# 1 Bowentown

## 1.1 Site description

The Bowentown shoreline is located in the northern basin of the Tauranga Harbour, approximately 0.75 km north-west from Bowentown Heads. The site consists of approximately 1.4 km of unconsolidated shoreline and 0.4 km of low coastal cliffs. The site is split into 5 cells based on differences in morphology, exposure and shoreline elevation (Figure 1-1).

Most of the Bowentown shoreline faces towards the west, south-west and is exposed to prevailing winds. The average fetch from the west is approximately 3 km and includes extensive shallow intertidal flats.


*Figure 1-1 Location and cell extent of the Bowentown shoreline within Tauranga Harbour.*

Along the northern end, the shoreline is unconsolidated with small patches of mangroves that back onto salt marsh (Cell 1A) (Figure 1-2A). Closer to the Bowentown Boating Club there is a small section of north-facing grass bank that is elevated approximately 2 m above RL (MD-53) and runs along the edge of the grass reserve and the boat club carpark. Along the western side of the boat club the shoreline consists of soft cliff that range in elevation from RL 1.5 to 2 m, with a retaining wall along the entire length (Cell 1B) (Figure 1-2B).

South from the boat ramp is a small embayment that is backed by a grass bank that runs parallel to the end of Pio Road (Cell 1C). South from the end of Pio Road the shoreline topography gradually rises to soft coastal cliff, ranging in elevation from RL 2 to 6.5 m (Cell 1D) (Figure 1-2C). The northern end of the cliff face is exposed but the southern end is well vegetated with shrubs. Along the top of the cliff are several dwellings set back approximately 10 m from the cliff edge. At the southernmost end of Bowentown, the shoreline comprises low-lying, unconsolidated beach sand which gradually slopes up to a small grass bank (Cell 1E) (Figure 1-2D). The backshore elevation is approximately 2 m above RL and comprises of several dwellings, including Otawhiwhi Marae.

