40 Baylys Beach

40.1 Description and geomorphology

Baylys Beach is located on the west coast of Northland 10 km from Dargaville. Figure 40.1 shows the site and its division into six coastal cells for the purpose of assessing coastal erosion hazards. Site photos showing key coastal features are presented in Figure 40.2.

The site extends for 1.1 km and is centred on the main coastal settlement. The beach is a discrete section of an open coast system that spans 115 km from the Kaipara Harbour entrance to the Hokianga Harbour entrance. Baylys is a high energy west coast beach with a wide dissipative foreshore and dynamic beach face. Unlike most west coast beaches, sand dunes are not a dominant feature at Baylys and the beach is instead backed by cliff. The cliffs are comprised of iron stained, weakly cemented sand (formed as sand dune in the Pleistocene) topped with a rich soil layer. A band of lignite is visible in the cliff face and outcrops of lignite rock are located on the beach face either side of the vehicle access. The modern beach face is dynamic and is understood to fluctuate in the order of 1-2 m vertically based on discussions with Kaipara District Council, although no regular beach profile surveys are being undertaken. Colour and texture differences exist between sediment on the beach face and cliff, indicating limited sediment exchange between features. Small discrete dunes are present near the two beach access points.

Present day beach is comprised of fine sand, with similar texture identified at intertidal and back beach locations.

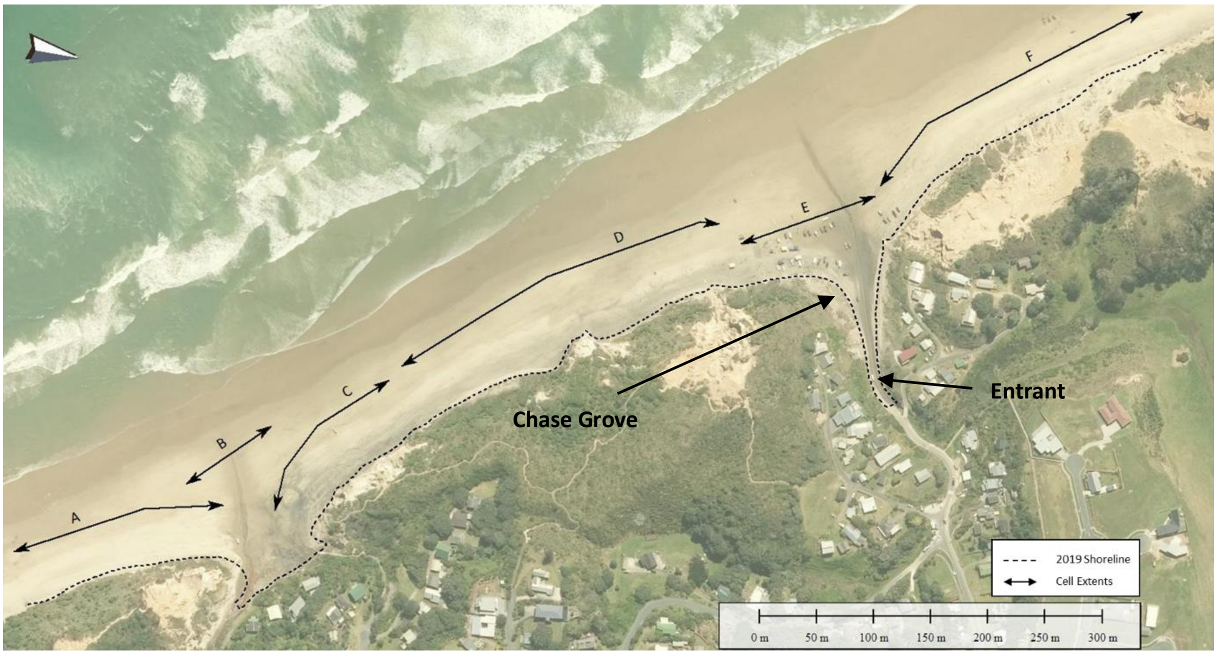


Figure 40.1: Map showing 2019 shoreline position and cell extents with background aerial imagery from 2014.

