Kapiti Coast Erosion Hazard Assessment

Part 3: Data-Base

A report prepared for the Kapiti Coast District Council

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1 INTRODUCTION

1.1 The Kapiti Coast Erosion Hazard Assessment

The sandy coastline administered by the Kapiti Coast District Council (KCDC) is approximately 38 km long and contains 12 inlets. In June 2005, Coastal Systems Ltd was commissioned to re-assess the erosion hazard along the *open coast*, and this was later expanded to include *inlets*, i.e. those areas of coast affected by stream and rivermouths. The resulting ***Kapiti Coast Erosion Hazard Assessment*** consists of the following 3 parts: ***Part 1*** covers erosion on the *open coast*; ***Part 2*** covers erosion at *inlets*, and ***Part 3*** contains the data-base. Part 3: the *Coastal Erosion Hazard Data-Base* (or referred to more simply as the *Data-Base*), is the subject of the present report.

The *Data-Base* has 3 main objectives. Firstly, to provide a record of shoreline data, together with its processing and analysis, for each of the 68 *coastal measurement sites* (Fig 1) used in the study; this is carried out in Section 2 below. Secondly, to detail the derivation of cross-shore erosion hazard distances (CEHDs) via a model comprising several erosion hazard components (see Section 1.2 below); this is carried out in Section 3 below. While the first two objectives are required to demonstrate application of the assessment model, the third objective is that the *Data-Base* facilitates future update of the erosion hazard assessment as new information becomes available. To this end, Sections 2 and 3 below are produced as a series of Microsoft Excel Spreadsheets.

1.2 Assessment Approach

The concepts and methods used to determine CEHDs are now summarized. They are described in greater detail in the *Open Coast and Inlet Erosion Hazard Assessment Reports*, and also in Section 3 below.

1.2.1 Open coast model

An empirically-based methodology was adopted that uses the following formula to derive cross-shore erosion hazard distances (CEHD):

$$CEHD = LT + ST + SLR + DS + CU \quad (1)$$

Where:

LT*: longer-term historic shoreline change.*
This component was derived for a 50 yr period using statistical (regression) analysis of shorelines derived from cadastral maps and aerial photographs;

ST*: Shorter-term shoreline fluctuation.*
This component was also derived using regression analysis of the historic shoreline data;

SLR*: Shoreline retreat associated with sea-level rise (SLR) induced by global warming.*

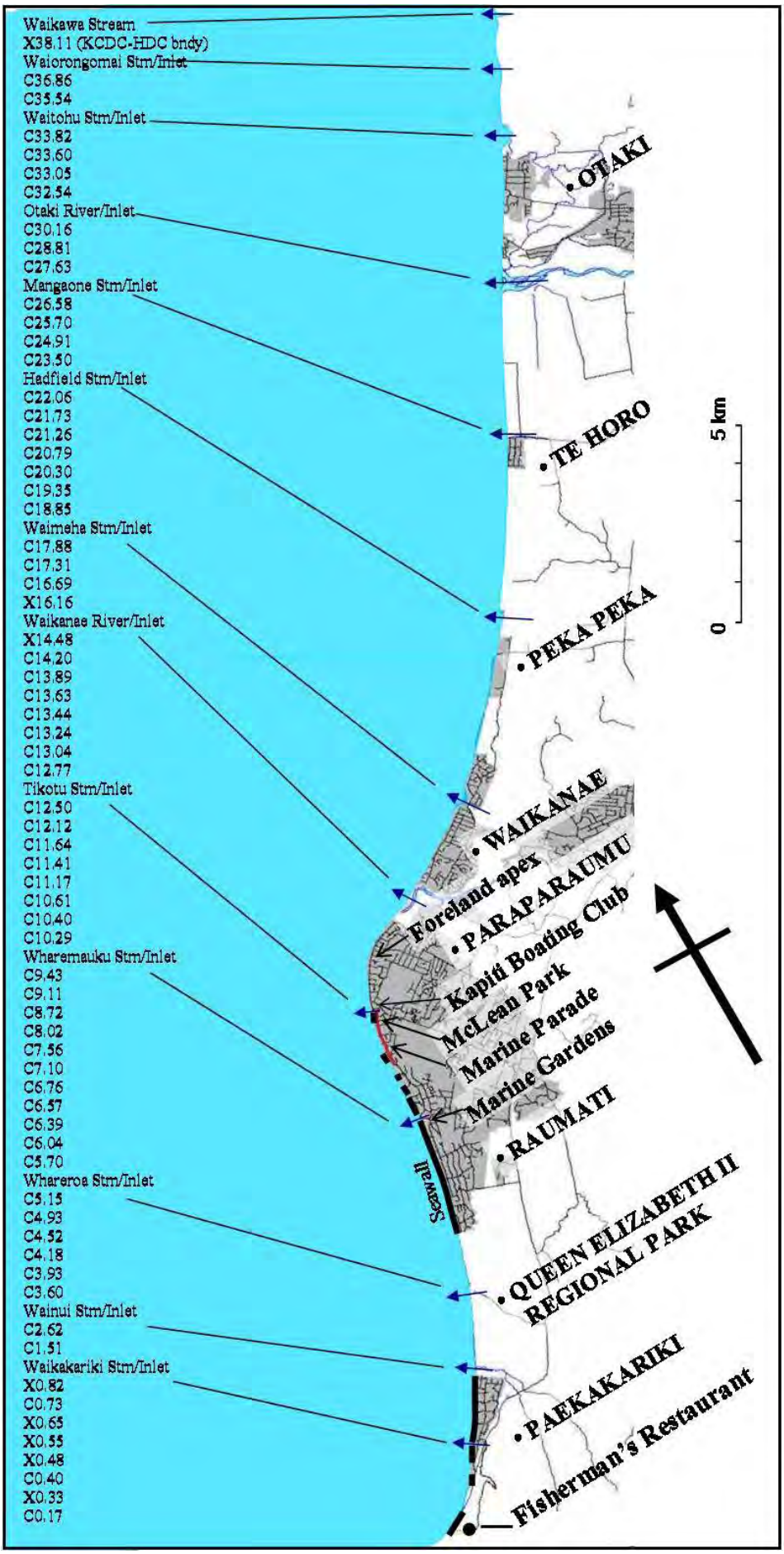


Figure 1 Map of the coastal area administered by the Kapiti Coast District Council which is referred to as the 'Kapiti Coast' in this report. Urban areas, water courses and stream mouths, seawalls and other locations referred to in the text have been marked. References across the top of map locate *coastal measurement sites* with the prefix **C** referring to sites used to provide data for determining erosion hazard Component values, references beginning with the prefix **X** referring to sites used to provide eXtra data for more detailed hazard assessment or for modelling the 2008 reference shoreline used for locating hazard lines, and the subsequent numbers refer to each site's longshore distance (km) from the datum at the southern end of Paekakariki Beach.

The SLR component was derived for a 50 yr period based on the most appropriate shoreline response model for the Kapiti Coast, and using the most recent SLR estimates;

***DS**: Dune-stability.*
This component accounts for scarp retreat to achieve a stable slope following storm erosion of the foredune;

***CU**: Combined uncertainty*
This refers to the safety margin derived by combining the *measurement error* which is the combined errors (usually random) associated with the above four components, together with a range of *other factors* (precautionary measures used in post-component processing) which serve to increase the overall safety margin. Those *other factors* which are quantified in Part 1, were included in the combined uncertainty (CU) value used in equation 1.

Erosion hazard lines along the open coast were then derived by applying CEHDs to the modelled 2008 shoreline, with intermediate coastal offsets being applied where the coastline between *coastal measurement sites* was non-linear.

1.2.2 Inlet model

Inlets are particularly dynamic regions being subject to the interaction of waves, tide, freshwater flow and wind. As such, the open coast CEHD formula (equation 1) had to be adapted for use in the inlet assessments. Component values for longer-term (LT), sea-level rise (SLR), and dune stability (DS) for the closest *coastal measurement site* on the adjacent open coast were used. The *shorter-term* component value was based on the location of the landwardmost shoreline locations contained within the shoreline record (termed the *inlet migration curve)*. The erosion hazard distance was then derived by offsetting for the remaining component values, plus the revised combined uncertainty (CU) value. The cross-shore *inlet erosion hazard distance (IEHD)* can thus be expressed as:

$$IEHD = IM - (LT + SLR + DS + CU) \qquad (2)$$

Where ***IM*** = landwardmost *inlet migration* and the negative sign refers to the landward direction.

The *erosion hazard lines* around an inlet were derived simply by applying equation 2 at several locations and then interpolating in between in such a manner as to preserve the general shoreline shape. In addition, the inlet erosion hazard lines were merged to landward with either the adjusted inlet throat or, where they existed, with permanent structures (e.g. bridge abutments), and to seaward they were merged with the open coast erosion hazard line. Some additional adjustment was required where long-term shoreline retreat will result in a

different channel orientation occurring at, and immediately upstream of, the new throat location, as channel geometry in this area has a significant influence on inlet configuration.

1.2.3 Natural and managed coasts

Where the coast is protected by structures or management practices, an erosion assessment for the simulated natural coast was also required. Calculating erosion hazard lines for the corresponding natural coast/inlet enables the effect that management has had on coastal processes and morphological behaviour to be identified and the consequences of not committing to existing management for the next 50 to 100 years to be defined. While it is not anticipated that these structures will cease to be maintained, or that other management practices be discontinued, informed decisions will be able to be made on both the continuance of present structures and practices, and also on their future extension.

The southern Kapiti open coast is punctuated with seawalls and rock revetments to protect the shoreline. The open coast assessment incorporates the following three future scenarios for the existing seawalls***:*** *seawalls hold, seawalls fail and are repaired, and seawalls are removed.*

Many of the inlets on the Kapiti Coast are contolled by structures (guide walls and groynes) and other management procedures such as *mouth cutting* when littoral sand builds up and impedes fresh water and tidal outflow. For such inlets, erosion hazard lines were derived for both the present managed inlet and the simulated natural inlet.

2 COASTAL MEASUREMENT SITE INFORMATION

2.1 Introduction

This section contains shoreline data, processing and analysis for the 68 individual *coastal measurement sites* depicted in Fig 1. A separate Excel Worksheets applies to each site and a summarized example (site C14-20) is given below with further explanation of the various parts appearing on the left. Each sheet concludes with the application of the shoreline regression model to define the 2008 shoreline which is then used to reference the CEHD (derived in Section 3) and thus locate the erosion hazard line. Note that the erosion hazard lines are provided electronically in vector files for application in GIS overlays.

* Name of site

* Natural or protected by:

* Location details relative to distance datum plus Reference Pt survey co-ordinates in NZMG.

* Relationship to beach profile and any other referencing systems (e.g. MWD, Gibb '78).

* Raw (cols 1 & 2) and processed (cols 2 & 4) shoreline data. Col 2 is time relative to an 1870 datum, while col 4 is distance relative to the first shoreline. These data were processed in this way to facilitate regression modelling.

* Shoreline time-series

* Shoreline regression model output for *earlier* and *later* sub-sets (see *Open Coast Assessment* for explanation). Coefficients used in derivation of LT and ST components,
and also for:
* modelling the present shoreline by substituting t = 138 yrs (relative to 1870 datum) in the *later pd* model and adding the original shoreline offset (11.9 m), and then:

* applying the CEHD (Section 3.2) of -59.11m to the 2008 modelled shoreline datum to locate the erosion hazard (or set-back) line.

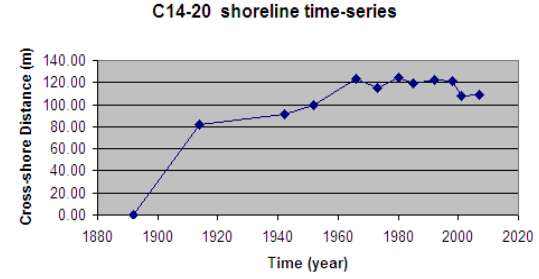
Coastal Hazard Measurement site C14-20

Type of shoreline: natural

Location:
14 119 m north of Fisherman's Restaurant datum….
Reference point co-ordinates:……..

Relationship to other surveys/refn systems
Online and 109.9 m landward of KCDC profile 182

date	Chron (1870)	Dist (m) (refn pt)	Dist (m) (1892)
1892	22.00	11.90	0.00
1914	44.00	93.90	82.00
1942	72.00	103.50	91.60
1952	82.00	111.50	99.60
1966	96.00	135.50	123.60
1973	103.00	127.50	115.60
etc	etc	etc	etc



Shoreline change modelling:

Earlier period (1892 - 1952)
dE = 0.1.766*tE - 23.351
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007), weighting 1966+
dL = -0.276*tL + 150.402 SEE = 5.428
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Modelled 2008 shoreline relative to C14-20 refn pt
11.9 + (-0.276 * 138 + 150.402) = 124.2 m

Erosion hazard line location rel to C14-20 refn pt
124.2 – 59.11 = 65.09 m (seaward of C14-02 refn pt)

2.2 Site information.xls

Refer to the Excel Workbook file ***2.2 Site information for Data-Base.xls*** to view the 68 Excel Worksheets.

Worksheet names:

C0-17	C12-50
X0-33	C12-77
C0-40	C13-04
X0-48	C13-24
X0-55	C13-44
X0-65	C13-63
C0-73	C13-89
X0-82	C14-20
C1-51	X14-48
C2-62	X16-16
C3-60	C16-69
C3-93	C17-31
C4-18	C17-88
C4-52	C18-85
C4-93	C19-35
C5-15	C20-30
C5_70	C20-79
C6-04	C21-26
C6-39	C21-73
C6-57	C22-06
C6-76	C23-50
C7-10	C24-91
C7-56	C25-70
C8-02	C26-58
C8-72	C27-63
C9-11	C28-81
C9-43	C30-16
C10-29	C32-54
C10-40	C33-05
C10-61	C33-60
C11-17	C33-82
C11-41	C35-54
C11-64	C36-89
C12-12	X38-11

Cross-shore coastal measurement site C0-17

Type of shoreline:

Full protection by rock revetment

Location

168 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C0-17 refn point co-ordinates: C0-17 2673323.27 6021367.22

Relationship to other reference systems:

Gibb (1978) reference 075 is 60 m south of C0-17 transect

KCDC old profile 0 = new profile 200 is 279 m south of C0-17 transect

Key

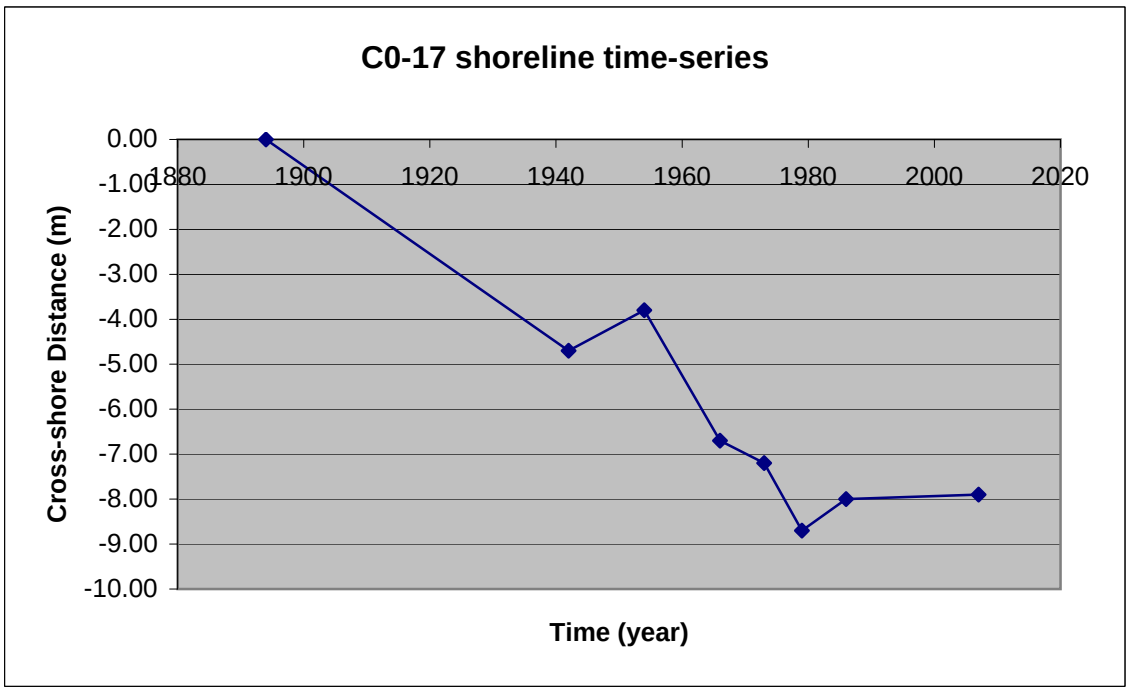
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_0-17	chron_0-17	mmt_0-17	dis_0-17
1894	24.00	50.80	0.00
1942	72.00	46.10	-4.70
1954	84.00	47.00	-3.80
1966	96.00	44.10	-6.70
1973	103.00	43.60	-7.20
1979	109.00	42.10	-8.70
1986	116.00	42.80	-8.00
2007	137.00	42.90	-7.90



Shoreline change modelling:

Earlier period (1894 - 1954)

dE = -0.080*tE + 1.520

where dE = cross-shore **d**istance (m) for the **E**arly period

tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007)

dL = 0 as seawall (rock revetment) SEE = 0

where dL = cross-shore **d**istance (m) for the **L**ate period

SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C0-17				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
NA	NA	NA	NA	42.9

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C0-40	Co-odinates (NZMG)		
-30.70	12.2	C0-17	2673313.7	6021374.75
Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C0-40	Co-odinates (NZMG)		
-41.10	1.8	C0-17	2673321.86	6021368.31

Coastal measurement site X0-33

Xtra site used in South Paekakariki Study (Appendix A)

Type of shoreline:

Natural

Location

326 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

X0-33 ref point co-ordinates: X0-33 2673420.85 6021488.01

Relationship to other reference systems:

None

Key

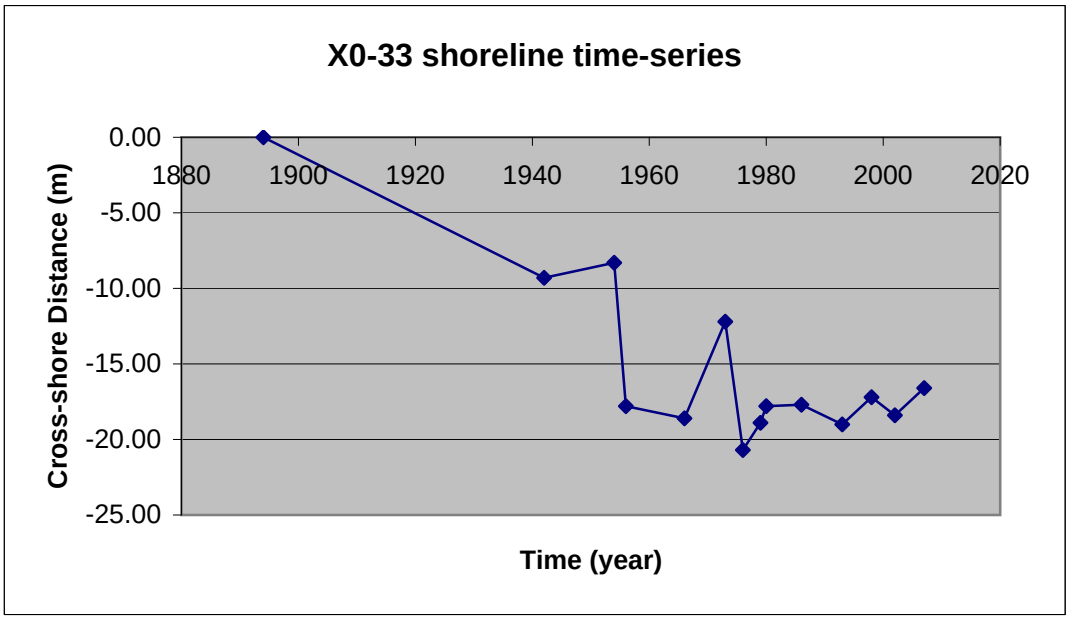
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from Reference Point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_0-33	chron_0-33	mmt_0-33	dis_0-33
1894	24.00	63.80	0.00
1942	72.00	54.50	-9.30
1954	84.00	55.50	-8.30
1956	86.00	46.00	-17.80
1966	96.00	45.20	-18.60
1973	103.00	51.60	-12.20
1976	106.00	43.10	-20.70
1979	109.00	44.90	-18.90
1980	110.00	46.00	-17.80
1986	116.00	46.10	-17.70
1993	123.00	44.80	-19.00
1998	128.00	46.60	-17.20
2002	132.00	45.40	-18.40
2007	137.00	47.20	-16.60



Shoreline change modelling:

Earlier period (1894 - 1954)

dE = -0.132*tE + 1.604

where dE = cross-shore **d**istance (m) for the **E**arly period

tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007)

dL = -0.114*tL - 4.036 and SEE = 3.300

where dL = cross-shore **d**istance (m) for the **L**ate period

tL = **t**ime (yrs) for the **L**ate period

SEE = **s**tandard **e**rror of **e**stimate

Coastal Hazard Measurement site C0-40

Used in South Paekakariki Study (Appendix A)

Type of shoreline:

Natural

Location

400 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C0-4 reference point co-ordinates: C0-40 2673461.9 6021550.86

Relationship to other reference systems:

MWD 1 is on-line with C0-40

KCDC old profile 1 = new profile 210 is 27.5 m north of C0-40 transect

Key

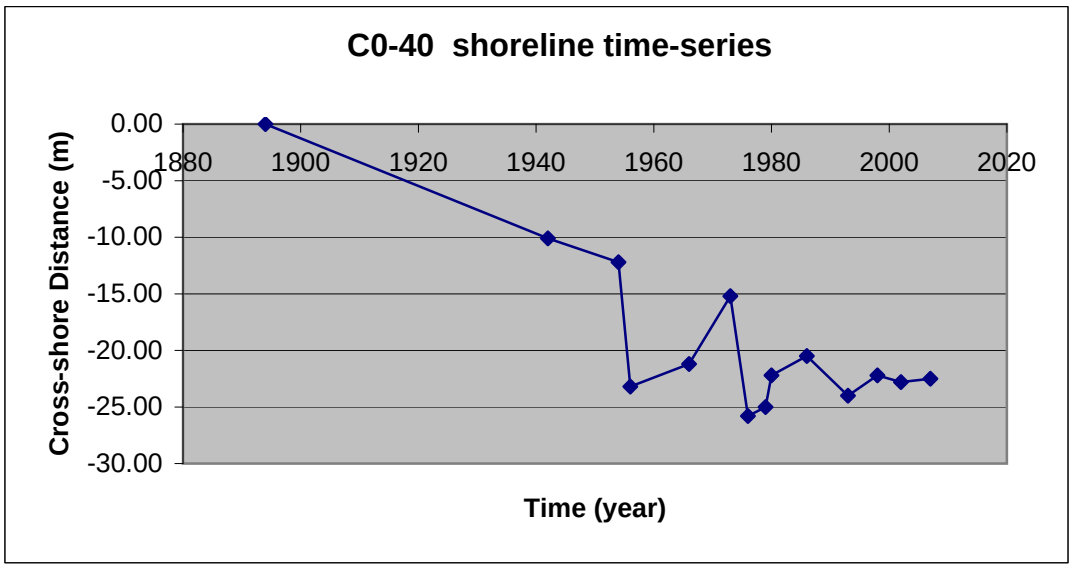
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_0-40	chron_0-40	mmt_0-40	dis_0-40
1894	24.00	62.30	0.00
1942	72.00	52.20	-10.10
1954	84.00	50.10	-12.20
1956	86.00	39.10	-23.20
1966	96.00	41.10	-21.20
1973	103.00	47.10	-15.20
1976	106.00	36.50	-25.80
1979	109.00	37.30	-25.00
1980	110.00	40.10	-22.20
1986	116.00	41.80	-20.50
1993	123.00	38.30	-24.00
1998	128.00	40.10	-22.20
2002	132.00	39.50	-22.80
2007	137.00	39.80	-22.50



Shoreline change modelling:

Earlier period (1894 - 1954)
dE = -0.205*tE + 4.888
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007)
dL = -0.157*tL - 3.577 SEE = 3.976
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C0-40				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
62.3	-0.157	-3.577	-25.243	37.1

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C0-40	Co-odinates (NZMG)		
-49.45	-12.35	C0-40	2673471.65	6021543.4

Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C0-40	Co-odinates (NZMG)		
-54.45	-17.35	C0-40	2673475.85	6021540.59

Coastal Hazard Measurement site X0-48

Xtra site used in South Paekakariki Study (Appendix A)

Type of shoreline:

Natural

Location

478 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

X0-48 ref point co-ordinates: X0-48 2673508.6 6021613.28

Relationship to other reference systems:

None

Key

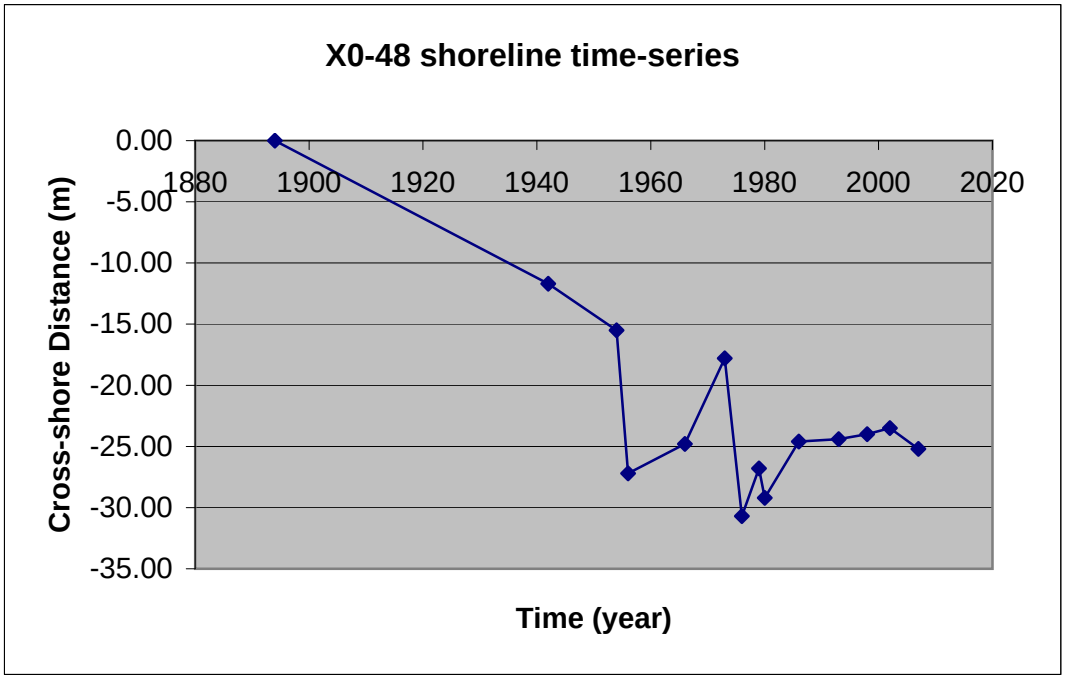
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_0-48	chron_0-48	mmt_0-48	dis_0-48
1894	24.00	65.80	0.00
1942	72.00	54.10	-11.70
1954	84.00	50.30	-15.50
1956	86.00	38.60	-27.20
1966	96.00	41.00	-24.80
1973	103.00	48.00	-17.80
1976	106.00	35.10	-30.70
1979	109.00	39.00	-26.80
1980	110.00	36.60	-29.20
1986	116.00	41.20	-24.60
1993	123.00	41.40	-24.40
1998	128.00	41.80	-24.00
2002	132.00	42.30	-23.50
2007	137.00	40.60	-25.20



Shoreline change modelling:

Earlier period (1894 - 1954)

dE = -0.254*tE + 6.183

where dE = cross-shore **d**istance (m) for the **E**arly period

tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007)

dL = -0.136*tL - 8.844 SEE = 4.917

where dL = cross-shore **d**istance (m) for the **L**ate period

tL = **t**ime (yrs) for the **L**ate period

SEE = **s**tandard **e**rror of **e**stimate

Coastal Hazard Measurement site X0-55

Xtra site used in South Paekakariki Study (Appendix A)

Type of shoreline:

Natural

Location

548 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

X0-55 ref point co-ordinates: X0-55 2673547.2 6021673.3

Relationship to other reference systems:

None

Key

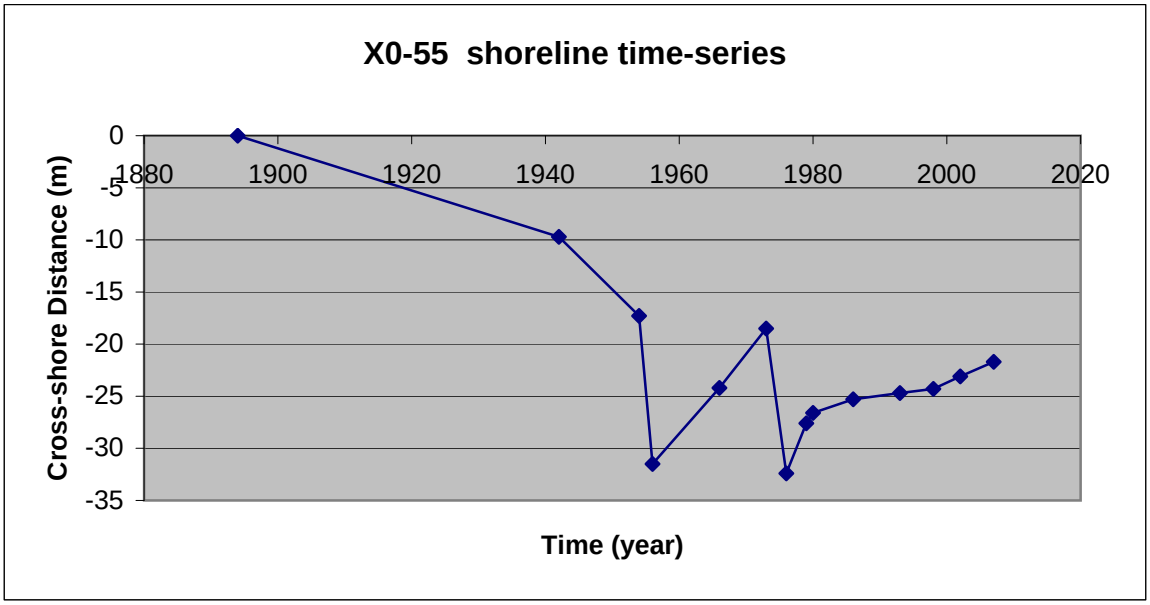
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_0-55	chron_0-55	mmt_0-55	dis_0-55
1894	24.00	64.70	0.00
1942	72.00	55.00	-9.70
1954	84.00	47.40	-17.30
1956	86.00	33.20	-31.50
1966	96.00	40.50	-24.20
1973	103.00	46.20	-18.50
1976	106.00	32.30	-32.40
1979	109.00	37.10	-27.60
1980	110.00	38.10	-26.60
1986	116.00	39.40	-25.30
1993	123.00	40.00	-24.70
1998	128.00	40.40	-24.30
2002	132.00	41.60	-23.10
2007	137.00	43.00	-21.70



Shoreline change modelling:

Earlier period (1894 - 1954)

dE = -0.264*tE + 6.821

where dE = cross-shore **d**istance (m) for the **E**arly period

tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007)

dL = -0.100*tL - 12.787 SEE = 5.923

where dL = cross-shore **d**istance (m) for the **L**ate period

tL = **t**ime (yrs) for the **L**ate period

SEE = **s**tandard **e**rror of **e**stimate

Coastal Hazard Measurement site X0-65

Xtra site used in South Paekakariki Study (Appendix A)

Type of shoreline:

Partial protection by remnant seawall

Location

647 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

X0-65 ref point co-ordinates: X0-65 2673598.98 6021758.37

Relationship to other reference systems:

None

Key

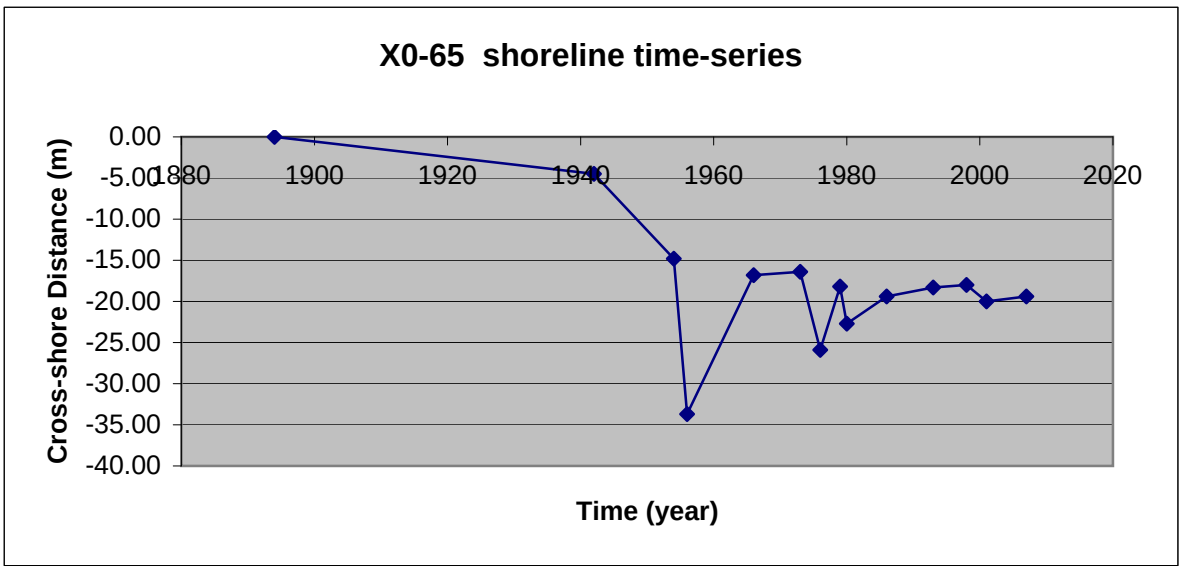
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_0-65	chron_0-65	mmt_0-65	dis_0-65
1894	24.00	60.00	0.00
1942	72.00	55.50	-4.50
1954	84.00	45.20	-14.80
1956	86.00	26.30	-33.70
1966	96.00	43.20	-16.80
1973	103.00	43.60	-16.40
1976	106.00	34.10	-25.90
1979	109.00	41.80	-18.20
1980	110.00	37.30	-22.70
1986	116.00	40.60	-19.40
1993	123.00	41.70	-18.30
1998	128.00	42.00	-18.00
2001	131.00	40.00	-20.00
2007	137.00	40.60	-19.40



Shoreline change modelling:

Earlier period (1894 - 1954)

dE = -0.203*tE + 5.745

where dE = cross-shore **d**istance (m) for the **E**arly period

tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007)

dL = -0.0.74*tL - 11.126 SEE = 6.709

where dL = cross-shore **d**istance (m) for the **L**ate period

tL = **t**ime (yrs) for the **L**ate period

SEE = **s**tandard **e**rror of **e**stimate

Coastal Hazard Measurement site C0-73

Used in South Paekakariki Study (Appendix A)

Type of shoreline:

Partial protection by remnant seawall

Location

732 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)
Mid way along Ames Street Reserve
C0-73 reference point co-ordinates: C0-73 2673645.16 6021829.45