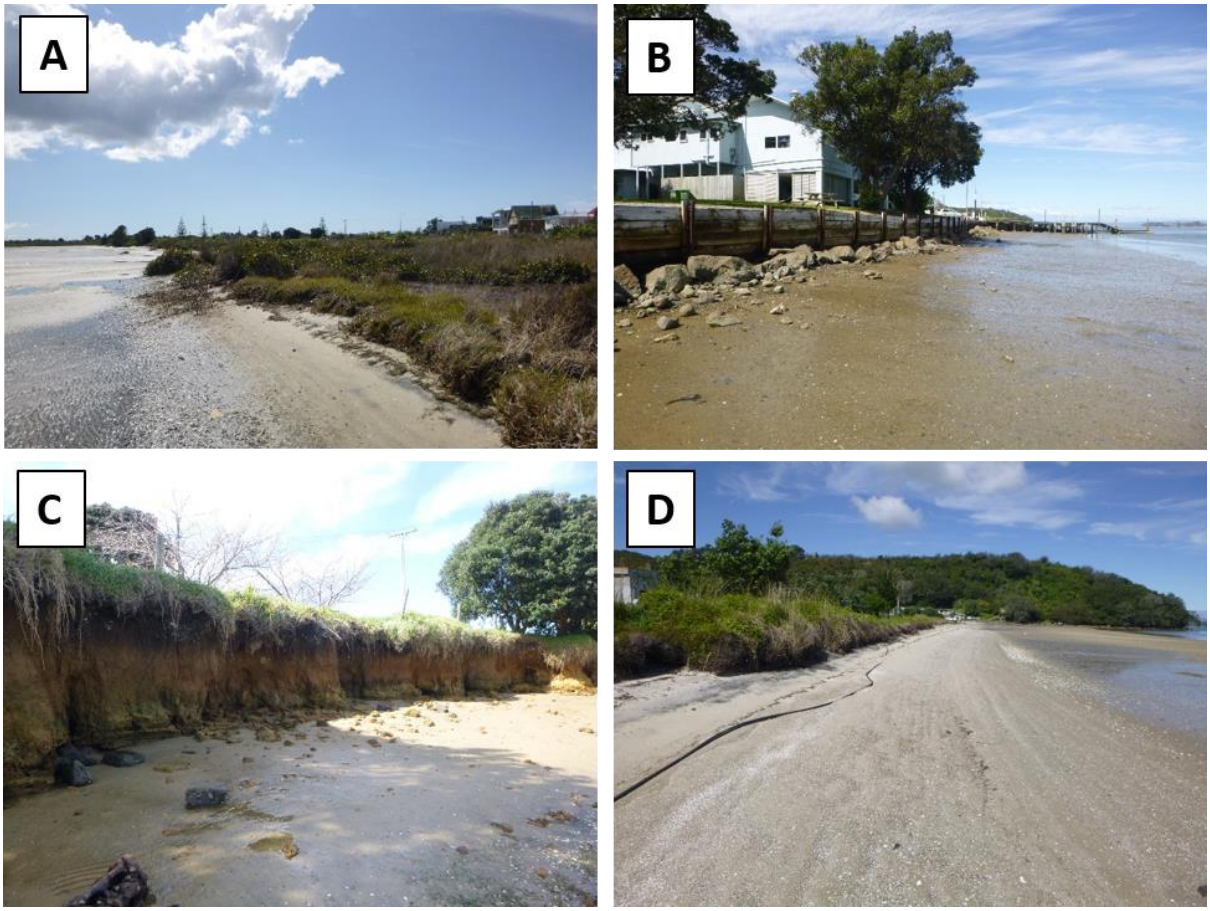



*Figure 1-2 Site photos for Bowentown. (A) Unconsolidated shoreline (Cell 1A), (B) Bowentown Boating Club (Cell 1B), (C) west-facing cliffs (Cell 1D), (D) unconsolidated beach (Cell 1E).*

## 1.2 Geology

The geological map of the area[1] indicates that the site comprises:

- Tauranga Group – Estuary Deposit: Sand, silt, mud and clay with local gravel and peat beds.
- Karioitahi Group – Late Pleistocene Stable Dune Deposits: Reddish to dark brown muddy sand and clay rich sandy paleosols. With rhyolitic ash and pumice lapilli.
- Karioitahi Group – Holocene Dune Deposits: Loose to poorly consolidated dune sands.

Field observations of the exposures are in line with the published geology, and also show Matua Subgroup sediments lower in the cliffs.

The existing slope angles in this area are between 3° to 20° in low unconsolidated areas, and between 12° to 50° in areas of banks or low cliffs. The range of stable slope angles for the Bowentown area are shown in Table 1-1 below.

The failure types observed around Bowentown were typically shallow surface failures. The likelihood of deep seated movement is low.

[1] Edbrooke, S.W. (compiler) 2001: *Geology of the Auckland area*. Institute of Geological & Nuclear Sciences 1:250,000 geological map 3. 1 sheet + 74 p. Lower Hutt, New Zealand. Institute of Geological & Nuclear Sciences Limited.

## 1.3 Coastal processes

The northern section of the Bowentown shoreline (Cell 1A) is the most sheltered from harbour waves. However, the historic shorelines (since 1982) indicate there is an average erosion trend of up to -0.25 m/yr. This shoreline erosion is most likely due to currents and meandering of the Waiau Stream Channel.

It is difficult to determine historic trends around the Bowentown Boating Club (Cell 1B) due to the shoreline modification with the seawall and boat ramp. However the site is relatively exposed and is close to the deep tidal channel. Therefore, without the seawall the site is likely to be prone to coastal erosion. In addition to wind waves and strong tidal currents, the process of wetting and drying is likely to impact weathering of the bare cliffs. Regression analysis for the adjacent cell (Cell 1C) shows long term erosion rates between -0.1 and -0.25 m/yr. This range of erosion rates is assumed the same for Cell 1B and is consistent with the average -0.2 m/yr estimated by Opus (2015).