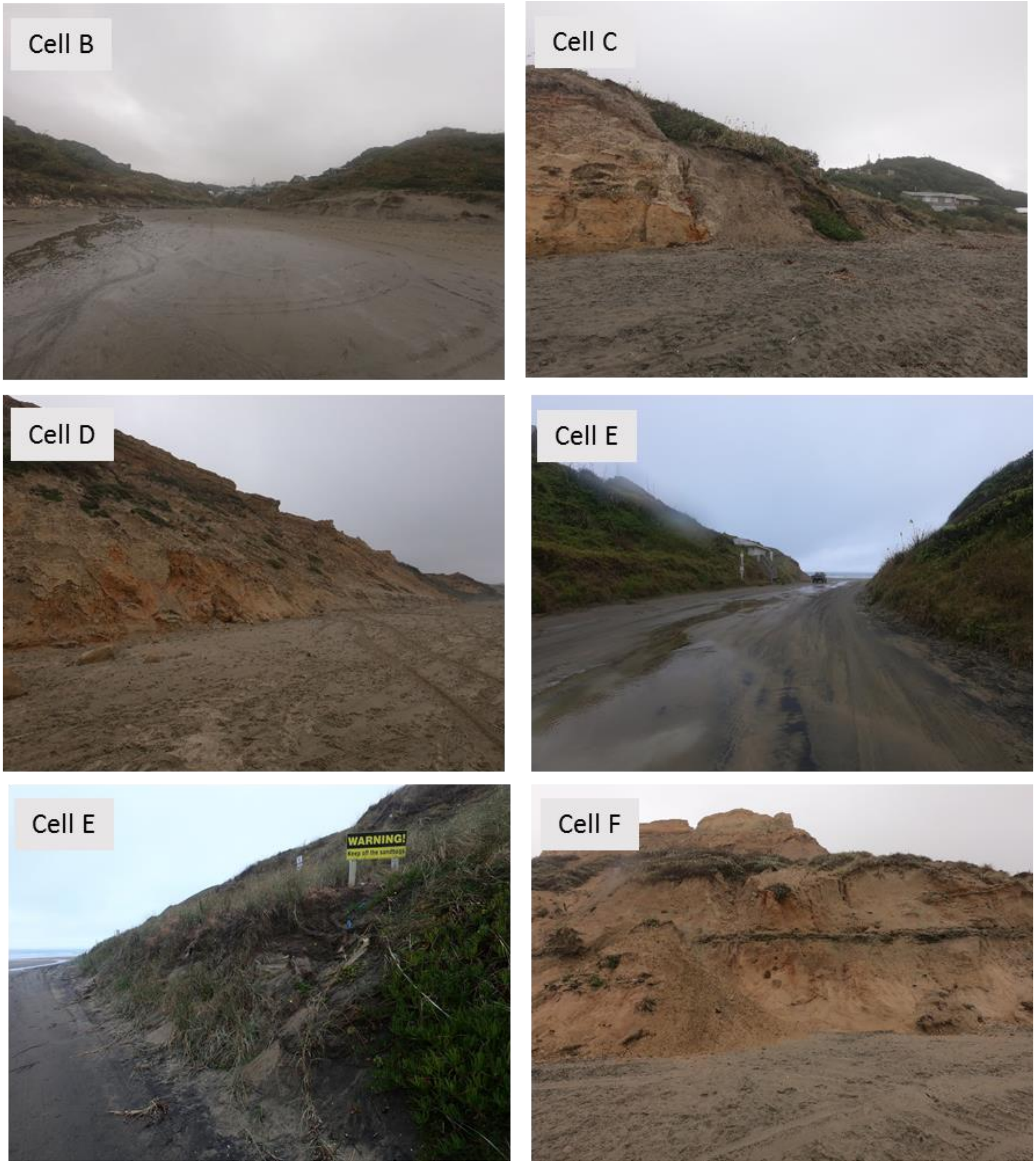


Figure 40.2: Photos from Baylys Beach site visit on 24/01/2020.

40.2 Local considerations

Baylys Beach is classified as a road. Vehicle access to the beach is available via an extension of the main road and a natural valley at Chase Grove. Here, the access is a 30-40 m wide gap between tall Pleistocene cliffs and modern sand dune. A stream flows through the access during rainfall events and waves surge up the access during wave events. Efforts were made to stabilise the eroding beach access bank in 2012 using sandbags that are now exposed and undermined. There was evidence of erosion observed during the site visit on 24/01/2020.

40.3 Component values

The site is split into six cells based on discrete spatial differences in coastal geomorphology. The shoreline at Baylys is primarily defined by the cliff toe except at Cell E, where the road extends onto the beach. There is a shoreline re-entrant at Cell E and here the processes are influenced by vehicle use, stream discharge and channelling of swash and backwash from ocean waves. Therefore, the inlet method outlined in Section 4.6 of the main report (T+T, 2020) is most suitable for Cell E. Component values used to calculate coastal erosion hazard zones are presented in Table 40.1 for all cells and future sea level rise scenarios are presented in Table 40.2.

The cliff cells all have the same underlying geology of weakly cemented sand from dune formation in the Pleistocene. A consistent stable angle and cliff response factor was applied to these cells. The stable angle of partly consolidated sand cliffs was assessed by senior geotechnical engineers and is relatively low and this type of cliff morphology is expected to be highly susceptible to increasing sea level due to a low material resistance. The cliff height was assessed using LiDAR, based on the elevation difference between the cliff toe and crest. Cliff height along the exposed cells reached up to 40 m, with lower cliffs at the two cells (B and E) influenced by valleys and beach access.

Analysis of historic shoreline positions that were digitised from aerial photographs indicate that the cliff toe is retreating landward at a typical rate of -0.03 to -0.15 m/yr. Landslides and slips were present in some of the digitised shorelines and attempts was made to remove these features from the long-term trend. Cells characterised by beach access (B and E) were typically more dynamic and had a lower long-term trend compared to the longer sections of uniform coast that directly face the ocean.