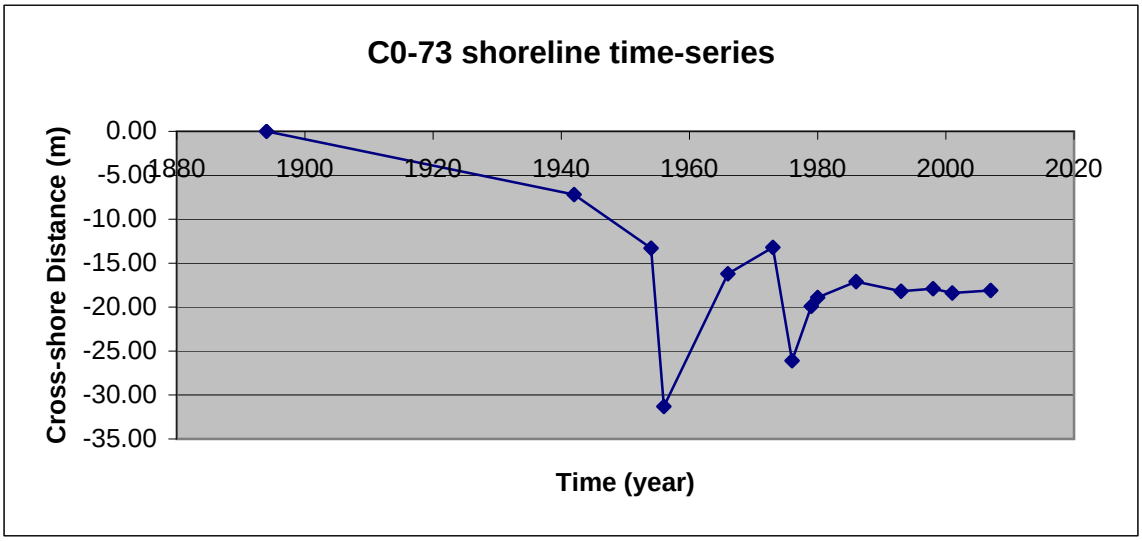
Relationship to other reference systems:

South Paekakariki Study (Appendix A) refn point x0-73 is at same location as C0-73
KCDC profile 215 is 13.1 m north of C0-73 transect
Gibb A47(1978) profile 076 is <50 m to north of C0-73 transect

Key

date_ Year of survey for site_
chron_ Chronology (yrs) from 1870 for site_
mmt_ Cross-shore distance (m) for shoreline from refn point for site_
dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_0-73	chron_0-73	mmt_0-73	dis_0-73
1894	24.00	59.00	0.00
1942	72.00	51.80	-7.20
1954	84.00	45.70	-13.30
1956	86.00	27.70	-31.30
1966	96.00	42.80	-16.20
1973	103.00	45.80	-13.20
1976	106.00	32.90	-26.10
1979	109.00	39.10	-19.90
1980	110.00	40.10	-18.90
1986	116.00	41.90	-17.10
1993	123.00	40.80	-18.20
1998	128.00	41.10	-17.90
2001	131.00	40.60	-18.40
2007	137.00	40.90	-18.10



Shoreline change modelling:

Earlier period (1894 - 1954)
dE = -0.201*tE + 5.238
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007)
dL = -0.054*tL - 12.309 SEE = 6.025
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C0-73				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
59	-0.054	-12.309	-19.761	39.239

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C0-73	Co-odinates (NZMG)		
-50.03	-10.79	C0-73	2673654.4	6021823.93
Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C0-73	Co-odinates (NZMG)		
-56.28	-17.04	C0-73	2673659.7	6021820.83

Coastal Hazard Measurement site X0-82

Xtra site used in South Paekakariki Study (Appendix A)

Type of shoreline:

Partial protection by remnant seawall

Location

822 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

X0-82 ref point co-ordinates: X0-82 2673693.78 6021904.87

Relationship to other reference systems:

None

Key

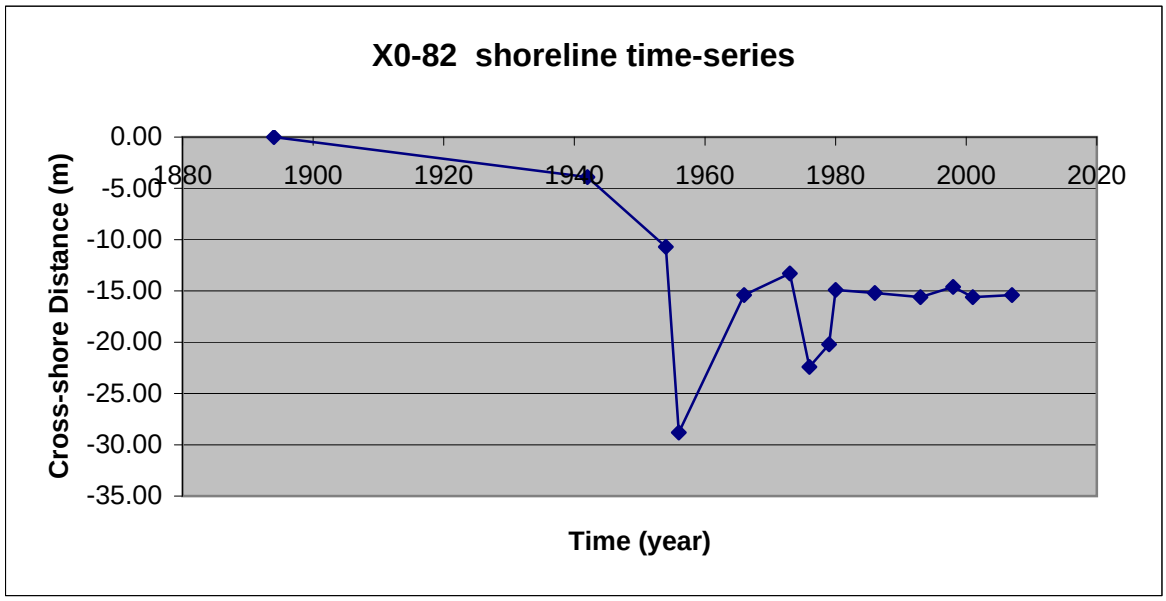
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_0-82	chron_0-82	mmt_0-82	dis_0-82
1894	24.00	56.90	0.00
1942	72.00	53.00	-3.90
1954	84.00	46.20	-10.70
1956	86.00	28.10	-28.80
1966	96.00	41.50	-15.40
1973	103.00	43.60	-13.30
1976	106.00	34.50	-22.40
1979	109.00	36.70	-20.20
1980	110.00	42.00	-14.90
1986	116.00	41.70	-15.20
1993	123.00	41.30	-15.60
1998	128.00	42.30	-14.60
2001	131.00	41.30	-15.60
2007	137.00	41.50	-15.40



Shoreline change modelling:

Earlier period (1894 - 1954)

dE = -0.151*tE + 4.169

where dE = cross-shore **d**istance (m) for the **E**arly period

tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007)

dL = -0.049*tL - 10.598 SEE = 6.014

where dL = cross-shore **d**istance (m) for the **L**ate period

tL = **t**ime (yrs) for the **L**ate period

SEE = **s**tandard **e**rror of **e**stimate

Coastal Hazard Measurement site C1-51

Type of shoreline:

Full protection by seawall and rock reventment

Location

1505 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)
Beach Rd and The Parade intersection
C1-51 refn point co-ordinates: C1-51 2674034.61 6022499.72

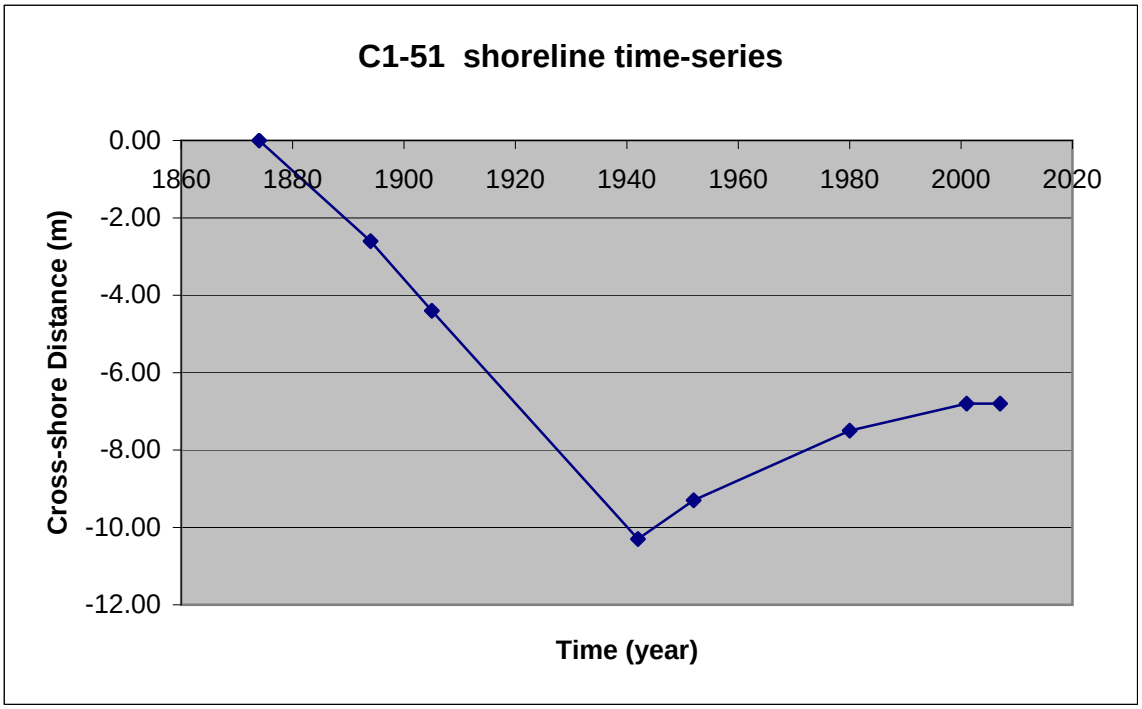
Relationship to other reference systems:

MWD profile 2 is approx (within 0.5 m) at C1-51
KCDC profile 220 (= old profile 2) is approx at C1-51

Key

date_ Year of survey for site_
chron_ Chronology (yrs) from 1870 for site_
mmt_ Cross-shore distance (m) for shoreline from refn point for site_
dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_1-51	chron_1-51	mmt_1-51	dis_1-51
1874	4.00	30.30	0.00
1894	24.00	27.70	-2.60
1905	35.00	25.90	-4.40
1942	72.00	20.00	-10.30
1952	82.00	21.00	-9.30
1980	110.00	22.80	-7.50
2001	131.00	23.50	-6.80
2007	137.00	23.50	-6.80



Shoreline change modelling:

Earlier period (1874 - 1952)

dE = -0.131*tE + 0.385

where dE = cross-shore **d**istance (m) for the **E**arly period

tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007) weighted to recent seawall period

dL = 0 SEE = 0 (because of seawall/rock revetment)

where dL = cross-shore **d**istance (m) for the **L**ate period

SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C1-51				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
NA	NA	NA	NA	23.5

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C1-51	Co-odinates (NZMG)		
-35.70	-12.2	C1-51	2674045.36	6022493.85
Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C1-51	Co-odinates (NZMG)		
-52.60	-29.1	C1-51	2674060.09	6022485.59

Coastal Hazard Measurement site C2-62

Type of shoreline:

Full protection by seawall and rock reventment

Location

2618 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)
The Parade, 40 m south of Paneta St.

C2-62 refn point co-ordinates:	C2-62	2674595.35	6023461.42

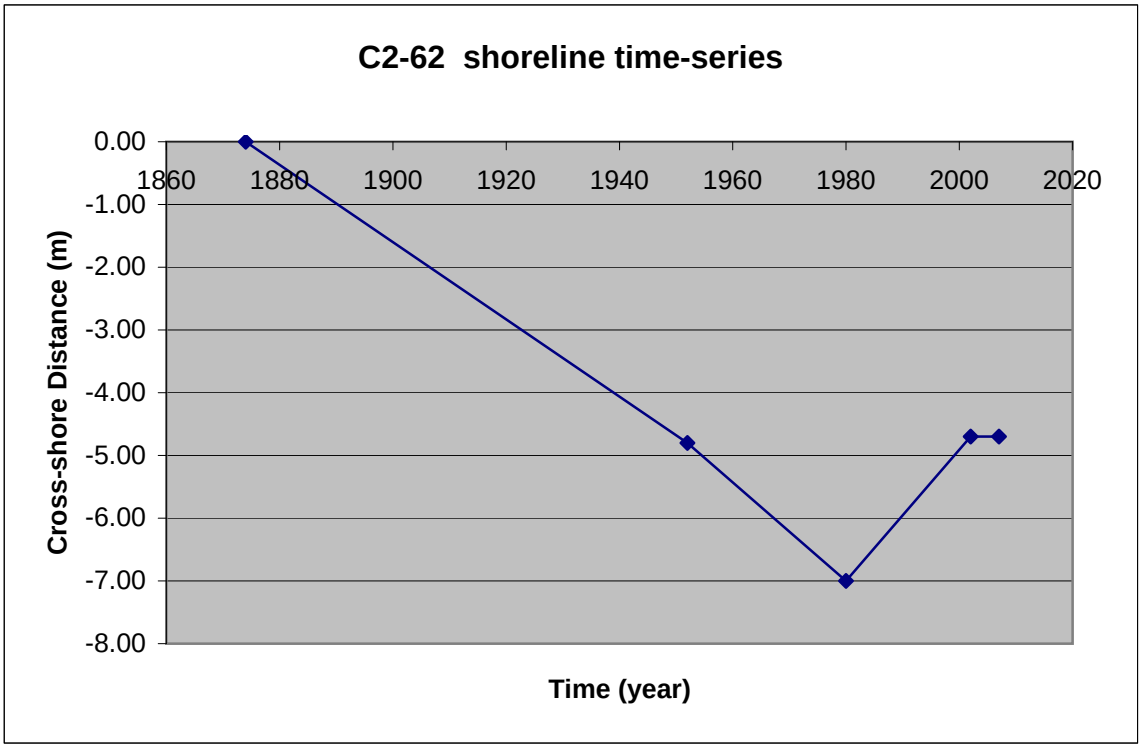
Relationship to other reference systems:

MWD profile 3 is approx (within 0.5 m) at C2.62
KCDC profile 230 (= old profile 3) is ~43 m north of C2-62

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_
mmt_	Cross-shore distance (m) for shoreline from refn point for site_
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_2-62	chron_2-62	mmt_2-62	dis_2-62
1874	4.00	37.50	0.00
1952	82.00	32.70	-4.80
1980	110.00	30.50	-7.00
2002	132.00	32.80	-4.70
2007	137.00	32.80	-4.70



Shoreline change modelling:

Earlier period (1874 - 1952)

dE = -0.062*tE + 0.246

where dE = cross-shore **d**istance (m) for the **E**arly period

tE = **t**ime (yrs) for the **E**arly period

Later period (1952 - 2007) weighted to recent seawall period

dL = 0 SEE = 0 (because of seawall/rock revetment)

where dL = cross-shore **d**istance (m) for the **L**ate period

SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C2-62				
Offset dist from refn pt	Model Slope	Model constance	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
NA	NA	NA	NA	32.8

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C2-62	Co-odinates (NZMG)		
-28.45	4.35	C2-62	2674591.63	6023463.7
Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C2-62	Co-odinates (NZMG)		
-46.16	-13.36	C2-62	2674607.03	6023455.02

Coastal Hazard Measurement site C3-60

Type of shoreline:

Natural

Location

3603 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C3-60 reference point co-ordinates:	C3-60	2675023.5	6024346

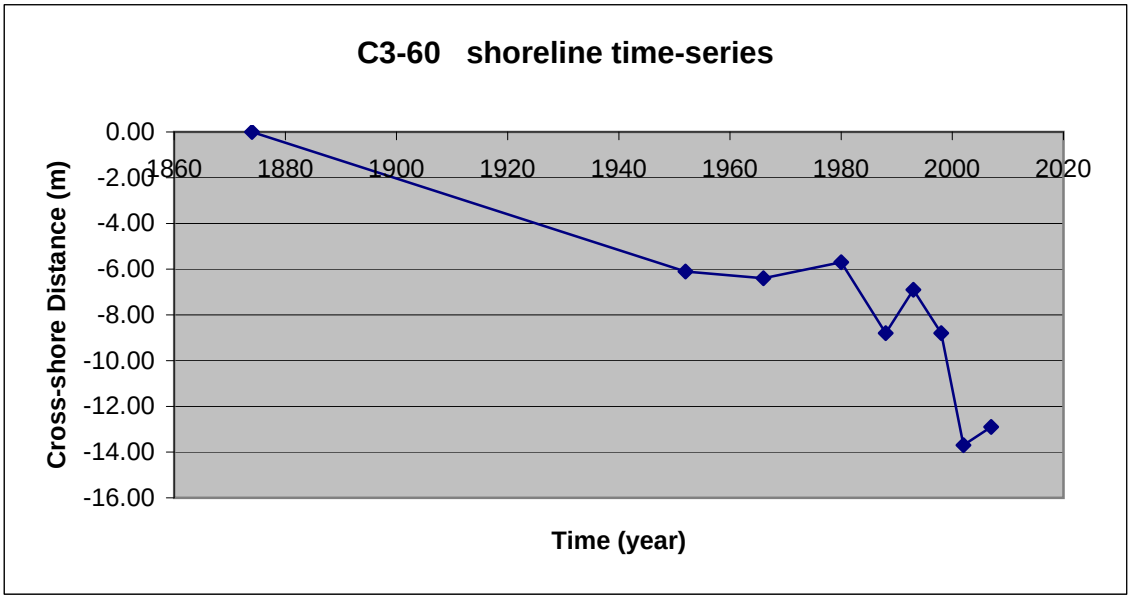
Relationship to other reference systems:

None

Key

date_ Year of survey for site_
chron_ Chronology (yrs) from 1870 for site_
mmt_ Cross-shore distance (m) for shoreline from refn point for site_
dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_3-60	chron_3-60	mmt_3-60	dis_3-60
1874	4.00	19.90	0.00
1952	82.00	13.80	-6.10
1966	96.00	13.50	-6.40
1980	110.00	14.20	-5.70
1988	118.00	11.10	-8.80
1993	123.00	13.00	-6.90
1998	128.00	11.10	-8.80
2002	132.00	6.20	-13.70
2007	137.00	7.00	-12.90



Shoreline change modelling:

Earlier period (1874 - 1952)
dE = -0.078*tE + 0.313
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1952 - 2007) weighted to 1980 to 2007
dL = -0.282*tL + 25.679 SEE = 1.822
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C3-60				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
19.9	-0.282	25.679	-13.237	6.7