Regression analysis indicates a slightly lower average long term erosion rate (-0.15 m/yr) for the cliffs within Cell 1D. Overhanging grass roots and undercut along the small coastal cliffs (Cell 1D) indicate that the cliffs are actively eroding. However the cliffs, particularly at the southern end of Cell 1D, do appear more vegetated and stable compared to the adjacent shoreline further north.

Recent coastal erosion is also apparent along the unconsolidated shoreline within Cell 1E, with evidence of scour and overtopping around the structures. Regression analysis indicates long term erosion rates between -0.05 and -0.15 m/yr. The shoreline within Cell 1E is slightly more sheltered that the rest of the shoreline due to sheltering by Bowentown Heads.

Based on the 3 km fetch from the southeast, the maximum theoretical significant wave height is estimated to be 1 m. Based on model results the short term storm cut is estimated to range from 2 to 5 m along the southern end of Bowentown (Cell 1E).

SLR response factors for the 3 consolidated cells (Cells 1B, 1C, 1 D) are estimated to be between 0.1 and 0.3 due to the relatively low exposure.

## 1.4 Local considerations

The Bowentown shoreline has a range of protection structures, plus the boat ramp in the middle (Cell 1B). Around the Bowentown Boating Club there is a timber seawall, which has been reinforced with steel beams (now very rusty) and rock rip rap along the base (Figure 1-2B). The seawall is approximately 2 m high and protects around 85 m of the shoreline north from the boat ramp. However, the wall does appear to be deteriorating in sections. The low shoreline that runs parallel to the end of Pio Road has approximately 110 m of rock revetment which is around 1 to 1.5 m high (Figure 1-3A). In a couple of sections there is evidence of small bank erosion behind the structure, indicating wave overtopping. While the coastal cliffs within Cell 1D are mostly unprotected, there are sections with rip rap along the base. Along the northern end of Cell 1E there are several seawalls, which vary in height from 0.5 to 1.5 m high (Figure 1-3B). Although some of the seawalls are reasonably well-structured, there is evidence of wave overtopping and bank scour behind the structures


*Figure 1-3 Examples of protection structures around the Bowentown shoreline. (A) Revetment along the grass bank (Cell 1C), (B) timber seawall (Cell 1D).*

## 1.5 Adopted component values

Adopted component values are presented within Table 1-1. 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 1-1 Adopted component values for the cells along Bowentown shoreline.**

| **Site** | | **1. Bowentown** | | | | |
|---|---|---|---|---|---|---|
| **Cell** | | 1A | 1B | 1C | 1D | 1E |
| **Cell centre (NZTM)** | **E** | 1863071 | 1862962 | 1863039 | 1863132 | 1863291 |
| | **N** | 5850843 | 5850400 | 5850305 | 5850133 | 5849788 |
| **Morphology** | | Unconsolidated | Consolidated | Consolidated | Consolidated | Unconsolidated |
| **Geology** | | Holocene dune deposits | Holocene estuary deposits | Holocene estuary deposits | Holocene estuary deposits | Stable dune deposits |
| **Exposure (average fetch + direction)** | | 1 km (W) | 2 km (W) | 3 km (W) | 3 km (W) | 3 km (W) |
| **State** | | Natural | Protected | Protected | Natural | Partially protected |
| **Short-term (m)** | Min | 1 | 0 | 0 | 0 | 2 |
| | Mode | 1.5 | 0 | 0 | 0 | 3 |
| | Max | 2 | 0 | 0 | 0 | 5 |
| **Dune/Cliff elevation (m above toe or scarp)** | Min | 1 | 1 | 1 | 2 | 1 |
| | Mode | 1.5 | 2 | 1.2 | 3 | 1.5 |
| | Max | 2 | 2.1 | 2 | 7 | 2 |
| **Stable angle (deg)** | Min | 30 | 24 | 24 | 24 | 30 |
| | Mode | 32 | 26 | 26 | 26 | 32 |
| | Max | 34 | 50 | 50 | 50 | 34 |
| **Long-term (m/yr)** | Min | -0.25 | -0.25 | -0.25 | -0.2 | -0.15 |
| | Mode | -0.2 | -0.2 | -0.2 | -0.15 | -0.1 |
| | Max | -0.1 | -0.1 | -0.1 | -0.05 | -0.05 |
| **Closure slope (beaches)/SLR response factor (cliffs)** | Min | 0.05 | 0.1 | 0.1 | 0.1 | 0.05 |
| | Mode | 0.08 | 0.2 | 0.2 | 0.2 | 0.1 |
| | Max | 0.1 | 0.3 | 0.3 | 0.3 | 0.2 |