Adopted component values at Cell E reflect the processes associated with the re-entrant. A short-term erosion component was adopted for this site based on Table 4.6 of the method in T+T (2020) and the stable slope was defined by unconsolidated sand material. A closure slope to assess response to sea level rise was adopted for Cell E based on the method in section 4.6.5.2 of the main report (T+T, 2020).

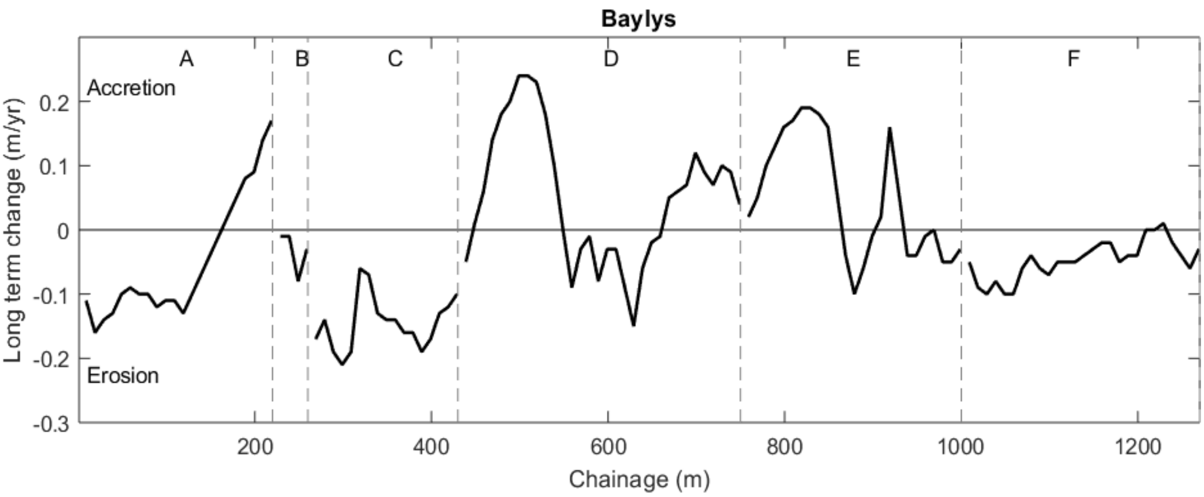


Figure 40.3: Rate of long-term shoreline change along the site showing each cell.

Table 40.1: Component values for Erosion Hazard Assessment

Site		1. Baylys Beach					
Cell		40A	40B	40C	40D	40E	40F
Cell centre (NZTM)	E	1667212	1667209	1667130	1666963	1666841	1666700
	N	6020707	6020814	6020838	6021015	6021232	6021372
Chainage, m (from S/E)		1-200	200-230	230-400	400-710	710-845	845:1100
Morphology		Partly cemented sand cliff	Partly cemented sand cliff	Partly cemented sand cliff	Partly cemented sand cliff	Re-entrant	Partly cemented sand cliff
Short-term (m)	Min	-	-	-	-	5	-
	Mode	-	-	-	-	8	-
	Max	-	-	-	-	10	-
Dune/Cliff elevation (m above toe or scarp)	Min	18	3	10	15	5	30
	Mode	35	5	15	25	10	35
	Max	45	6	40	40	14	45
Stable angle (deg)	Min	18.4	18.4	18.4	18.4	30	18.4
	Mode	22.5	22.5	22.5	22.5	32	22.5
	Max	26.6	26.6	26.6	26.6	34	26.6
Long-term (m) -ve erosion +ve accretion	Min	-0.15	-0.08	-0.20	-0.10	-0.1	-0.10
	Mode	-0.10	-0.03	-0.15	-0.05	-0.05	-0.05
	Max	-0.05	-0.01	-0.05	0.00	0	0.00
Closure slope (beaches) / Cliff response factor	Min	0.3	0.3	0.3	0.3	0.02	0.3
	Mode	0.4	0.4	0.4	0.4	0.03	0.4
	Max	0.5	0.5	0.5	0.5	0.04	0.5

Table 40.2: Sea level rise scenarios (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
Unconsolidated beach[1]	2080	0.16	0.21	0.33	0.51
	2130	0.28	0.42	0.85	1.17

[1]Adjusted to remove the influence of historic SLR (2.2 mm/year) on long-term rates of shoreline change