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C3-60	Co-odinates (NZMG)		
-50.81	-44.11	C3-60	2675064.34	6024328.34

Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C3-60	Co-odinates (NZMG)		
-41.31	-34.61	C3-60	2675055.2	6024331.98

Coastal Hazard Measurement site C3-93

Type of shoreline:

Natural

Location

3920 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C3-93 reference point co-ordinates: C3-93 2675177.5 6024633

Relationship to other reference systems:

None

Key

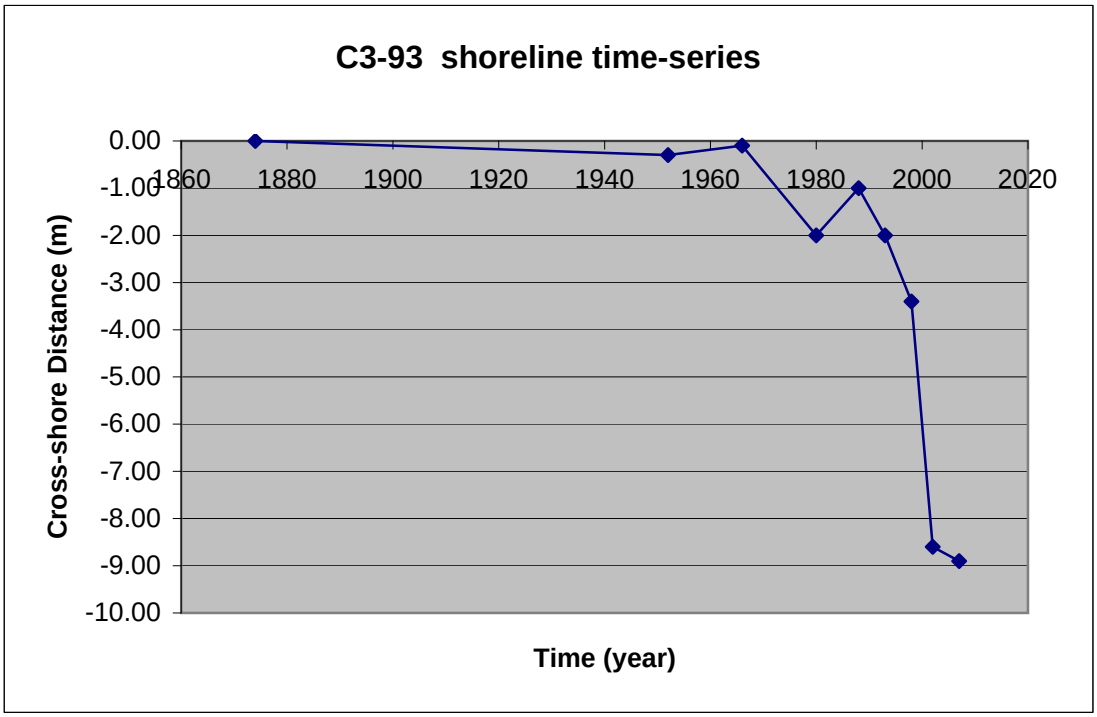
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_3-93	chron_3-93	mmt_3-93	dis_3-93
1874	4.00	34.90	0.00
1952	82.00	34.60	-0.30
1966	96.00	34.80	-0.10
1980	110.00	32.90	-2.00
1988	118.00	33.90	-1.00
1993	123.00	32.90	-2.00
1998	128.00	31.50	-3.40
2002	132.00	26.30	-8.60
2007	137.00	26.00	-8.90



Shoreline change modelling:

Earlier period (1874 - 1952)
dE = -0.004*tE + 0.015
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1952 - 2007) weighted to 1966 to 2007
dL = -0.210*tL + 21.592 SEE = 2.237
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C3-93				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
34.9	-0.21	21.593	-7.387	27.5

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C3-93	Co-odinates (NZMG)		
-57.37	-29.87	C3-93	2675205.48	6024622.64

Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C3-93	Co-odinates (NZMG)		
-44.87	-17.37	C3-93	2675193.63	6024626.66

Coastal Hazard Measurement site C4-18

Type of shoreline:

Natural

Location

4178 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C4-18 reference point co-ordinates: C4.18 2675286.53 6024855.81

Relationship to other reference systems:

None

Key

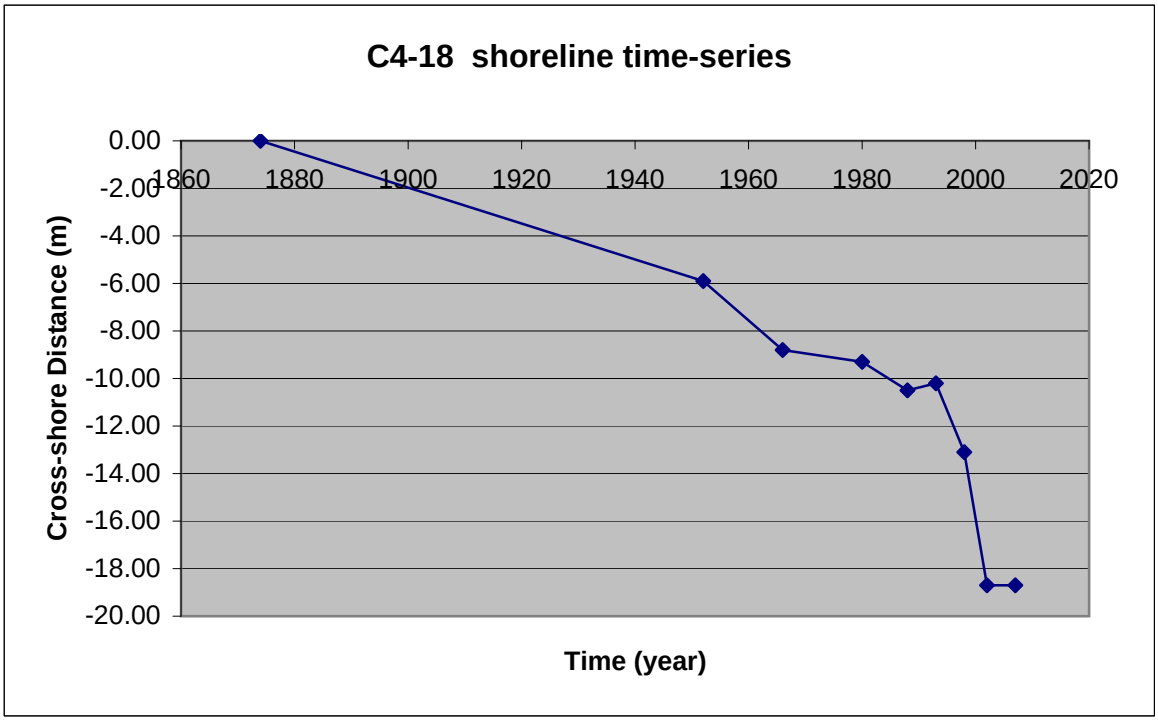
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_4-18	chron_4-18	mmt_4-18	dis_4-18
1874	4.00	55.50	0.00
1952	82.00	49.60	-5.90
1966	96.00	46.70	-8.80
1980	110.00	46.20	-9.30
1988	118.00	45.00	-10.50
1993	123.00	45.30	-10.20
1998	128.00	42.40	-13.10
2002	132.00	36.80	-18.70
2007	137.00	36.80	-18.70



Shoreline change modelling:

Earlier period (1874 - 1952)
dE = -0.076*tE + 0.303
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1952 - 2007) weighted to 1980 to 2007
dL = -0.392*tL + 35.488 SEE = 2.119
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C4-18				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
55.5	-0.392	35.488	-18.608	36.9

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C4.18	Co-odinates (NZMG)		
-60.39	-23.49	C4-18	2675308.63	6024847.62

Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C4-18	Co-odinates (NZMG)		
-46.64	-9.74	C4-18	2675295.54	6024852.23

Coastal Hazard Measurement site C4-52

Type of shoreline:

Natural

Location

4517 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C4-52 reference point co-ordinates: C4-52 2675428.4 6025173.79

Relationship to other reference systems:

Gibb (1978) site *Trig Beach* is online with C4-52

Key

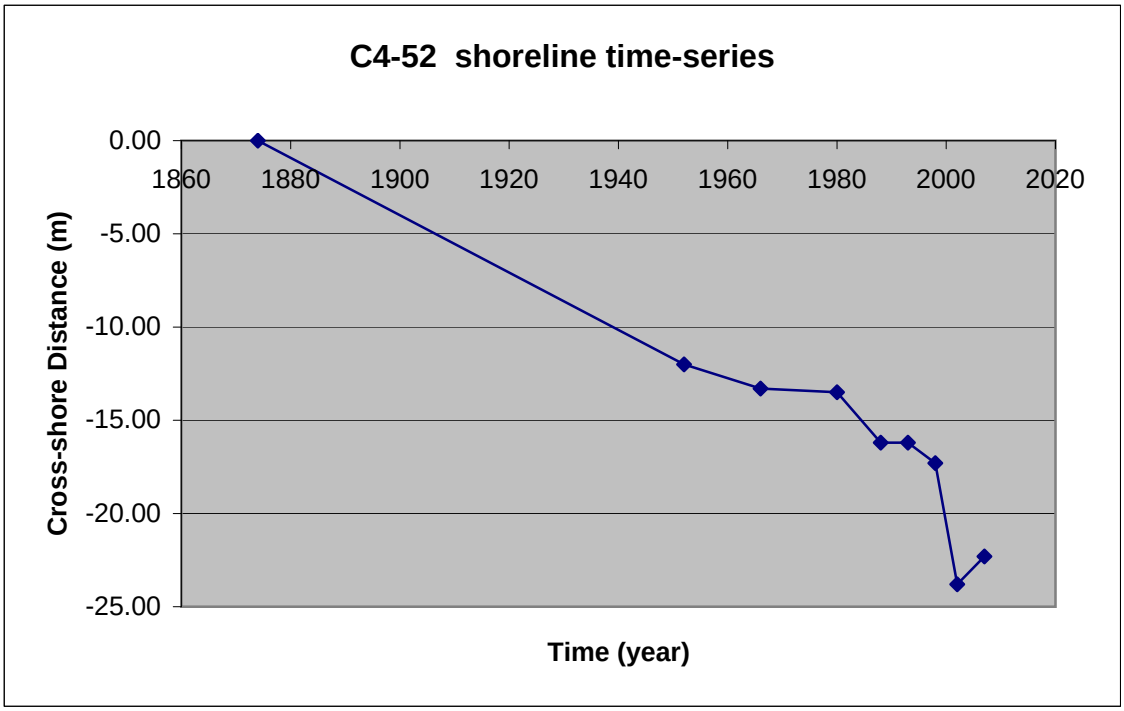
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_4-52	chron_4-52	mmt_4-52	dis_4-52
1874	4.00	67.50	0.00
1952	82.00	55.50	-12.00
1966	96.00	54.20	-13.30
1980	110.00	54.00	-13.50
1988	118.00	51.30	-16.20
1993	123.00	51.30	-16.20
1998	128.00	50.20	-17.30
2002	132.00	43.70	-23.80
2007	137.00	45.20	-22.30



Shoreline change modelling:

Earlier period (1874 - 1952)
dE = -0.154*tE + 0.615
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1952 - 2007) weighted to 1980 to 2007
dL = -0.363*tL + 27.099 SEE = 1.983
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C4-52				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
67.5	-0.363	27.099	-22.995	44.5

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C4.52	Co-odinates (NZMG)		
-62.14	-17.64	C4-52	2675445.17	6025168.34

Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C4-52	Co-odinates (NZMG)		
-47.14	-2.64	C4-52	2675430.83	6025172.8

Coastal Hazard Measurement site C4-93

Type of shoreline:

Natural

Location

4929 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C4-93 reference point co-ordinates:	C4-93	2675574.26	6025559.46

Relationship to other reference systems:

Gibb (1978) *profile 4* is 88 m north of C4-93

MWD profile 4 is approx online with C4-93

Key

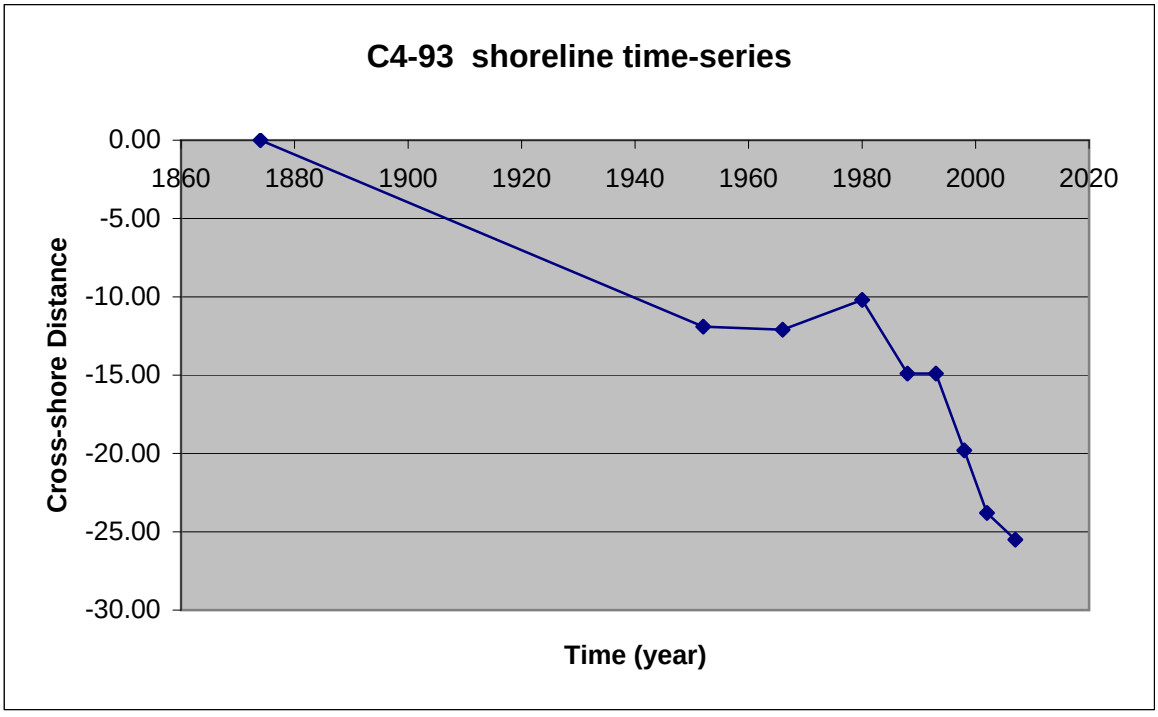
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_4-93	chron_4-93	mmt_4-93	dis_4-93
1874	4.00	59.40	0.00
1952	82.00	47.50	-11.90
1966	96.00	47.30	-12.10
1980	110.00	49.20	-10.20
1988	118.00	44.50	-14.90
1993	123.00	44.50	-14.90
1998	128.00	39.60	-19.80
2002	132.00	35.60	-23.80
2007	137.00	33.90	-25.50



Shoreline change modelling:

Earlier period (1874 - 1952)
dE = -0.153*tE + 0.610
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1952 - 2007) weighted to 1966 to 2007
dL = -0.364*tL + 26.561 SEE = 3.097
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C4-93				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
59.4	-0.364	26.561	-23.671	35.7

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C4.93	Co-odinates (NZMG)		
-67.40	-31.67	C4-93	2675604.5	6025549.82

Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C4-93	Co-odinates (NZMG)		
-50.90	-15.2	C4-93	2675588.76	6025554.72

Coastal Hazard Measurement site C5-15

Type of shoreline:

Natural

Location

5145 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C5-15 reference point co-ordinates: C5-15 2675723.65 6025734.17

Relationship to other reference systems:

KCDC profile 240 (previously profile 4) is 88 m north of C5-15 transect

Key

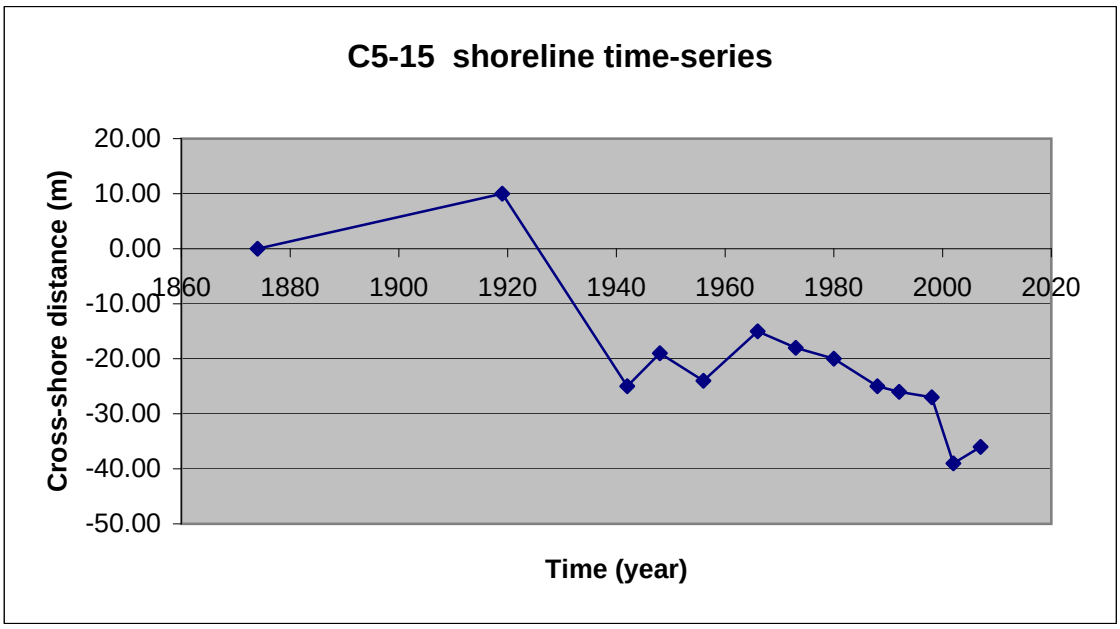
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_ A16

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_5-15	chron_5-15	mmt_5-15	dis_5-15
1874	4.00	147.00	0.00
1919	49.00	157.00	10.00
1942	72.00	122.00	-25.00
1948	78.00	128.00	-19.00
1956	86.00	123.00	-24.00
1966	96.00	132.00	-15.00
1973	103.00	129.00	-18.00
1980	110.00	127.00	-20.00
1988	118.00	122.00	-25.00
1992	122.00	121.00	-26.00
1998	128.00	120.00	-27.00
2002	132.00	108.00	-39.00
2007	137.00	111.00	-36.00



Shoreline change modelling:

Earlier period 1974 - 1948)
dE = ???? inlet affected

Later period (1942 - 2007) weighted to 1966 to 2007
dL = -0.548*tL + 39.081 SEE = 3.082
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C5-15				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
147	-0.548	39.081	-36.543	110.5

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C5-15	Co-odinates (NZMG)		
-69.40	41.06	C5-15	2675684.96	6025748.19

Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback cell to C5-15	Co-odinates (NZMG)		
-50.90	59.4**	C5-15	2675684.96	6025748.19

CEHD ***seawalls remove*** no early rate as possible inlet influence so use C4-93 value (50.9 m) and measure from 2008 modelled shoreline to locate set-back poistion.

