erosion Hazard Assessment

Site		**39. Kaimaumau**	
Cell		**39A**	**39B**
Cell centre (NZTM)	E	1624515	1624193
	N	6135819	6135506
Chainage, m (from N)		1-500	500-1080
Morphology		Partly cemented sand cliff	Partly cemented sand cliff
Short-term (m)	Min	-	-
	Mode	-	-
	Max	-	-
Dune/Cliff elevation (m above toe or scarp)	Min	2.7	2.7
	Mode	3.0	3.2
	Max	3.3	3.6
Stable angle (deg)	Min	18.4	18.4
	Mode	22.5	22.5
	Max	26.6	26.6
Long-term (m) -ve erosion +ve accretion	Min	-0.05	0
	Mode	-0.15	-0.05
	Max	-0.2	-0.1
Closure slope (beaches) / Cliff response factor	Min	0.3	0.3
	Mode	0.4	0.4
	Max	0.5	0.5

Table 39.2: Adopted sea level rise values (m) based on four scenarios included in MfE (2017) adjusted to 2019 baseline

Coastal type	**Year**	**RCP2.6M**	**RCP4.5M**	**RCP8.5M**	**RCP8.5+**
Consolidated cliff	2080	0.29	0.34	0.46	0.64
	2130	0.52	0.66	1.09	1.41

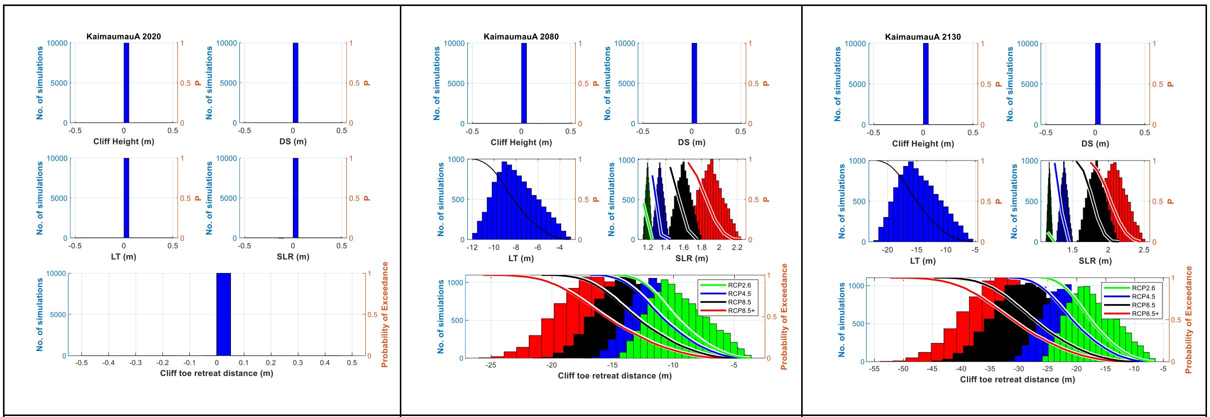
39.4 Coastal erosion hazard assessment

Histograms of individual components and resultant CEHZ distances computed using a Monte Carlo technique are shown in Figure 39.4 to Figure 39.5 . Future shoreline distances are presented within Table 39.3 to Table 39.5 and mapped in Figure 39.6.

The cliff projection method was adopted for both cells at Kaimaumau. Therefore, the probabilistic results presented below only show the cliff toe recession component. Future toe erosion distances to 2080 range from 4 to 12 m for RCP8.5. To 2130, distances range from 17 to 37 m for RCP8.5 and 20 to 43 m for RCP8.5+.

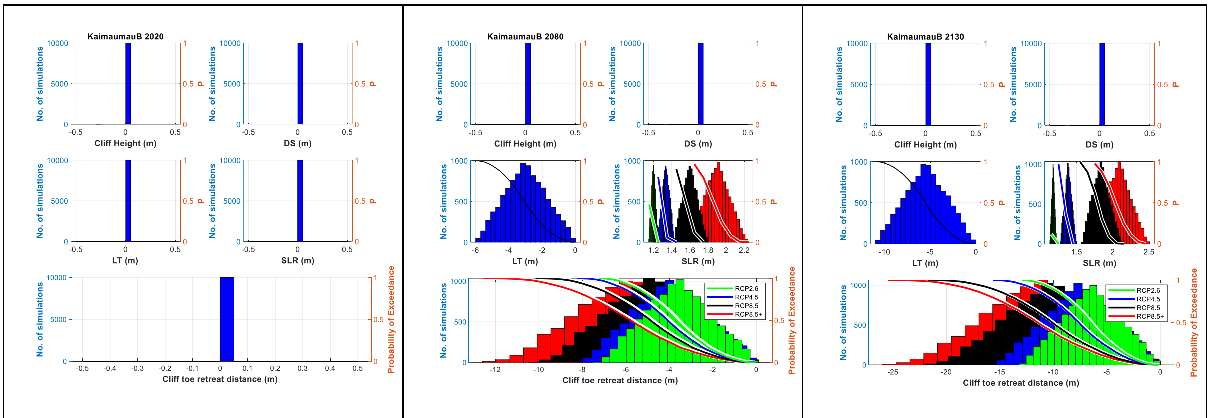
Toe recession values and the stable angle were used to account for the cliff stability component and define the total hazard distance. This was done by extracting across-shore profile from LiDAR data, spaced in 10m intervals. A summary of the resulting total coastal erosion hazard distances is presented in Table 39.6.

Figure 39.7 shows the available historic shorelines for Kaimaumau.