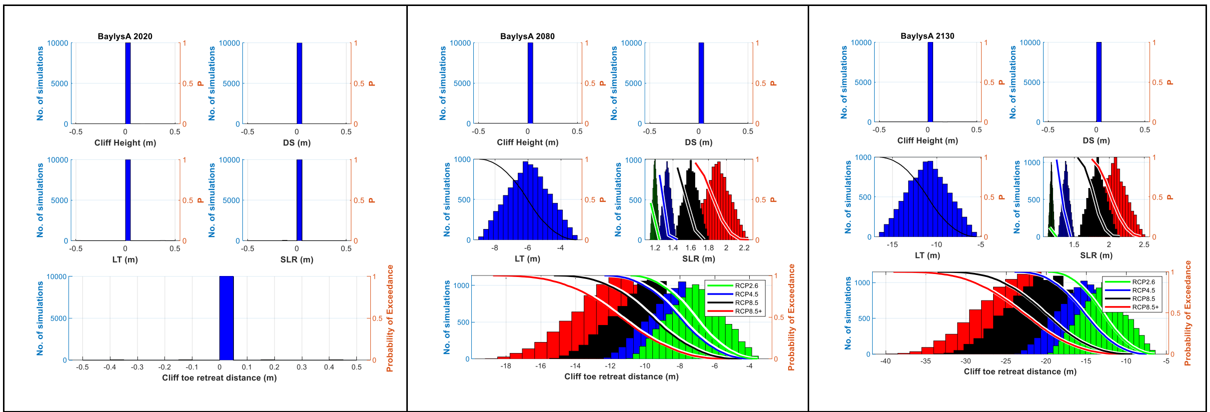
40.4 Coastal erosion hazard assessment

Histograms of individual components and resultant CEHZ distances computed using a Monte Carlo technique are shown in Figure 40.4 to Figure 40.9. Future shoreline distances are presented within Table 40.3 to Table 40.5 and mapped in Figure 40.10.

The cliff projection method was adopted for all cells at Baylys. Therefore, the probabilistic results presented below show the future toe recession distance instead of the total CEHZ distances. Projected cliff toe erosion distances to 2080 range from 3 to 12 m for RCP8.5. Distances to 2130 range from 10 to 37 m for RCP8.5 and 10 to 42 m for RCP8.5+.

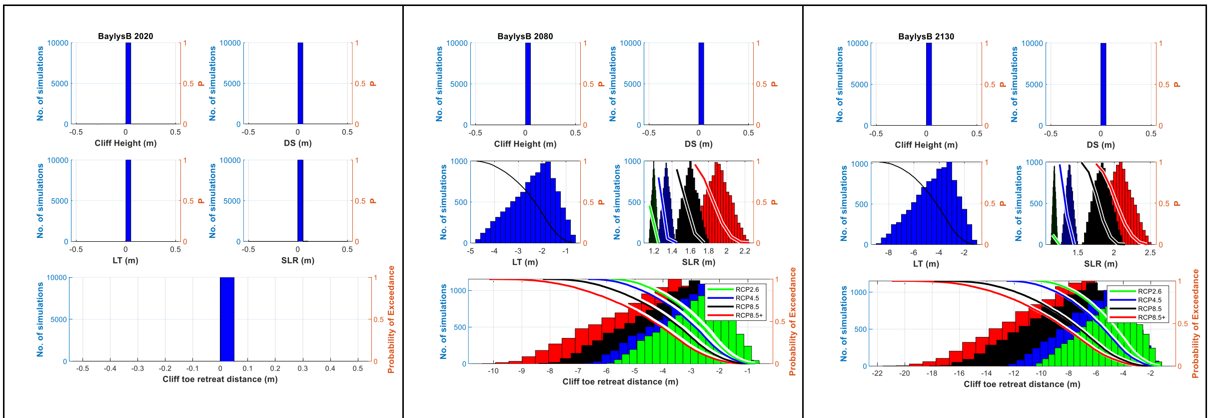
The toe recession outputs and the stable angle were used to project the future cliff stability zone, and total erosion hazard zone, using LiDAR derived across-shore profiles spaced in 10m intervals. A summary of the resulting total hazard zones for cliff cells at Baylys Beach are presented in Table 40.6.

Figure 40.11 shows the available historic shorelines for Baylys Beach.



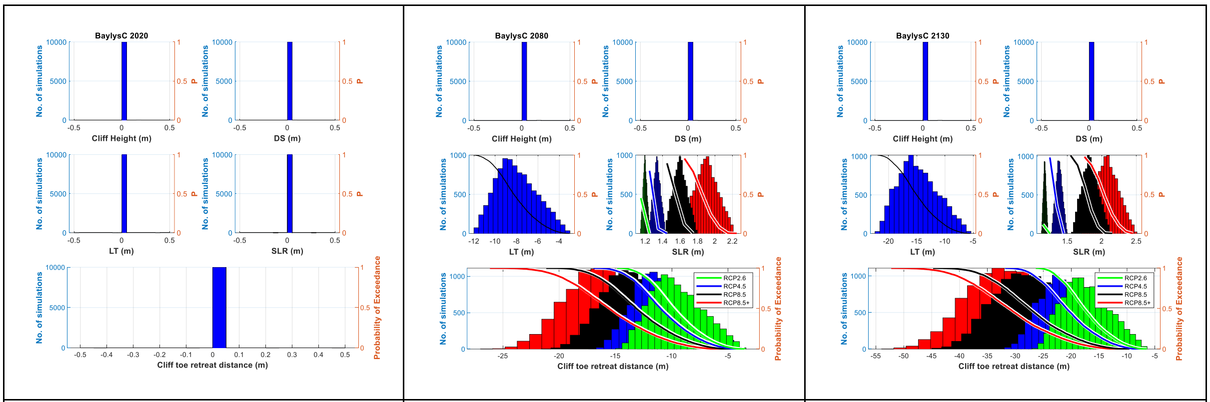
2020	*2080*	*2130*

Figure 40.4: Histograms of parameter samples and the resultant shoreline distances for 2020, 2080 and 2130 timeframes for cell 40A