** measured setback position to C5-15 location

Coastal Hazard Measurement site C5-70

Type of shoreline:

Natural

Location

5702 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C5-70 reference point co-ordinates: C5-70 2675883.65 6026274.81

Relationship to other reference systems:

Gibb (1978) *Trig 0* is 57 m south of C5-70 transect

Key

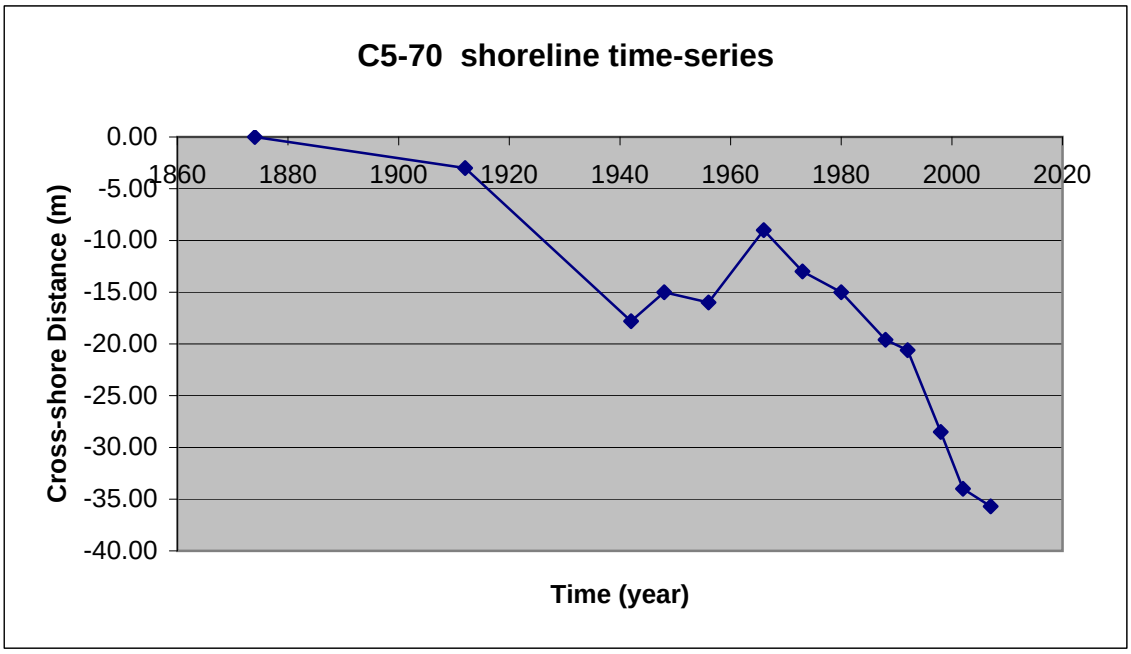
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_5-70	chron_5-70	mmt_5-70	dis_5-70
1874	4.00	117.00	0.00
1912	42.00	114.00	-3.00
1942	72.00	99.20	-17.80
1948	78.00	102.00	-15.00
1956	87.00	101.00	-16.00
1966	96.00	108.00	-9.00
1973	103.00	104.00	-13.00
1980	110.00	102.00	-15.00
1988	118.00	97.40	-19.60
1992	122.00	96.40	-20.60
1998	128.00	88.50	-28.50
2002	132.00	83.00	-34.00
2007	137.00	81.30	-35.70



Shoreline change modelling:

Earlier period (1874 - 1948)
dE = -0.239*tE + 2.765
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007) weighted to 1966 to 2007
dL = -0.667*tL + 57.005 SEE = 2.470
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C5-70				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
117	-0.667	57.005	-35.041	82

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C5-70	Co-odinates (NZMG)		
-76.76	5.24	C5-70	2675878.68	6026276.39

Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C5-70	Co-odinates (NZMG)		
-55.76	26.24	C5-70	2675858.64	6026282.66

Coastal Hazard Measurement site C6-04

Type of shoreline:

Natural

Location

6038 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C6-04 reference point co-ordinates: C6-04 2675979.55 6026599.57

Relationship to other reference systems:

None

Key

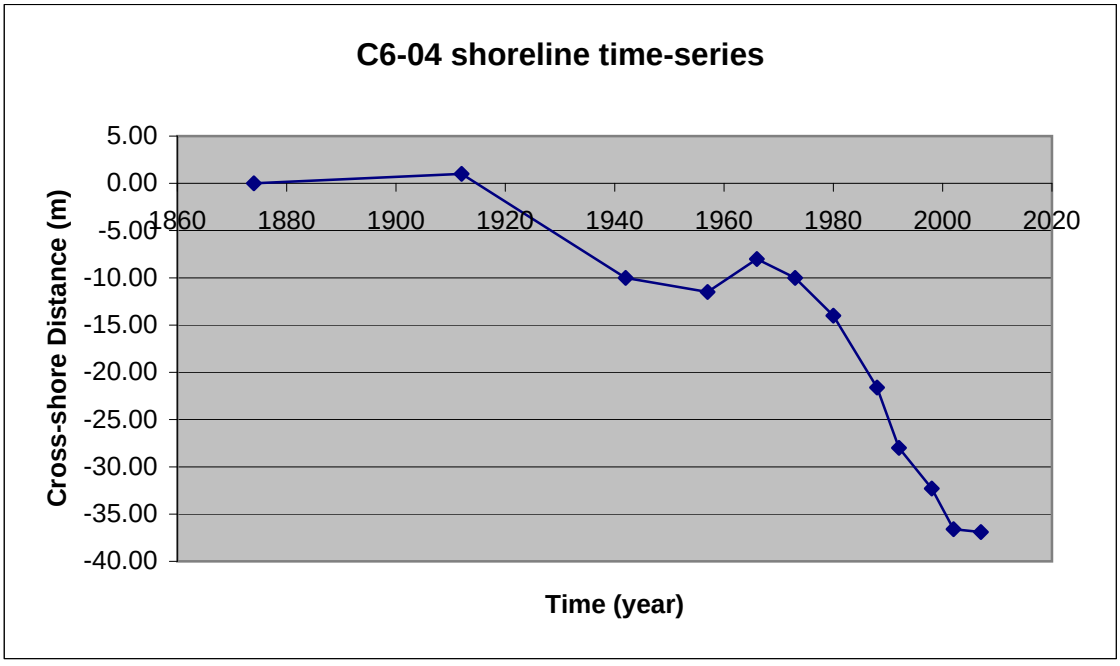
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_6-04	chron_6-04	mmt_6-04	dis_6-04
1874	4.00	111.00	0.00
1912	42.00	112.00	1.00
1942	72.00	101.00	-10.00
1957	87.00	99.50	-11.50
1966	96.00	103.00	-8.00
1973	103.00	101.00	-10.00
1980	110.00	97.00	-14.00
1988	118.00	89.40	-21.60
1992	122.00	83.00	-28.00
1998	128.00	78.70	-32.30
2002	132.00	74.40	-36.60
2007	137.00	74.10	-36.90



Shoreline change modelling:

Earlier period (1874 - 1942)
dE = -0.139*tE + 2.487
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007) weighted to 1966 to 2007
dL = -0.805*tL + 71.768 SEE = 2.176
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C6-04				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
111	-0.805	71.768	-39.322	71.7

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C6-04	Co-odinates (NZMG)		
-81.61	-9.91	C6-04	2675989.31	6026597.08

Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C6-04	Co-odinates (NZMG)		
-53.61	18.09	C6-04	2675962.27	6026604.61

Coastal Hazard Measurement site C6-39

Type of shoreline:

Natural

Location

6389 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C6-39 reference point co-ordinates:	C6-39	2676056.77	6026943.78

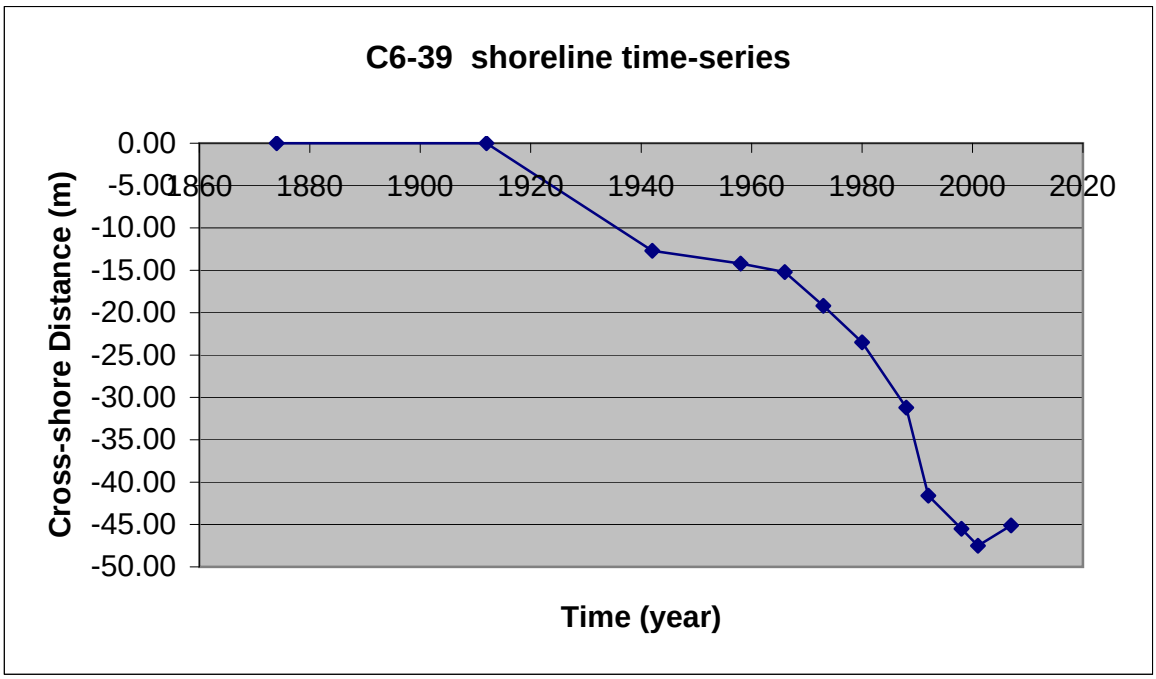
Relationship to other reference systems:

None

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_
mmt_	Cross-shore distance (m) for shoreline from refn point for site_ A48
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_6-39	chron_6-39	mmt_6-39	dis_6-39
1874	4.00	94.70	0.00
1912	42.00	94.70	0.00
1942	72.00	82.00	-12.70
1958	88.00	80.50	-14.20
1966	96.00	79.50	-15.20
1973	103.00	75.50	-19.20
1980	110.00	71.20	-23.50
1988	118.00	63.50	-31.20
1992	122.00	53.10	-41.60
1998	128.00	49.20	-45.50
2001	131.00	47.20	-47.50
2007	137.00	49.60	-45.10



Shoreline change modelling:

Earlier period (1874 - 1942)
dE = -0.179*tE + 2.792
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007) weighted to 1966 to 2007
dL = -0.882*tL + 70.616 SEE = 3.660
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C6-39				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
94.7	-0.882	70.616	-51.1	43.6

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C6-39	Co-odinates (NZMG)		
-98.19	-54.6	C6-39	2676109.72	6026930.51
Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C6-39	Co-odinates (NZMG)		
-60.69	-17.09	C6-39	2676073.23	6026939.42

Coastal Hazard Measurement site C6-57

Type of shoreline:

Natural

Location

6567 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C6-57 reference point co-ordinates:	C6-57	2676099.88	6027116.54

Relationship to other reference systems:

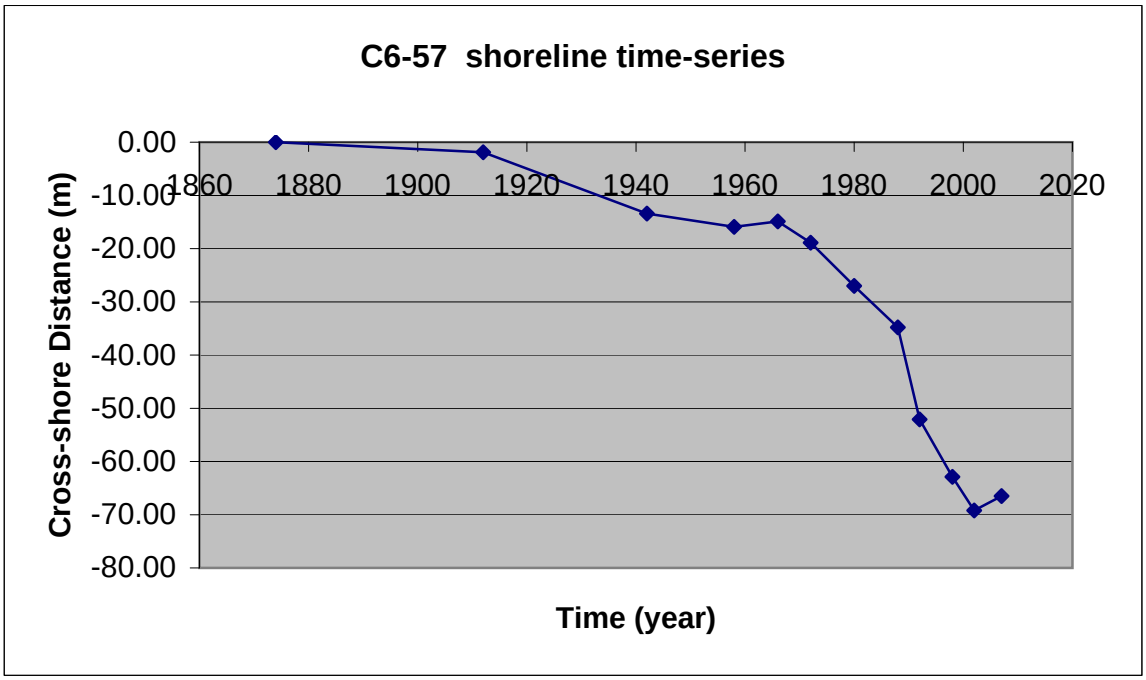
MWD profile 5 is online with C6-57

KCDC profile 250 (previously profile 5) is 76.5 m north of C6-57 transect

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_
mmt_	Cross-shore distance (m) for shoreline from refn point for site_
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_6-57	chron_6-57	mmt_6-57	dis_6-57
1874	4.00	90.40	0.00
1912	42.00	88.50	-1.90
1942	72.00	77.00	-13.40
1958	88.00	74.50	-15.90
1966	96.00	75.50	-14.90
1972	102.00	71.50	-18.90
1980	110.00	63.40	-27.00
1988	118.00	55.60	-34.80
1992	122.00	38.30	-52.10
1998	128.00	27.50	-62.90
2002	132.00	21.20	-69.20
2007	137.00	23.90	-66.50



Shoreline change modelling:

Earlier period (1874 - 1942)
dE = -0.191*tE + 2.399
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007) weighted to 1966 to 2007
dL = -1.476*tL + 131.093 SEE = 5.657
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C6-57				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
90.4	-1.476	131.093	-72.6	17.8

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C6-57	Co-odinates (NZMG)		
-119.92	-102.12	C6-57	2676200.55	6027096.31

Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C6-57	Co-odinates (NZMG)		
-57.42	-39.62	C6-57	2676138.76	6027108.08

Coastal Hazard Measurement site C6-76

Type of shoreline:

Full protection by seawall and rock reventment

Location

6760 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C6-76 refn point co-ordinates: C6-76 2676146.16 6027301.78

Relationship to other reference systems:

KCDC profile 250 (= old profile 5) is 117 m south of C6-76 transect

Key

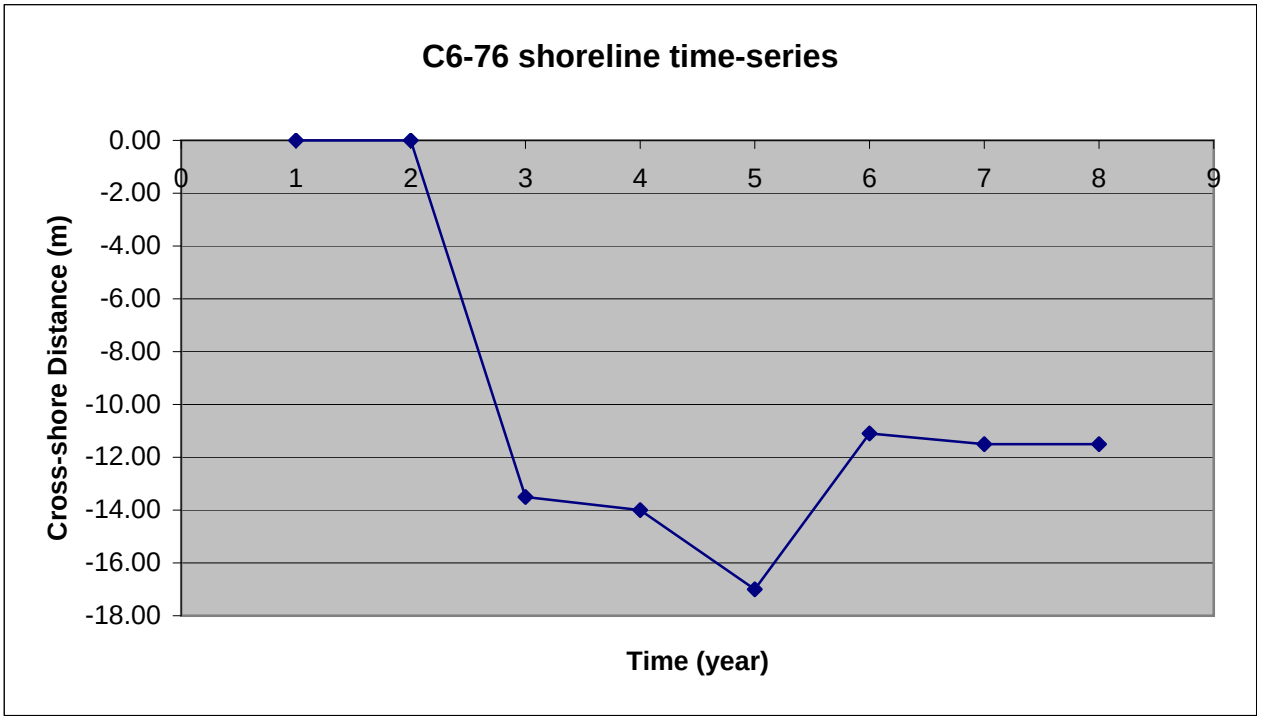
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_6-76	chron_6-76	mmt_6-76	dis_6-76
1874	4.00	88.00	0.00
1912	42.00	88.00	0.00
1942	72.00	74.50	-13.50
1952	82.00	74.00	-14.00
1957	87.00	71.00	-17.00
1980	110.00	76.90	-11.10
2001	131.00	76.50	-11.50
2007	137.00	76.50	-11.50



Shoreline change modelling:

Earlier period (1874 - 1952)

dE = -0.193*tE + 3.041

where dE = cross-shore **d**istance (m) for the **E**arly period

tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007) weighted to recent seawall period

dL = 0 SEE = 0 (because of seawall/rock revetment)

where dL = cross-shore **d**istance (m) for the **L**ate period

SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C6-76				
Offset dist from refn pt	Model Slope	Model constance	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
NA	NA	NA	NA	76.5

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C6-76	Co-odinates (NZMG)		
-28.08	48.4	C6-76	2676099.42	6027314.66
Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C6-76	Co-odinates (NZMG)		
-64.36	12.14	C6-76	2676134.47	6027305.03

Coastal Hazard Measurement site C7-10

Type of shoreline:

Full protection by seawall and rock reventment

Location

6760 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C7-10 refn point co-ordinates:	C7-10	2676204.43	6027638.97

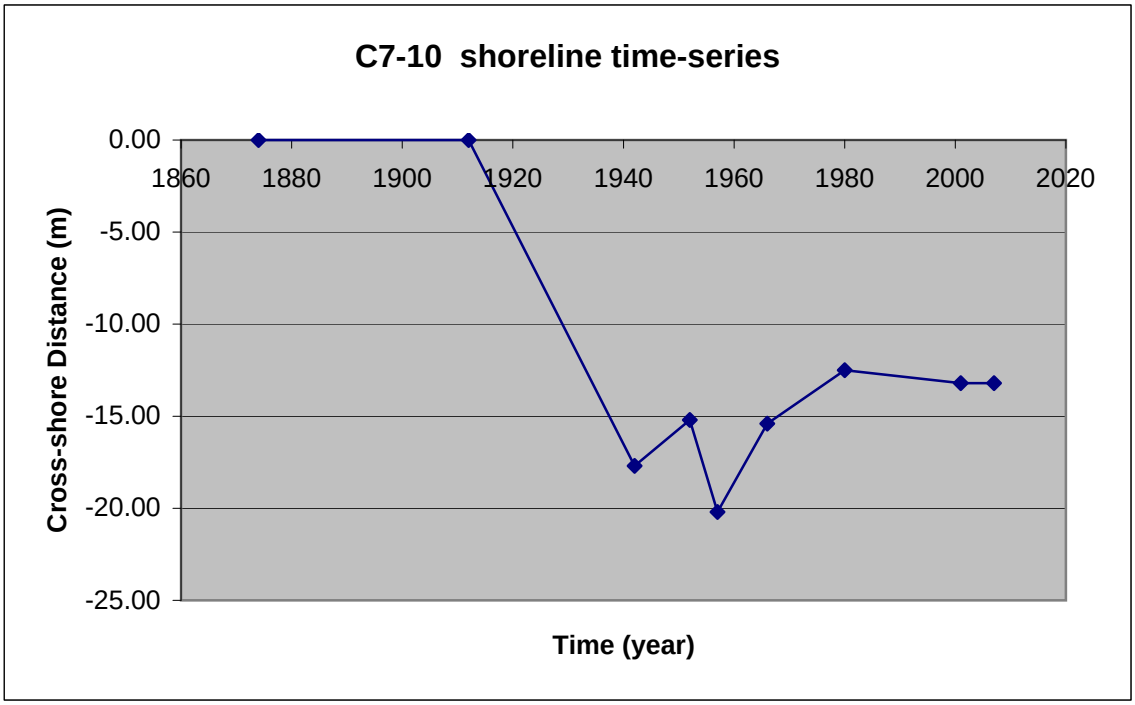
Relationship to other reference systems:

None

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_
mmt_	Cross-shore distance (m) for shoreline from refn point for site_
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_7-10	chron_7-10	mmt_7-10	dis_7-10
1874	4.00	67.70	0.00
1912	42.00	67.70	0.00
1942	72.00	50.00	-17.70
1952	82.00	52.50	-15.20
1957	87.00	47.50	-20.20
1966	96.00	52.30	-15.40
1980	110.00	55.20	-12.50
2001	131.00	54.50	-13.20
2007	137.00	54.50	-13.20



Shoreline change modelling:

Earlier period (1874 - 1952)

dE = -0.237*tE + 3.649

where dE = cross-shore **d**istance (m) for the **E**arly period

tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007) weighted to recent seawall period

dL = 0 SEE = 0 (because of seawall/rock revetment)

where dL = cross-shore **d**istance (m) for the **L**ate period

SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C7-10				
Offset dist from refn pt	Model Slope	Model constance	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
NA	NA	NA	NA	54.5

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C7-10	Co-odinates (NZMG)		
-33.64	20.86	C7-10	2676183.95	6027643.45
Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C7-10	Co-odinates (NZMG)		
-69.92	-15.42	C7-10	2676219.55	6027635.69

Coastal Hazard Measurement site C7-56

Type of shoreline:

Full protection by seawall and rock reventment

Location

7555 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C7-56 refn point co-ordinates:	C7-56	2676357.98	6028071.02

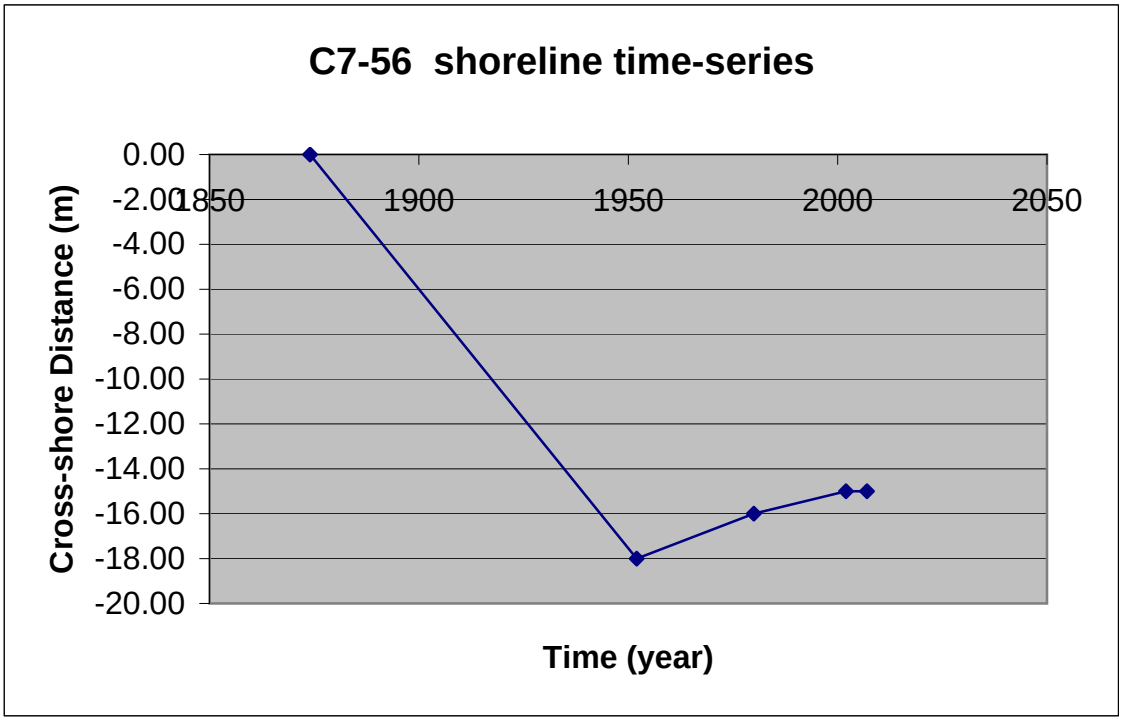
Relationship to other reference systems:

None

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_
mmt_	Cross-shore distance (m) for shoreline from refn point for site_
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_7-56	chron_7-56	mmt_7-56	dis_7-56
1874	4.00	127.00	0.00
1952	82.00	109.00	-18.00
1980	110.00	111.00	-16.00
2002	132.00	112.00	-15.00
2007	137.00	112.00	-15.00



Shoreline change modelling:

Earlier period (1874 - 1952)

dE = -0.231*tE + 0.923

where dE = cross-shore **d**istance (m) for the **E**arly period

tE = **t**ime (yrs) for the **E**arly period

Later period (1952 - 2007) weighted to recent seawall period

dL = 0 SEE = 0 (because of seawall/rock revetment)

where dL = cross-shore **d**istance (m) for the **L**ate period

SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C7-56				
Offset dist from refn pt	Model Slope	Model constance	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
NA	NA	NA	NA	112

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C7-56	Co-odinates (NZMG)		
-35.86	76.14	C7-56	2676283.38	6028086.69
Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C7-56	Co-odinates (NZMG)		
-72.15	39.85	C7-56	2676318.94	6028078.9

Coastal Hazard Measurement site C8-02

Type of shoreline:

Full protection by seawall and rock reventment

Location

8022 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C8-02 refn point co-ordinates:	C8-02	2676348.88	6028552.75

Relationship to other reference systems:

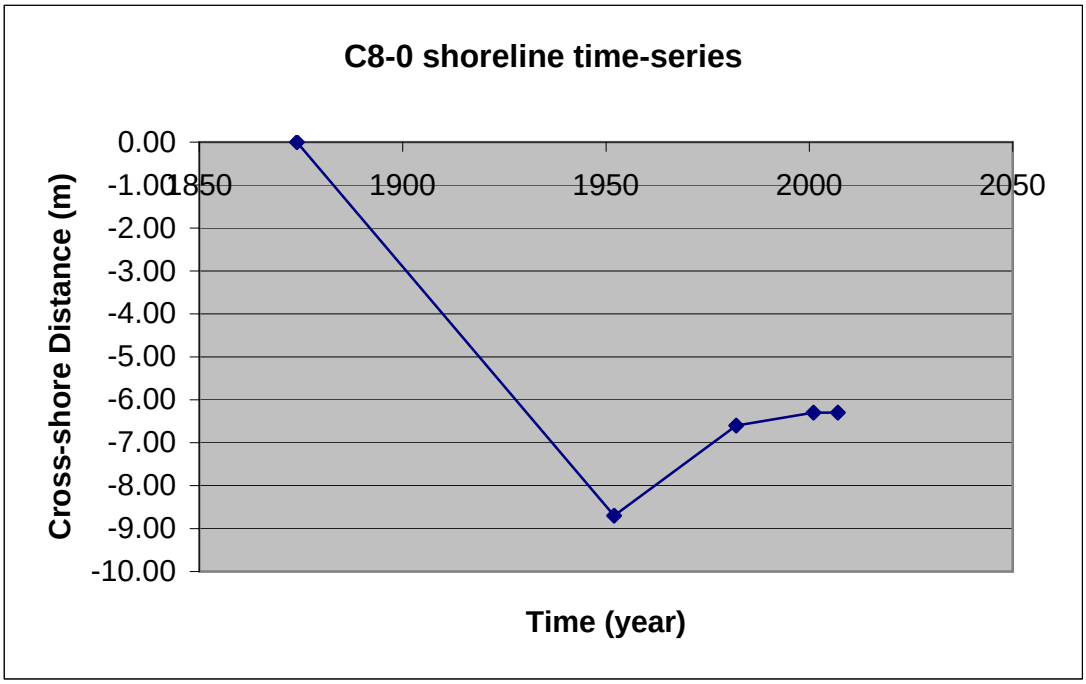
KCDC profile 260 (old 6) is 5.5 m south of C8-02 transect

MWD profile 6 reference point = C8-02 reference point

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_
mmt_	Cross-shore distance (m) for shoreline from refn point for site_
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_8-02	chron_8-02	mmt_8-02	dis_8-02
1874	4.00	16.70	0.00
1952	82.00	8.00	-8.70
1982	112.00	10.10	-6.60
2001	131.00	10.40	-6.30
2007	137.00	10.40	-6.30



Shoreline change modelling:

Earlier period (1874 - 1952)

dE = -0.112*tE + 0.446

where dE = cross-shore **d**istance (m) for the **E**arly period

tE = **t**ime (yrs) for the **E**arly period

Later period (1952 - 2007) weighted to recent seawall period

dL = 0 SEE = 0 (because of seawall/rock revetment)

where dL = cross-shore **d**istance (m) for the **L**ate period

SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C8-02				
Offset dist from refn pt	Model Slope	Model constance	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
NA	NA	NA	NA	10.4

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C8-02	Co-odinates (NZMG)		
-32.01	-21.61	C8-02	2676370.34	6028549.47

Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C8-02	Co-odinates (NZMG)		
-69.01	-58.61	C8-02	2676406.75	6028543.69

Coastal Hazard Measurement site C8-72

Type of shoreline:

Full protection by seawall and rock reventment

Location

8723 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C8-72 refn point co-ordinates:	C8-72	2676493	6029241.58

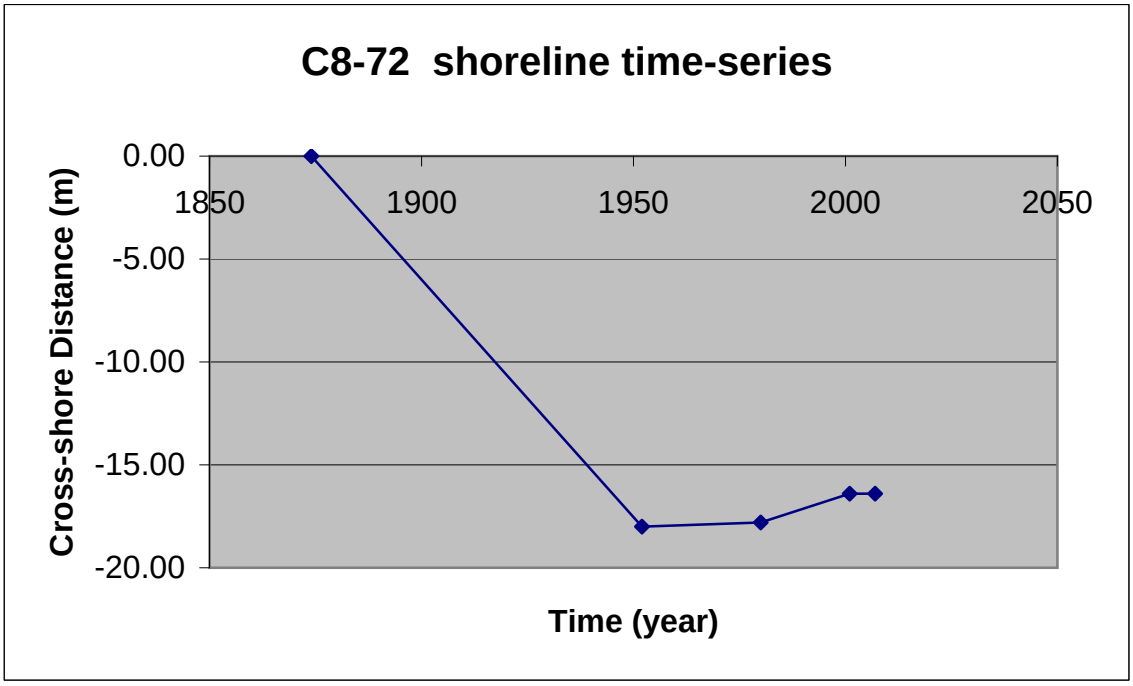
Relationship to other reference systems:

None

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_
mmt_	Cross-shore distance (m) for shoreline from refn point for site_
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_8-72	chron_8-72	mmt_8-72	dis_8-72
1874	4.00	59.00	0.00
1952	82.00	41.00	-18.00
1980	110.00	41.20	-17.80
2001	131.00	42.60	-16.40
2007	137.00	42.60	-16.40



Shoreline change modelling:

Earlier period (1874 - 1952)

dE = -0.231*tE + 0.923

where dE = cross-shore **d**istance (m) for the **E**arly period

tE = **t**ime (yrs) for the **E**arly period

Later period (1952 - 2007) weighted to recent seawall period

dL = 0 SEE = 0 (because of seawall/rock revetment)

where dL = cross-shore **d**istance (m) for the **L**ate period

SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C8-72				
Offset dist from refn pt	Model Slope	Model constance	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
NA	NA	NA	NA	42.6

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C8-72	Co-odinates (NZMG)		
-30.67	11.93	C8-72	2676480.99	6029242.63
Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C8-72	Co-odinates (NZMG)		
-67.67	-25.07	C8-72	2676517.83	6029238.29