2020	*2080*	*2130*

Figure 39.4: Histograms of parameter samples and the resultant shoreline distances for 2020, 2080 and 2130 timeframes for cell 39A



2020	*2080*	*2130*

Figure 39.5: Histograms of parameter samples and the resultant shoreline distances for 2020, 2080 and 2130 timeframes for cell 39B

Table 39.3: Coastal Erosion Hazard Zone Widths (m) Projected for 2020

Site		39. Kaimaumau	
	Cell	39A*	39B*
Probability of CEHZ (m) Exceedance	Min	0	0
	99%	0	0
	95%	0	0
	90%	0	0
	80%	0	0
	70%	0	0
	66%	0	0
	60%	0	0
	50%	0	0
	40%	0	0
	33%	0	0
	30%	0	0
	20%	0	0
	10%	0	0
	5%	0	0
	1%	0	0
	Max	0	0

*Cliff projection method has been used, so cliff toe position has been tabulated, which has been assumed to be unchanged from the adopted 2019 baseline. Actual CEHZ width will be greater depending on cliff height and stable slope angle.

Table 39.4: Coastal Erosion Hazard Zone Widths (m) Projected for 2080

Site		39. Kaimaumau							
Cell		39A				39B			
RCP scenario		2.6	4.6	8.5	8.5+	2.6	4.6	8.5	8.5+
Probability of CEHZ (m) Exceedance	Min	-4	-4	-5	-5	0	0	0	0
	99%	-5	-5	-6	-7	0	-1	-1	-1
	95%	-6	-6	-7	-9	-1	-1	-1	-2
	90%	-6	-7	-8	-10	-2	-2	-2	-2
	80%	-7	-8	-10	-12	-2	-3	-3	-4
	70%	-8	-9	-11	-13	-3	-3	-4	-4
	66%	-9	-10	-12	-14	-3	-3	-4	-5
	60%	-9	-10	-12	-14	-3	-4	-4	-5
	50%	-10	-11	-13	-16	-4	-4	-5	-6
	40%	-10	-12	-14	-16	-4	-4	-5	-6
	33%	-11	-12	-14	-17	-4	-5	-6	-7
	30%	-11	-12	-15	-17	-4	-5	-6	-7
	20%	-12	-13	-16	-19	-5	-5	-7	-8
	10%	-12	-14	-17	-20	-6	-6	-7	-9
	5%	-13	-15	-18	-21	-6	-7	-8	-10
	1%	-14	-16	-19	-23	-7	-8	-9	-11
	Max	-15	-17	-21	-26	-7	-8	-10	-13
	CEHZ1	-12*				-4*			

*Cliff projection methodology used, so distance to future cliff toe position has been tabulated. Actual CEHZ width will be greater depending on cliff height and stable slope angle.

Table 39.5: Coastal Erosion Hazard Zone Widths (m) Projected for 2130

Site		39. Kaimaumau							
Cell		39A				39B			
RCP scenario		2.6	4.6	8.5	8.5+	2.6	4.6	8.5	8.5+
Probability of CEHZ (m) Exceedance	Min	-7	-7	-10	-11	0	0	0	0
	99%	-8	-9	-12	-14	-1	-1	-1	-2
	95%	-10	-12	-15	-17	-2	-2	-3	-4
	90%	-11	-13	-18	-20	-3	-3	-5	-5
	80%	-14	-16	-21	-24	-4	-5	-6	-7
	70%	-15	-18	-23	-26	-5	-6	-8	-9
	66%	-16	-18	-24	-27	-5	-6	-8	-9
	60%	-16	-19	-25	-29	-6	-7	-9	-10
	50%	-18	-21	-27	-31	-6	-8	-10	-11
	40%	-19	-22	-29	-33	-7	-8	-11	-13
	33%	-19	-23	-30	-34	-8	-9	-12	-14
	30%	-20	-23	-31	-35	-8	-9	-12	-14
	20%	-21	-25	-33	-37	-9	-10	-14	-16
	10%	-22	-26	-35	-40	-10	-12	-16	-18
	5%	-23	-28	-37	-43	-11	-13	-17	-20
	1%	-25	-29	-40	-46	-12	-14	-19	-22
	Max	-26	-32	-44	-52	-13	-16	-22	-26
	CEHZ2	-37*				-17*			
	CEHZ3	-43*				-20*			

*Cliff projection methodology used, so distance to future cliff toe position has been tabulated. Actual CEHZ width will be greater depending on cliff height and stable slope angle.

Table 39.6: Summary of CEHZ distances for cliff cells mapped using cliff projection method

	CEHZ1			CEHZ2			CEHZ3		
Cell	Min (m)	Average (m)	Max (m)	Min (m)	Average (m)	Max (m)	Min (m)	Average (m)	Max (m)
39A	-16	-18	-18	-39	-44	-46	-47	-49	-51
39B	-6	-11	-14	-20	-25	-28	-26	-28	-32

Notes: Dashed CEHZ indicates greater uncertainty around stream mouths and backshore topography.
Northland 0.4m Rural Aerial Photos (2014-2016).

A4 SCALE 1:3,500

0 0.1 0.2 (km)

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PROJECT No. 1012360

NORTHLAND REGIONAL COUNCIL

Coastal Erosion Hazard Assessment
Kaimaumau

Site: 39

FIGURE No. Figure 39-6

Rev. 1

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Notes: Dashed CEHZ indicates greater uncertainty around stream mouths and backshore topography. Northland 0.4m Rural Aerial Photos (2014-2016).

A4 SCALE 1:3,500

0 0.1 0.2 (km)

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PROJECT No. 1012360		

NORTHLAND REGIONAL COUNCIL

Historic Shorelines

Kaimaumau

Site: 39

FIGURE No. Figure 39-7

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