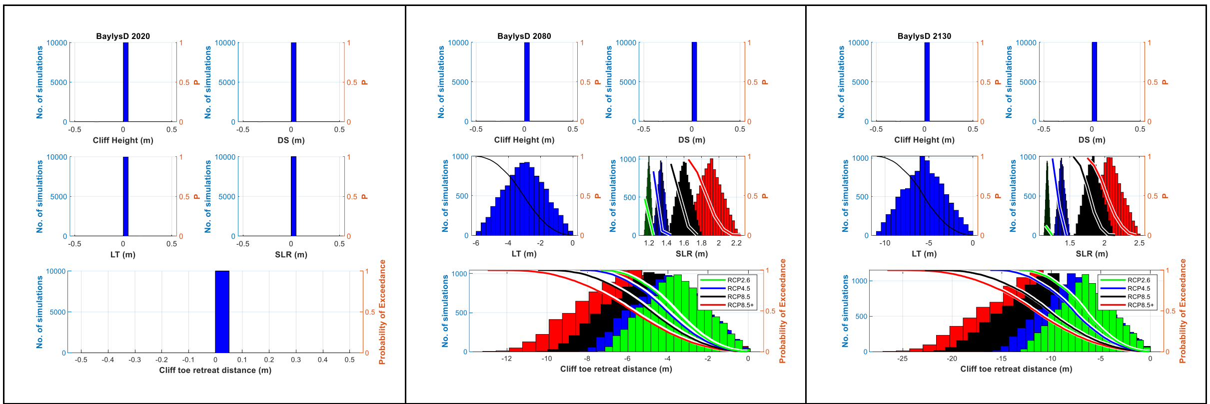
2020	*2080*	*2130*

Figure 40.5: Histograms of parameter samples and the resultant shoreline distances for 2020, 2080 and 2130 timeframes for cell 40B



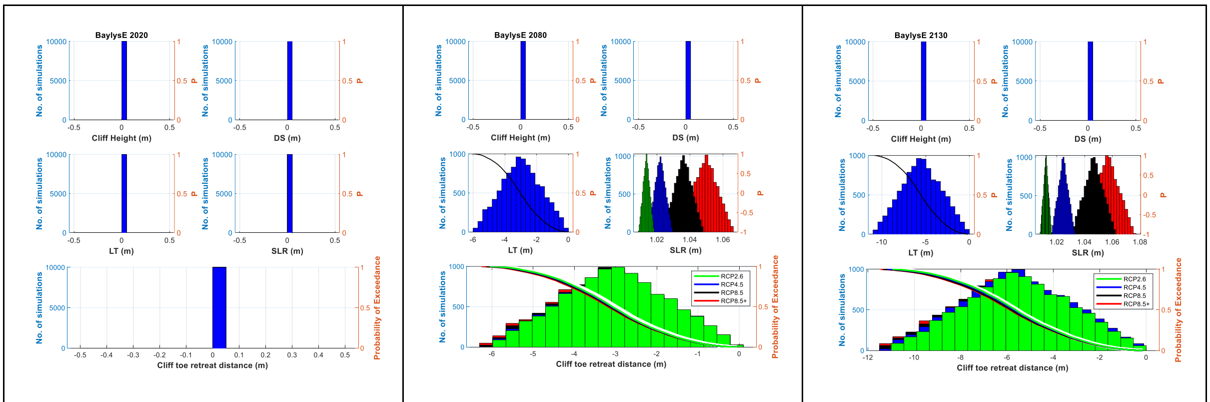
2020	*2080*	*2130*

Figure 40.6: Histograms of parameter samples and the resultant shoreline distances for 2020, 2080 and 2130 timeframes for cell 40C