## 1.6 Coastal erosion hazard assessment

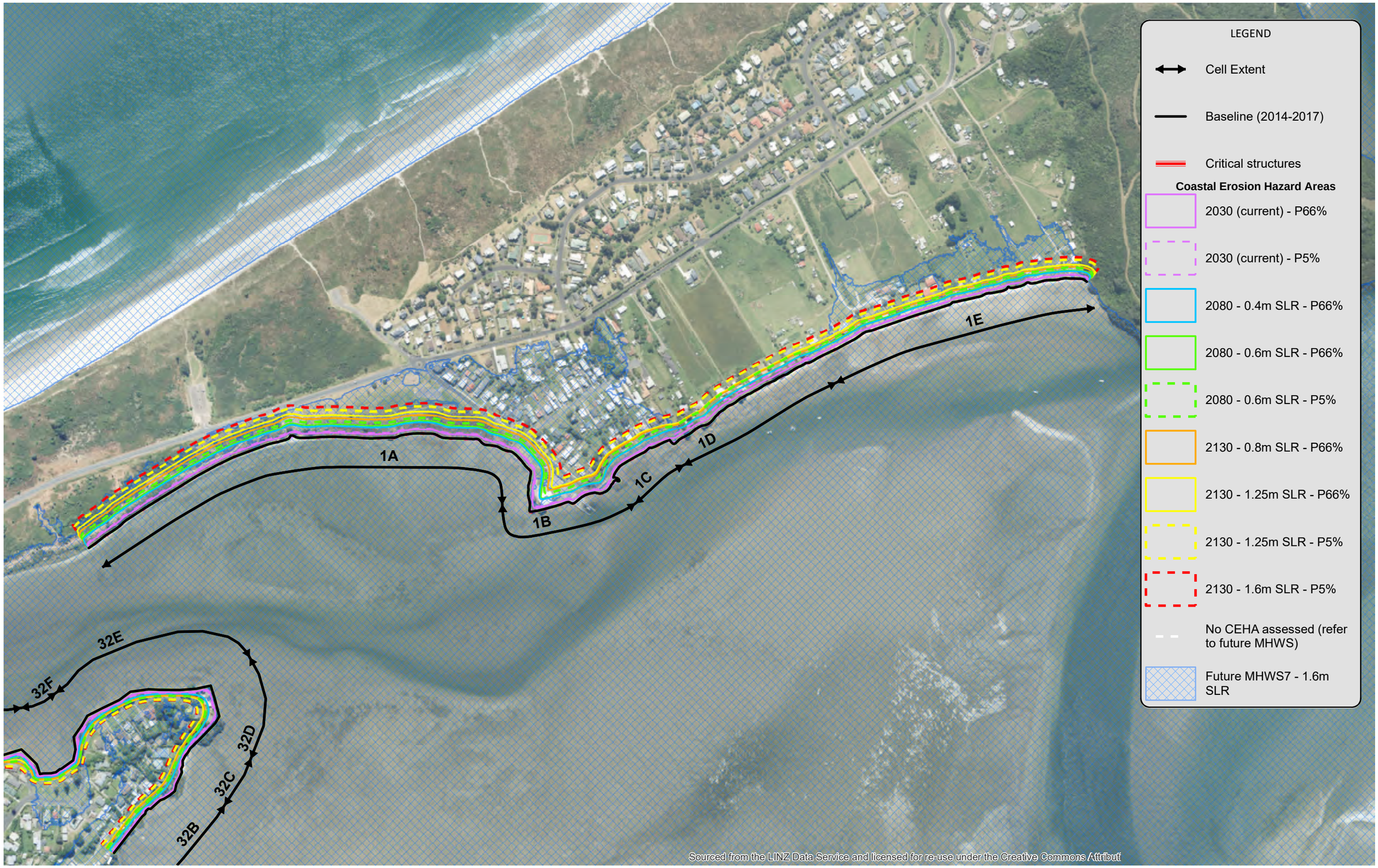
Coastal erosion hazard distances for Bowentown are presented within Table 1-2 and an overview map in Figure 1-4. Histograms of individual components and resultant erosion hazard distances using a Monte Carlo technique are shown in Appendix B. For the purpose of this assessment all coastal erosion protection structures have been ignored (refer to main report Section 4.6.4).