Coastal Hazard Measurement site C9-11

Type of shoreline:

Full protection by seawall and rock reventment

Location

9110 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C9-11 refn point co-ordinates:	C9-11	2676516.87	6029627.45

Relationship to other reference systems:

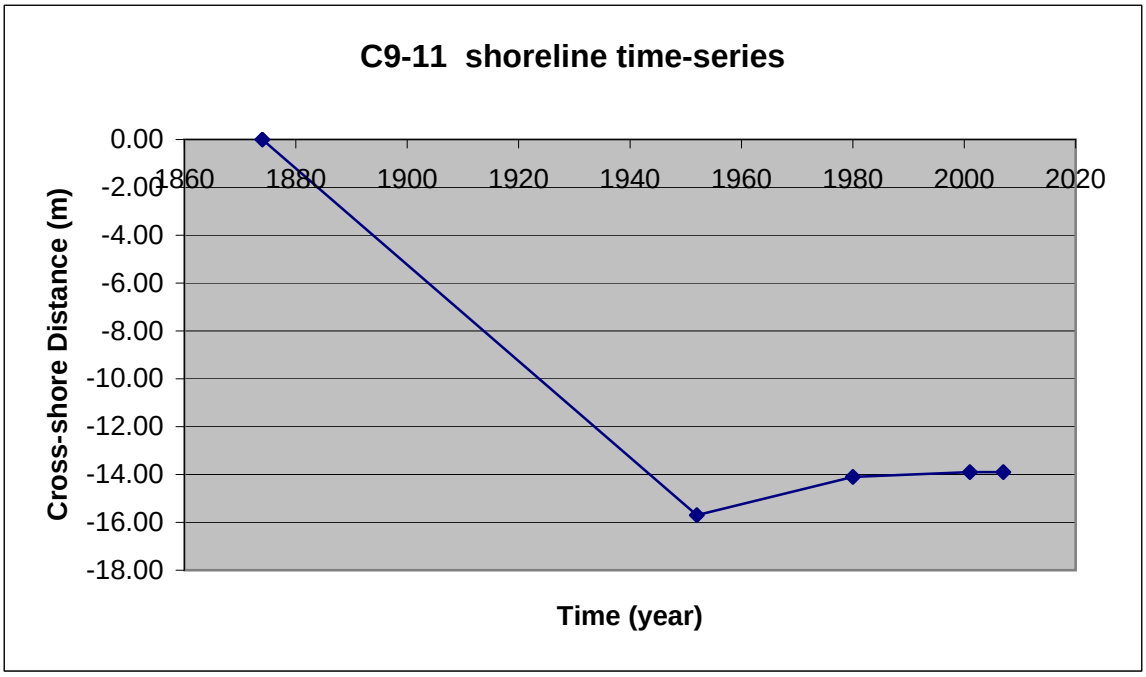
MWD profile 7 refn point = C9-11 refn point

KCDC profile 270 (old 11) is approx online with C9-11 transect

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_
mmt_	Cross-shore distance (m) for shoreline from refn point for site_
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_9-11	chron_9-11	mmt_9-11	dis_9-11
1874	4.00	23.40	0.00
1952	82.00	7.70	-15.70
1980	110.00	9.30	-14.10
2001	131.00	9.50	-13.90
2007	137.00	9.50	-13.90



Shoreline change modelling:

Earlier period (1874 - 1952)

dE = -0.201*tE + 0.805

where dE = cross-shore **d**istance (m) for the **E**arly period

tE = **t**ime (yrs) for the **E**arly period

Later period (1952 - 2007) weighted to recent seawall period

dL = 0 SEE = 0 (because of seawall/rock revetment)

where dL = cross-shore **d**istance (m) for the **L**ate period

SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C9-11				
Offset dist from refn pt	Model Slope	Model constance	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
NA	NA	NA	NA	9.5

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C9-11	Co-odinates (NZMG)		
-29.56	-20.06	C9-11	2676536.63	6029624.44
Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C9-11	Co-odinates (NZMG)		
-61.56	-52.06	C9-11	2676568.53	6029620.23

Coastal Hazard Measurement site C9-43

Type of shoreline:

Full protection by seawall and rock reventment

Location

9431 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C9-43 refn point co-ordinates:	C9-43	2676585.16	6029939.78

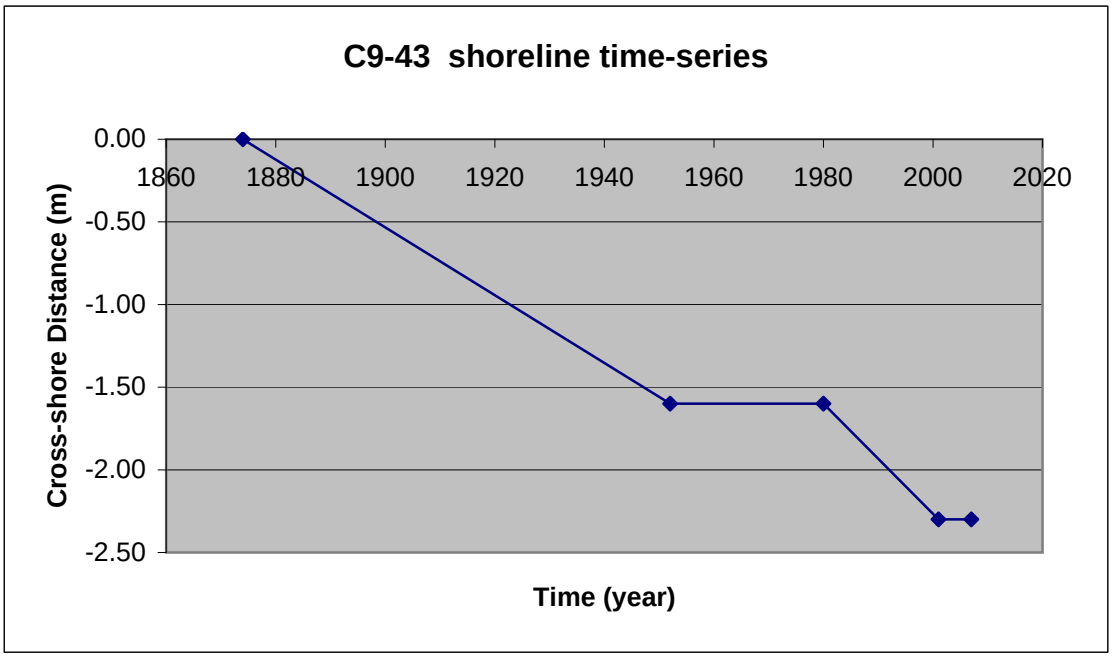
Relationship to other reference systems:

None

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_
mmt_	Cross-shore distance (m) for shoreline from refn point for site_
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_9-43	chron_9-43	mmt_9-43	dis_9-43
1874	4.00	43.20	0.00
1952	82.00	41.60	-1.60
1980	110.00	41.60	-1.60
2001	131.00	40.90	-2.30
2007	137.00	40.90	-2.30



Shoreline change modelling:

Earlier period (1874 - 1952)

dE = -0.021*tE + 0.082

where dE = cross-shore **d**istance (m) for the **E**arly period

tE = **t**ime (yrs) for the **E**arly period

Later period (1952 - 2007) weighted to recent seawall period

dL = 0 SEE = 0 (because of seawall/rock revetment)

where dL = cross-shore **d**istance (m) for the **L**ate period

SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C9-43				
Offset dist from refn pt	Model Slope	Model constance	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
NA	NA	NA	NA	40.9

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C9-43	Co-odinates (NZMG)		
-28.60	12.3	C9-43	2676573.03	6029940.91
Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C9-43	Co-odinates (NZMG)		
-50.60	-9.7	C9-43	2676594.85	6029939.19

Coastal Hazard Measurement site C10.29

Type of shoreline:

Natural (between seawalls)

Location

10295 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C10.29 reference point co-ordinates: D10-29 2676725.16 6030815.53

Relationship to other reference systems:

None

Key

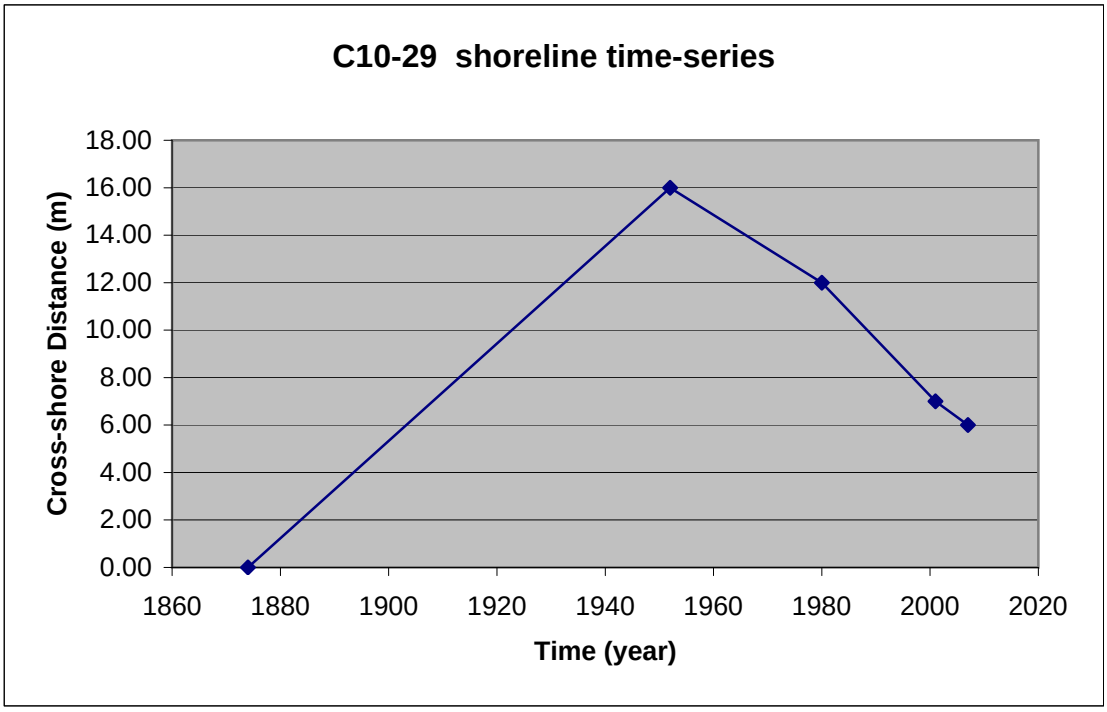
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_10-29	chron_10-29	mmt_10-29	dis_10.29
1874	4.00	123.00	0.00
1952	82.00	139.00	16.00
1980	110.00	135.00	12.00
2001	131.00	130.00	7.00
2007	137.00	129.00	6.00



Shoreline change modelling:

Earlier period (1874 - 1952)
dE = 0.205*tE - 0.821
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1952 - 2007), no weighting
dL = -0.186*tL + 31.588 SEE = 0.679
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C10.29				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
123	-0.186	31.588	5.92	128.92

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C10.29	Co-odinates (NZMG)		
-45.84	83.08	C10-29	2676109.72	6026930.51
Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C10-29	Co-odinates (NZMG)		
-36.34	92.58	C10-29	2676073.23	6026939.42

Coastal Hazard Measurement site C10.40

Type of shoreline:

Localised section of seawall

Location

10406 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)
End of Tainui Street
C10.40 refn point co-ordinates: C10-40 2676674.84 6030926.05

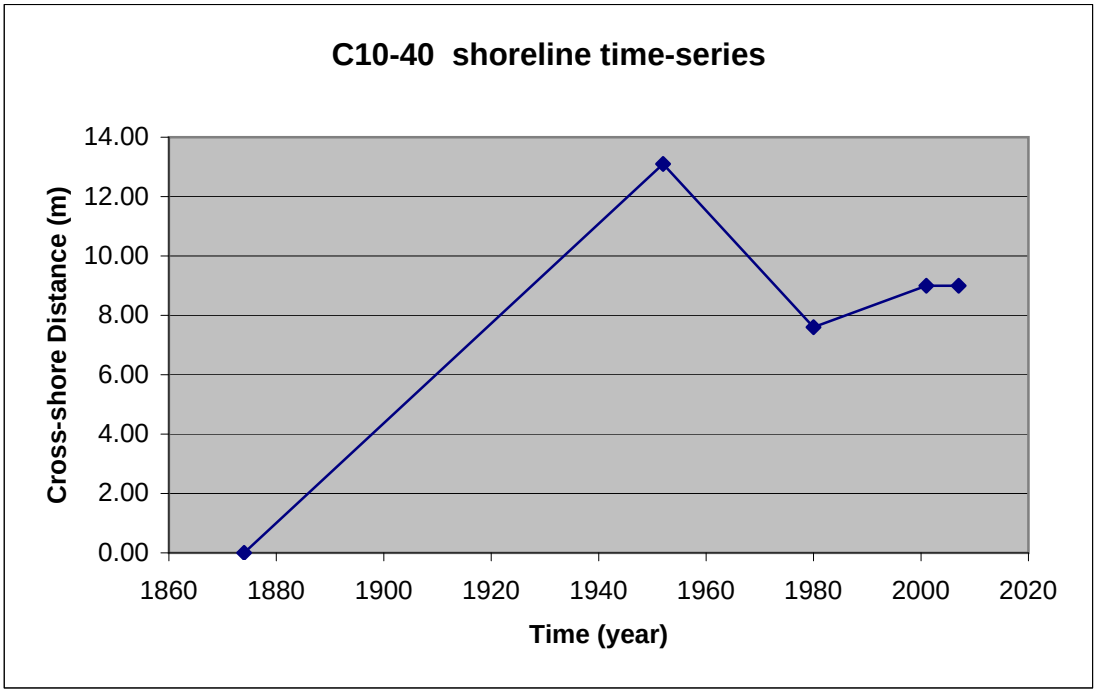
Relationship to other reference systems:

KCDC profile 280 (previously 7D) is online with, and 97 m seaward of, the C10-40 reference point

Key

date_ Year of survey for site_
chron_ Chronology (yrs) from 1870 for site_ data
mmt_ Cross-shore distance (m) for shoreline from refn point for site_ data
dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_10-40	chron_10-40	mmt_10-40	dis_10-40
1874	4.00	84.50	0.00
1952	82.00	97.60	13.10
1980	110.00	92.10	7.60
2001	131.00	93.50	9.00
2007	137.00	93.50	9.00



Shoreline change modelling:

Earlier period (1874 - 1952)

dE = 0.168*tE - 0.672

where dE = cross-shore **d**istance (m) for the **E**arly period

tE = **t**ime (yrs) for the **E**arly period

Later period (1952 - 2007) weighted to recent seawall period

dL = 0 SEE = 0 (because of seawall/rock revetment)

where dL = cross-shore **d**istance (m) for the **L**ate period

SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C10-40				
Offset dist from refn pt	Model Slope	Model constance	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
NA	NA	NA	NA	93.5
				84.8

Seawall top: use for REPAIR scenario

Interpolated adjacent natual shorelines: use for REMOVE scenario

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C10-40	Co-odinates (NZMG)		
-20.85	72.65	C10-40		

Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C10-40	Co-odinates (NZMG)		
-32.83	51.97	C10-40		

Coastal Hazard Measurement site C10.61

Type of shoreline:

Natural (between seawalls)

Location

10614 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C10.61 reference point co-ordinates:	D10-61	2676639.97	6031134.19

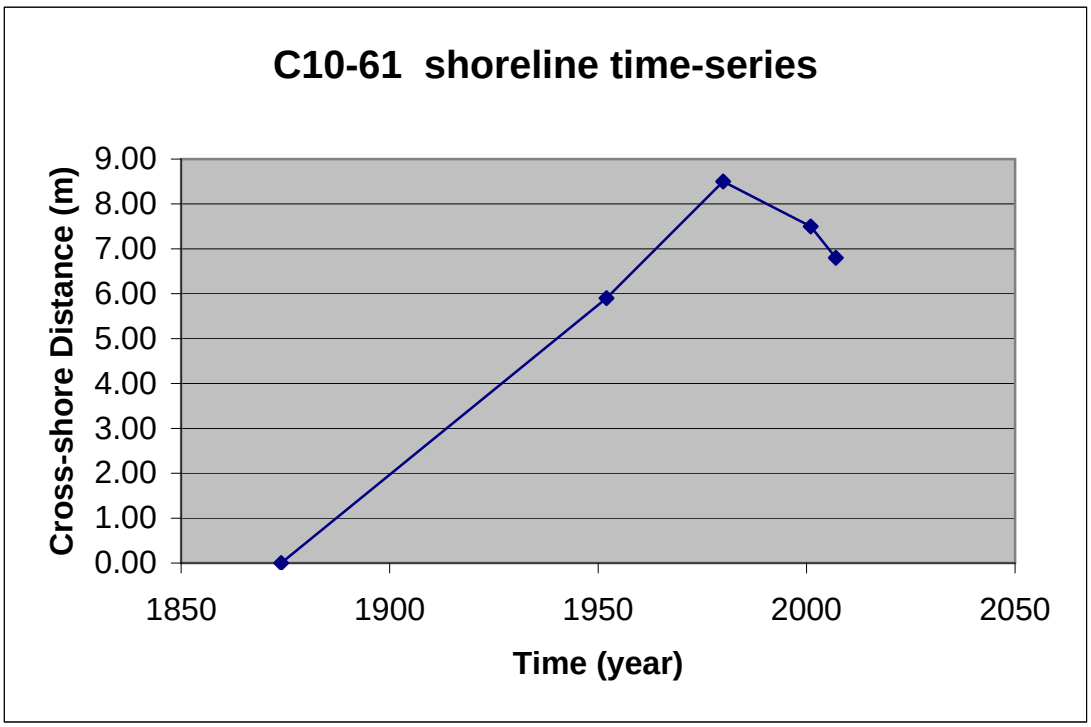
Relationship to other reference systems:

None

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_
mmt_	Cross-shore distance (m) for shoreline from refn point for site_
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_10-29	chron_10-29	mmt_10-29	dis_10.29
1874	4.00	56.10	0.00
1952	82.00	62.00	5.90
1980	110.00	64.60	8.50
2001	131.00	63.60	7.50
2007	137.00	62.90	6.80