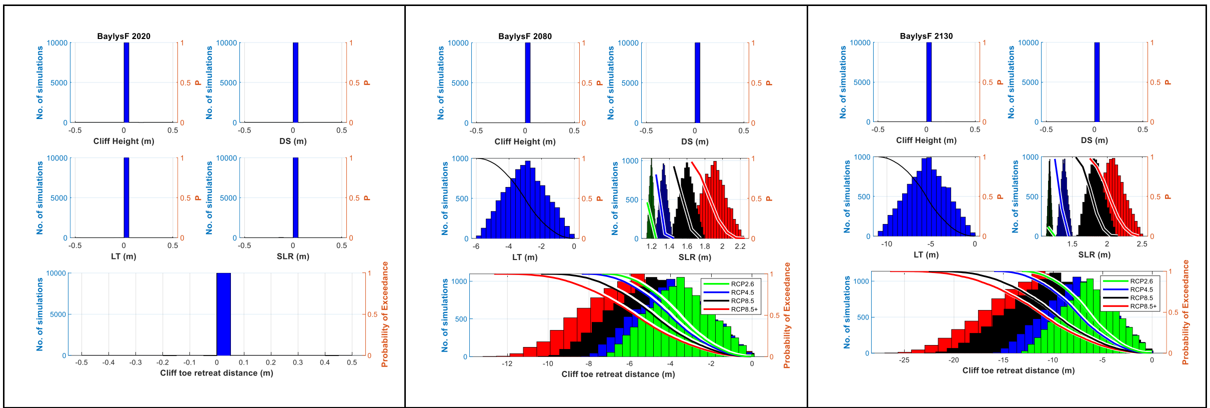
2020	*2080*	*2130*

Figure 40.7: Histograms of parameter samples and the resultant shoreline distances for 2020, 2080 and 2130 timeframes for cell 40D



2020	*2080*	*2130*

Figure 40.8: Histograms of parameter samples and the resultant shoreline distances for 2020, 2080 and 2130 timeframes for cell 40E



2020	*2080*	*2130*

Figure 40.9: Histograms of parameter samples and the resultant shoreline distances for 2020, 2080 and 2130 timeframes for cell 40F

Table 40.3: Coastal Erosion Hazard Zone Widths (m) Projected for 2020

Site		40. Baylys					
	Cell	**40A***	**40B***	**40C***	**40D***	**40E***	**40F***
Probability of CEHZ (m) Exceedance	**Min**	0	0	0	0	0	0
	99%	0	0	0	0	0	0
	95%	0	0	0	0	0	0
	90%	0	0	0	0	0	0
	80%	0	0	0	0	0	0
	70%	0	0	0	0	0	0
	66%	0	0	0	0	0	0
	60%	0	0	0	0	0	0
	50%	0	0	0	0	0	0
	40%	0	0	0	0	0	0
	33%	0	0	0	0	0	0
	30%	0	0	0	0	0	0
	20%	0	0	0	0	0	0
	10%	0	0	0	0	0	0
	5%	0	0	0	0	0	0
	1%	0	0	0	0	0	0
	Max	0	0	0	0	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 40.4: Coastal Erosion Hazard Zone Widths (m) Projected for 2080

Site		40. Baylys																							
Cell		40A				40B				40C				40D				40E				40F			
RCP scenario		2.6	4.6	8.5	8.5+	2.6	4.6	8.5	8.5+	2.6	4.6	8.5	8.5+	2.6	4.6	8.5	8.5+	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	-1	-1	-1	-1	-4	-4	-4	-5	0	0	0	0	0	0	0	0	0	0	0	0
	99%	-4	-5	-5	-6	-1	-1	-1	-2	-4	-5	-6	-7	-1	-1	-1	-1	0	0	0	0	-1	-1	-1	-1
	95%	-5	-5	-6	-7	-1	-1	-2	-2	-6	-6	-7	-9	-1	-1	-1	-2	-1	-1	-1	-1	-1	-1	-2	-2
	90%	-5	-6	-7	-8	-2	-2	-2	-2	-6	-7	-8	-10	-2	-2	-2	-3	-1	-1	-1	-1	-2	-2	-2	-3
	80%	-6	-7	-8	-9	-2	-2	-3	-3	-8	-8	-10	-12	-2	-3	-3	-4	-2	-2	-2	-2	-2	-3	-3	-4
	70%	-6	-7	-8	-10	-2	-2	-3	-3	-8	-9	-11	-13	-3	-3	-4	-4	-2	-2	-2	-2	-3	-3	-4	-4
	66%	-7	-7	-9	-10	-2	-3	-3	-4	-9	-10	-12	-14	-3	-3	-4	-5	-3	-3	-3	-3	-3	-3	-4	-5
	60%	-7	-8	-9	-11	-2	-3	-3	-4	-9	-10	-12	-14	-3	-4	-4	-5	-3	-3	-3	-3	-3	-4	-4	-5
	50%	-7	-8	-10	-11	-3	-3	-4	-4	-10	-11	-13	-16	-4	-4	-5	-6	-3	-3	-3	-3	-4	-4	-5	-6
	40%	-8	-8	-10	-12	-3	-3	-4	-5	-10	-12	-14	-16	-4	-4	-5	-6	-3	-3	-3	-3	-4	-4	-5	-6
	33%	-8	-9	-11	-13	-3	-4	-4	-5	-11	-12	-14	-17	-4	-5	-6	-7	-4	-4	-4	-4	-4	-5	-6	-7
	30%	-8	-9	-11	-13	-3	-4	-5	-5	-11	-12	-15	-17	-4	-5	-6	-7	-4	-4	-4	-4	-4	-5	-6	-7
	20%	-9	-10	-11	-14	-4	-4	-5	-6	-12	-13	-16	-19	-5	-5	-7	-8	-4	-4	-4	-4	-5	-5	-7	-8
	10%	-9	-10	-12	-15	-4	-5	-6	-7	-12	-14	-17	-20	-6	-6	-7	-9	-5	-5	-5	-5	-6	-6	-7	-9
	5%	-10	-11	-13	-16	-5	-5	-6	-8	-13	-15	-18	-21	-6	-7	-8	-10	-5	-5	-5	-5	-6	-7	-8	-10
	1%	-10	-12	-14	-17	-5	-6	-7	-9	-14	-16	-19	-23	-7	-8	-9	-11	-6	-6	-6	-6	-7	-7	-9	-11
	Max	-11	-13	-16	-20	-6	-7	-8	-10	-15	-17	-21	-25	-7	-8	-10	-13	-6	-6	-6	-6	-7	-8	-10	-13
	CEHZ1	-9*				-3*				-12*				-4*				-3*				-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 40.5: Coastal Erosion Hazard Zone Widths (m) Projected for 2130