The current $P_{66\%}$ erosion hazard width ranges from -4 m to -7 m along the Bowentown shoreline. For the future erosion hazard, the $P_{5\%}$ with 1.6 m SLR in 2130 ranges from -37 m at the southern end of the shoreline to -51 m at the northern end, where historic erosion rates have been higher.

**Table 1-2 Coastal erosion hazard widths (m) for current, 2080 and 2130 timeframes.**

| Site | Cell | Timeframe | SLR (m) | Probability of exceedance (m) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | $P_{66\%}$ | $P_{50\%}$ | $P_{5\%}$ | $P_{1\%}$ | Max |
| Bowentown | 1A | Current | 0.03 | -5 | -7 | -7 | -9 | -9 | -10 |
| | | 50yr (2080) | 0.12 | -10 | -16 | -17 | -20 | -21 | -22 |
| | | | 0.2 | -11 | -17 | -18 | -21 | -22 | -23 |
| | | | 0.4 | -13 | -19 | -20 | -24 | -25 | -26 |
| | | | 0.6 | -15 | -22 | -23 | -26 | -28 | -30 |
| | | 100 yr (2130) | 0.22 | -15 | -24 | -26 | -31 | -32 | -34 |
| | | | 0.6 | -20 | -29 | -31 | -36 | -38 | -40 |
| | | | 0.8 | -22 | -32 | -34 | -39 | -41 | -44 |
| | | | 1.25 | -27 | -38 | -39 | -46 | -48 | -52 |
| | | | 1.6 | -31 | -42 | -44 | -51 | -54 | -59 |
| | 1B | Current | 0.03 | -3 | -5 | -5 | -7 | -7 | -8 |
| | | 50yr (2080) | 0.12 | -8 | -14 | -15 | -18 | -19 | -20 |
| | | | 0.2 | -8 | -15 | -16 | -19 | -20 | -22 |
| | | | 0.4 | -9 | -17 | -18 | -22 | -23 | -25 |
| | | | 0.6 | -10 | -18 | -19 | -24 | -25 | -28 |
| | | 100 yr (2130) | 0.22 | -13 | -22 | -24 | -29 | -31 | -32 |
| | | | 0.6 | -15 | -27 | -29 | -35 | -38 | -40 |
| | | | 0.8 | -16 | -28 | -30 | -38 | -40 | -43 |
| | | | 1.25 | -17 | -30 | -33 | -41 | -44 | -49 |
| | | | 1.6 | -17 | -32 | -34 | -44 | -47 | -52 |
| | 1C | Current | 0.03 | -3 | -5 | -5 | -6 | -7 | -8 |
| | | 50yr (2080) | 0.12 | -8 | -13 | -14 | -17 | -18 | -19 |
| | | | 0.2 | -9 | -14 | -15 | -19 | -20 | -21 |
| | | | 0.4 | -9 | -16 | -17 | -21 | -23 | -25 |
| | | | 0.6 | -10 | -17 | -19 | -23 | -25 | -27 |