Site		40. Baylys																							
Cell		40A				40B				40C				40D				40E				40F			
RCP scenario		2.6	4.6	8.5	8.5+	2.6	4.6	8.5	8.5+	2.6	4.6	8.5	8.5+	2.6	4.6	8.5	8.5+	2.6	4.6	8.5	8.5+	2.6	4.6	8.5	8.5+
Probability of CEHZ (m) Exceedance	Min	-6	-7	-9	-10	-1	-2	-2	-2	-7	-8	-10	-11	0	0	0	0	0	0	0	0	0	0	0	0
	99%	-7	-9	-11	-13	-2	-2	-3	-3	-8	-10	-13	-14	-1	-1	-1	-2	-1	-1	-1	-1	-1	-1	-1	-2
	95%	-9	-10	-13	-15	-2	-3	-4	-4	-10	-12	-16	-18	-2	-2	-3	-4	-2	-2	-2	-2	-2	-2	-3	-4
	90%	-9	-11	-15	-16	-3	-3	-4	-5	-11	-13	-18	-20	-3	-3	-5	-5	-2	-2	-3	-3	-3	-3	-5	-5
	80%	-11	-12	-16	-19	-3	-4	-5	-6	-14	-16	-21	-24	-4	-5	-6	-7	-3	-4	-4	-4	-4	-5	-6	-7
	70%	-11	-13	-18	-20	-4	-5	-6	-7	-15	-18	-23	-27	-5	-6	-8	-9	-4	-4	-4	-4	-5	-6	-8	-9
	66%	-12	-14	-18	-21	-4	-5	-6	-7	-16	-18	-24	-28	-5	-6	-8	-9	-5	-5	-5	-5	-5	-6	-8	-9
	60%	-12	-14	-19	-22	-4	-5	-7	-8	-17	-19	-26	-29	-6	-7	-9	-10	-5	-5	-5	-5	-6	-7	-9	-10
	50%	-13	-15	-20	-23	-5	-6	-8	-9	-18	-21	-27	-31	-6	-8	-10	-11	-6	-6	-6	-6	-6	-8	-10	-11
	40%	-14	-16	-21	-24	-6	-6	-9	-10	-19	-22	-29	-33	-7	-8	-11	-13	-6	-6	-6	-6	-7	-8	-11	-13
	33%	-14	-17	-22	-25	-6	-7	-9	-11	-19	-23	-30	-35	-8	-9	-12	-14	-7	-7	-7	-7	-8	-9	-12	-14
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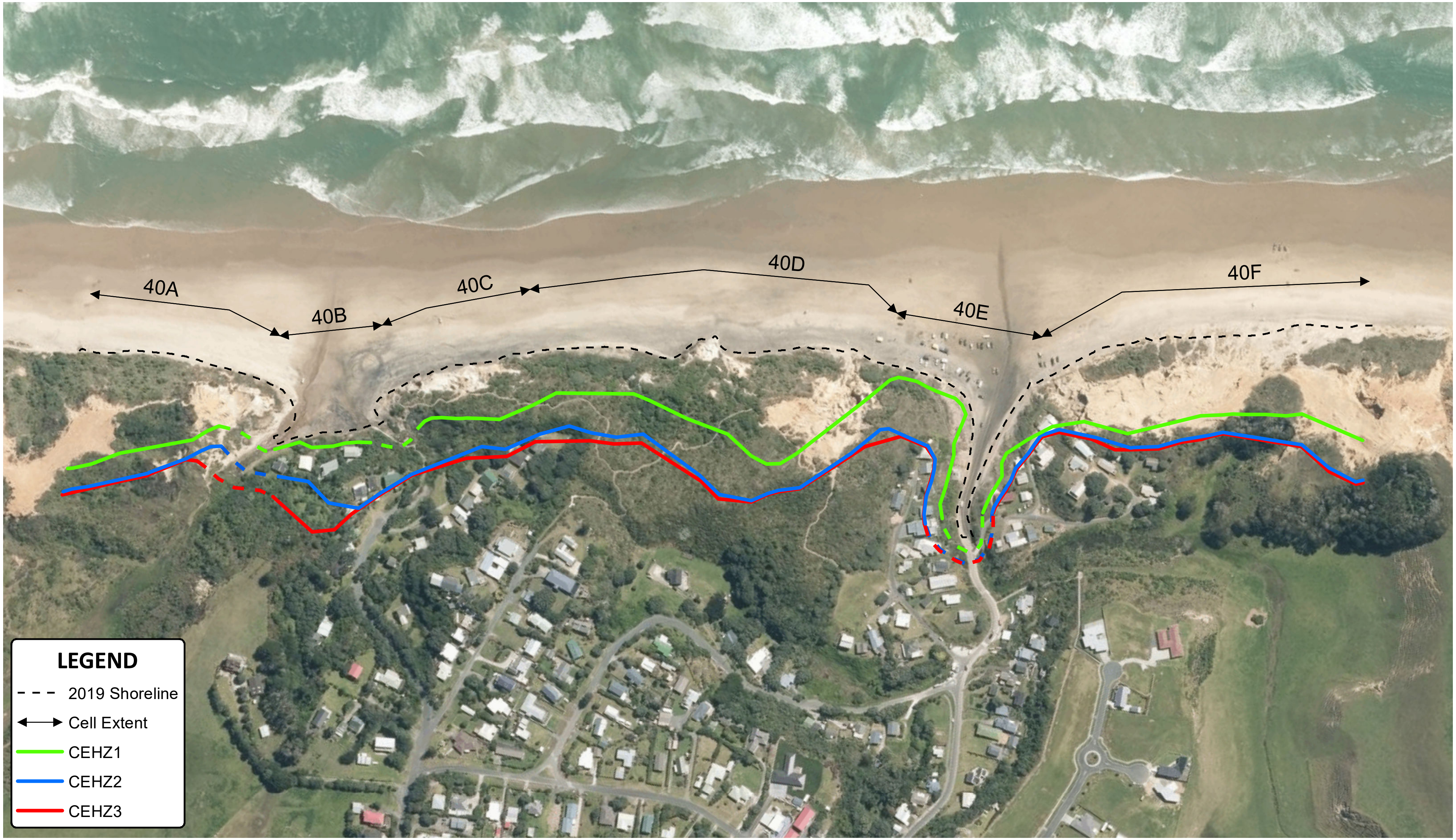
	20%	-15	-18	-24	-27	-7	-8	-11	-12	-21	-25	-33	-37	-9	-10	-14	-16	-8	-8	-8	-8	-9	-10	-14	-16
	10%	-16	-19	-26	-30	-8	-9	-12	-14	-22	-26	-35	-40	-10	-12	-16	-18	-9	-9	-9	-9	-10	-12	-16	-18
	5%	-17	-20	-27	-31	-9	-10	-14	-15	-23	-28	-37	-42	-11	-13	-17	-20	-9	-10	-10	-10	-11	-13	-17	-20
	1%	-19	-22	-30	-34	-10	-11	-15	-18	-25	-29	-40	-46	-12	-14	-19	-22	-10	-10	-11	-11	-12	-14	-19	-22
	Max	-20	-24	-33	-39	-11	-13	-18	-21	-26	-32	-45	-52	-13	-16	-22	-25	-11	-11	-12	-12	-13	-16	-23	-26
	CEHZ2	-27*				-14*				-37*				-17*				-10*				-17*			
	CEHZ3	-31*				-15*				-42*				-20*				-10*				-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 40.6: 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)**
40A	25	66	102	48	88	122	50	92	125
40B	4	9	16	17	45	82	18	54	100
40C	24	43	57	45	63	79	51	71	84
40D	6	41	101	29	87	134	33	94	137
40E	4	13	27	12	28	56	12	28	56
40F	64	72	98	74	92	132	75	94	134



Path: P:\1012360\WorkingMaterial\GIS\CEHZ maps\1012360_CEHZ001_v2.mxd Date: 29/05/2020 Time: 6:11:01 am

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

A4 SCALE 1:4,500

0 0.1 0.2 (km)

Tonkin+Taylor
105 Carlton Gore Rd, Newmarket, Auckland
www.tonkintaylor.co.nz

DRAWN	JJOU	May.20
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APPROVED		
ARCFILE 1012360_CEHZ001_v2.mxd		
SCALE (AT A4 SIZE) 1:4,500		
PROJECT No. 1012360		

NORTHLAND REGIONAL COUNCIL
Coastal Erosion Hazard Assessment
Baylys Beach
Site: 40

FIGURE No. Figure 40-10

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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 1:4,500

0 0.1 0.2 (km)

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PROJECT No. 1012360		

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Historic Shorelines
Baylys Beach
Site: 40

FIGURE No. Figure 40-11

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