| Site | Cell | Timeframe | SLR (m) | Probability of exceedance (m) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | $P_{66\%}$ | $P_{50\%}$ | $P_{5\%}$ | $P_{1\%}$ | Max |
| Bowentown | 1C | 100 yr (2130) | 0.22 | -13 | -22 | -24 | -29 | -30 | -32 |
| | | | 0.6 | -16 | -26 | -28 | -35 | -37 | -40 |
| | | | 0.8 | -16 | -28 | -30 | -37 | -40 | -43 |
| | | | 1.25 | -17 | -30 | -32 | -41 | -44 | -48 |
| | | | 1.6 | -17 | -31 | -34 | -43 | -47 | -52 |
| | 1D | Current | 0.03 | -3 | -7 | -8 | -12 | -14 | -17 |
| | | 50yr (2080) | 0.12 | -6 | -13 | -14 | -20 | -22 | -26 |
| | | | 0.2 | -6 | -14 | -15 | -21 | -23 | -27 |
| | | | 0.4 | -7 | -16 | -17 | -23 | -25 | -29 |
| | | | 0.6 | -7 | -16 | -18 | -24 | -26 | -31 |
| | | 100 yr (2130) | 0.22 | -9 | -20 | -21 | -28 | -30 | -37 |
| | | | 0.6 | -10 | -23 | -25 | -32 | -35 | -42 |
| | | | 0.8 | -10 | -24 | -26 | -34 | -37 | -44 |
| | | | 1.25 | -11 | -25 | -28 | -37 | -40 | -48 |
| | | | 1.6 | -11 | -26 | -29 | -38 | -42 | -51 |
| | 1E | Current | 0.03 | -4 | -6 | -6 | -7 | -8 | -8 |
| | | 50yr (2080) | 0.12 | -7 | -10 | -11 | -13 | -14 | -15 |
| | | | 0.2 | -7 | -11 | -12 | -14 | -15 | -16 |
| | | | 0.4 | -9 | -13 | -14 | -16 | -18 | -19 |
| | | | 0.6 | -10 | -15 | -15 | -19 | -20 | -23 |
| | | 100 yr (2130) | 0.22 | -10 | -15 | -16 | -20 | -21 | -23 |
| | | | 0.6 | -12 | -18 | -20 | -24 | -25 | -29 |
| | | | 0.8 | -13 | -20 | -21 | -26 | -28 | -32 |
| | | | 1.25 | -16 | -24 | -25 | -32 | -35 | -40 |
| | | | 1.6 | -18 | -27 | -28 | -37 | -41 | -47 |




Notes:
- Aerial photograph sourced from the LINZ Data Service (dated 2015)
- Coastal Erosion Hazard Areas (CEHA) are offset from the baseline (2014-2017)
- Refer to Stephens, 2018 for all MHWS7 scenarios

A3 SCALE 1:6,000
0 0.1 0.2 (km)

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| | | |
|---|---|---|
| DRAWN | RHAU | Dec.18 |
| CHECKED | | |
| APPROVED | | |
| ARCFILE | CEHA OverviewFINAL.mxd | |
| SCALE (AT A3 SIZE) | 1:6,000 | |
| PROJECT No. | 1001628.1000 | |

# Tauranga Harbour Coastal Erosion Assessment

## Erosion Hazard Overview

## Site 1: Bowentown

FIGURE No. Figure 1-4 Rev. 0

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