Shoreline change modelling:

Earlier period (1874 - 1952)
dE = 0.078*tE - 0.303
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1952 - 2007), weighted to 1980 to 2007
dL = -0.059*tL + 15.028 SEE = 0.251
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C10.61				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
56	-0.059	15.028	6.889	62.9

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C10.61	Co-odinates (NZMG)		
-46.48	16.42	C10.61	2676623.5	6031134
Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C10-61	Co-odinates (NZMG)		
-36.98	25.92	C10-61	2676614	6031134

Coastal Hazard Measurement site C11-17

Type of shoreline:

Natural but between road-end seawall to south and 2006 Marine Parade rock toe-revetment approx 50 m to north

Location

11172m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C11-17 reference point co-ordinates:	C11-17	2676624.81	6031690.19

Relationship to other reference systems:

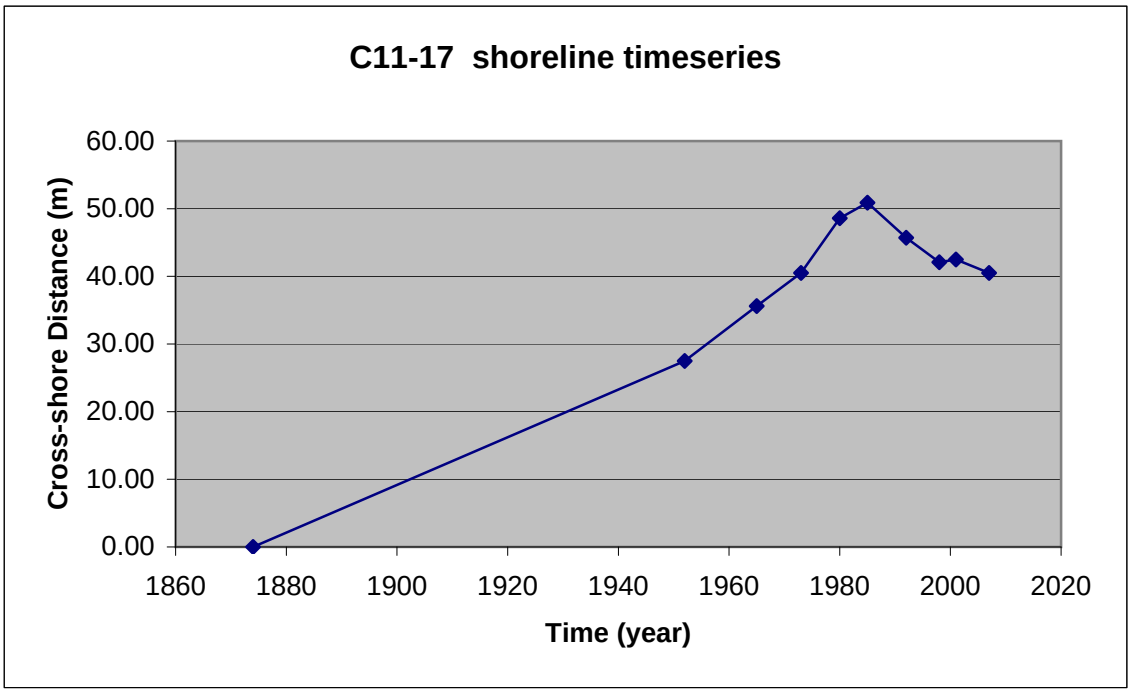
MWD profile 8 online and 61.5 m seaward of C11-17

KCDC profile 14 online and 61.5 m seaward of C11-17

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_
mmt_	Cross-shore distance (m) for shoreline from refn point for site_
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_11-17	chron_11-17	mmt_11-17	dis_11-17
1874	4.00	30.40	0.00
1952	82.00	57.90	27.50
1965	95.00	66.00	35.60
1973	103.00	70.90	40.50
1980	110.00	79.00	48.60
1985	115.00	81.30	50.90
1992	122.00	76.10	45.70
1998	128.00	72.50	42.10
2001	131.00	72.90	42.50
2007	137.00	70.90	40.50



Shoreline change modelling:

Earlier period (1874 - 1952)
dE = 0.353*tE - 1.410
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1952 - 2007), weighted to 1980 to 2007
dL = -0.374*tL + 91.340 SEE = 1.674
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C11.17				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
30.4	-0.374	91.34	39.728	70.1

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C11.17	Co-odinates (NZMG)		
-53.38	16.75	C11.17	2676608	6031690.6

Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C11.17	Co-odinates (NZMG)		
-54.38	15.72	C11.17	2676609.1	6031689.9

Coastal Hazard Measurement site C11.41

Type of shoreline:

Natural until 2005/06 when contouring and rock toe-protection carried out.
Nourishment during the 1990s

Location

11412 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)
Marine Parade and Tahi Rd intersection

C11.41 refn point co-ordinates:	C11-41	2676569.69	6031927.05

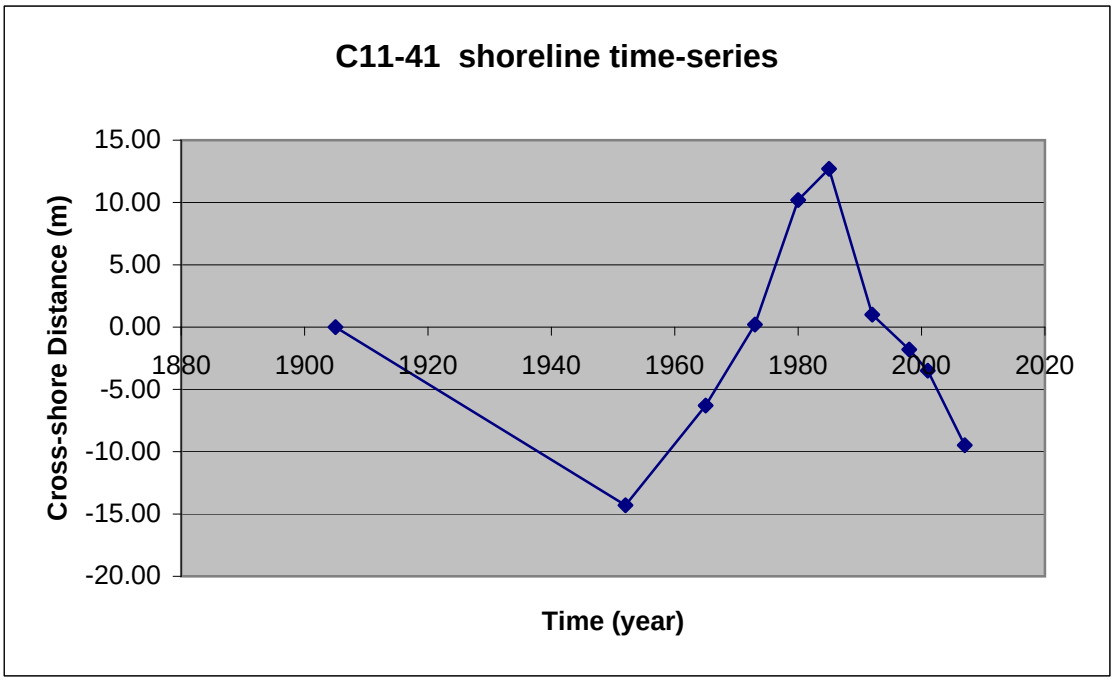
Relationship to other reference systems:

Close to KCDC profile 144 (exact location not known)

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_
mmt_	Cross-shore distance (m) for shoreline from refn point for site_
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_11-41	chron_11-41	mmt_11-41	dis_11-41	
1905	35.00	15.80	0.00	
1952	82.00	1.50	-14.30	
1965	95.00	9.50	-6.30	
1973	103.00	16.00	0.20	
1980	110.00	26.00	10.20	
1985	115.00	28.50	12.70	
1992	122.00	16.80	1.00	
1998	128.00	14.00	-1.80	
2001	131.00	12.30	-3.50	
2007	137.00	6.32	-9.48	Fence at top embankment



Shoreline change modelling:

Earlier period (1905 - 1952)

dE = -0.304*tE + 10.649

where dE = cross-shore **d**istance (m) for the **E**arly period

tE = **t**ime (yrs) for the **E**arly period

Later period (1952 - 2007) weighted to recent seawall period (2006-) for use in LT components under seawalls *Hold and* seawalls *Remove* scenarios.

dL = 0 SEE = 0 (because of seawall/rock revetment)

where dL = cross-shore **d**istance (m) for the **L**ate period

SEE = **s**tandard **e**rror of **e**stimate

BUT no reventment until 2006 and C11-41 shoreline data relevant until that time. So usual (weighted) regression (1980 to 2001) relevant in determining the *seawall remove* LT component.

Later period (1952 - 2007), weighted to 1980 to 2001 (2007 excluded as revetment in place)

dL = -0.778*tL + 98.025 SEE = 2.993

where dL = cross-shore **d**istance (m) for the **L**ate period

tL = time (yrs) for the Late period

SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C11-41				
Offset dist from refn pt	Model Slope	Model constance	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
NA	NA	NA	NA	6.32

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C11.41	Co-odinates (NZMG)		
-21.08	-14.76	C11-41	2676584.5	6031926.4

Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C11.41	Co-odinates (NZMG)		
-73.87	-67.55	C11-41	2676637.3	6031925.7

Coastal Hazard Measurement site C11.64

Type of shoreline:

Natural until 2005/06 when contouring and rock toe-protection carried out.
Nourishment during the 1990s

Location

11639 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)
Marine Parade and Rua Rd intersection
C11.64 refn point co-ordinates: C11-64 2676595.26 6032154.81

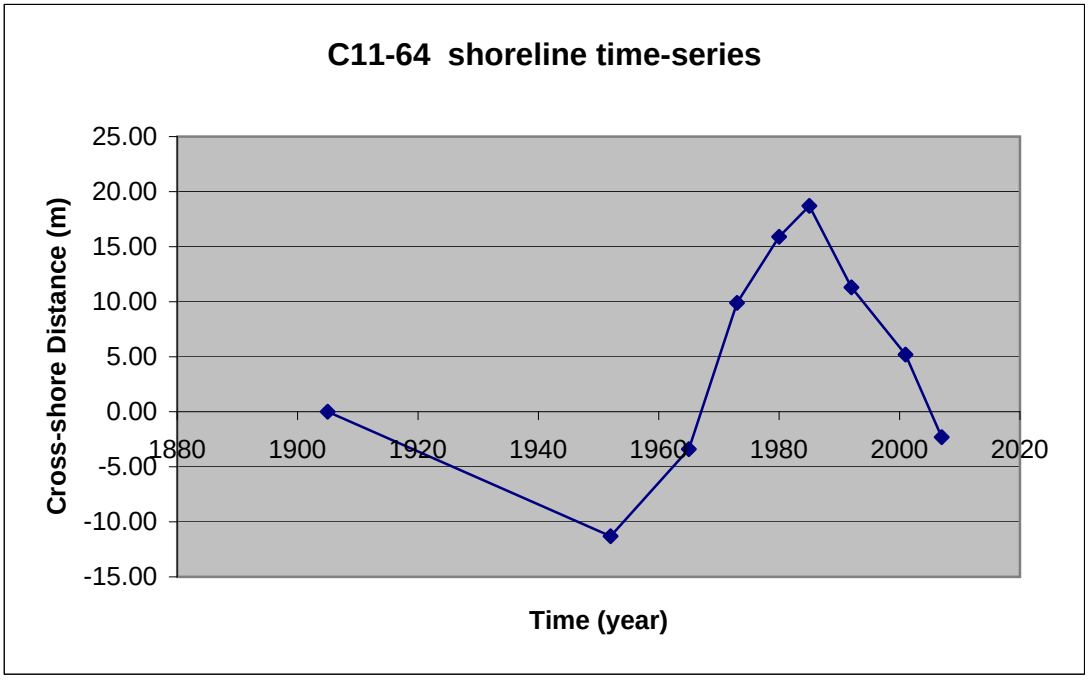
Relationship to other reference systems:

KCDC Profile 20 is 8.5 m north of C11-64 transect

Key

date_ Year of survey for site_
chron_ Chronology (yrs) from 1870 for site_
mmt_ Cross-shore distance (m) for shoreline from refn point for site_
dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_11-64	chron_11-64	mmt_11-64	dis_11-64	
1905	35.00	17.70	0.00	
1952	82.00	6.40	-11.30	
1965	95.00	14.30	-3.40	
1973	103.00	27.60	9.90	
1980	110.00	33.60	15.90	
1985	115.00	36.40	18.70	
1992	122.00	29.00	11.30	
2001	131.00	22.90	5.20	
2007	137.00	15.40	-2.30	Fence line at top of embankment



Shoreline change modelling:

Earlier period (1905 - 1952)

dE = -0.240*tE + 8.415

where dE = cross-shore **d**istance (m) for the **E**arly period

tE = **t**ime (yrs) for the **E**arly period

Later period (1952 - 2007) weighted to recent seawall period (2006-) for use in LT components under seawalls *Hold and* seawalls *Remove* scenarios.

dL = 0 SEE = 0 (because of seawall/rock revetment)

where dL = cross-shore **d**istance (m) for the **L**ate period

SEE = **s**tandard **e**rror of **e**stimate

BUT no reventment until 2006 and C11-61 shoreline data relevant until that time. So usual (weighted) regression (1980 to 2001) relevant in determing the *seawall remove* LT component.

Later period (1952 - 2007), weighted to 1980 to 2001 (2007 excluded as revetment in place)

dL = -0.591*tL + 83.395 SEE = 2.955

where dL = cross-shore **d**istance (m) for the **L**ate period

tL = time (yrs) for the Late period

SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C11-64				
Offset dist from refn pt	Model Slope	Model constance	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
NA	NA	NA	NA	15.4

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C11.64	Co-odinates (NZMG)		
-21.00	-5.6	C11-64	2676600.9	6032154.5

Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C11.64	Co-odinates (NZMG)		
-64.67	-49.27	C11-64	2676644.6	6032152.5

Coastal Hazard Measurement site C12-12

Type of shoreline:

Natural (between Marine Parade toe revetment to south and buried seawall to north)

Location

12125 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)
Marine Parade and Ocean Rd intersection
C12-12 reference point co-ordinates: C12-12 2676702.94 6032628.68

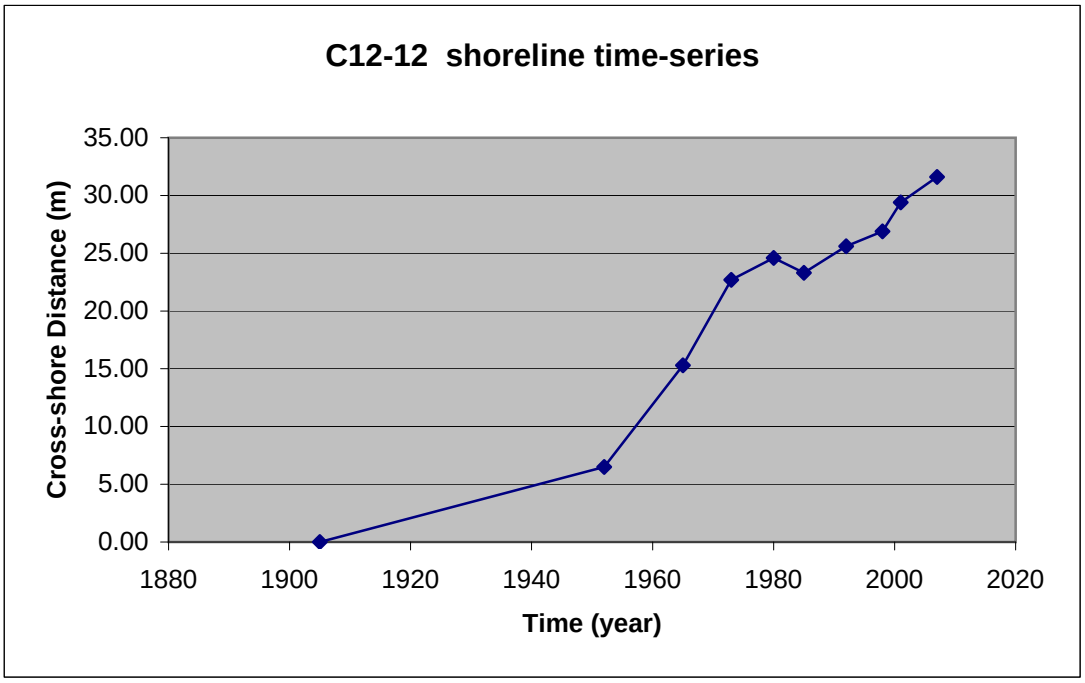
Relationship to other reference systems:

MWD profile 9 online and 29.7 m seaward of C12-12
KCDC profile 15 online and 29.7 m seaward of C12-12

Key

date_ Year of survey for site_
chron_ Chronology (yrs) from 1870 for site_
mmt_ Cross-shore distance (m) for shoreline from refn point for site_
dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_12-12	chron_12-12	mmt_12-12	dis_12-12
1905	35.00	22.20	0.00
1952	82.00	28.70	6.50
1965	95.00	37.50	15.30
1973	103.00	44.90	22.70
1980	110.00	46.80	24.60
1985	115.00	45.50	23.30
1992	122.00	47.80	25.60
1998	128.00	49.10	26.90
2001	131.00	51.60	29.40
2007	137.00	53.80	31.60



Shoreline change modelling:

Earlier period (1905 - 1952)
dE = 0.138*tE - 4.840
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1952 - 2007). Note no weighting
dL = 0.410*tL - 23.643 SEE = 2.504
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C12-12				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
22.2	0.41	-23.643	32.937	55.1

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C12-12	Co-odinates (NZMG)		
-35.65	19.45	C12-12	2676684	6032633.4

Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C12.12	Co-odinates (NZMG)		
-35.65	19.45	C12-12	2676684	6032633.4

NOTE Repair = Remove

Coastal Hazard Measurement site C12-50

Type of shoreline:

Seawall operating 1960s to 1980s, then buried as shoreline prograded.

Location

12505 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)
Marine Parade and Howell Street intersection
C12-50 reference point co-ordinates: C12-50 2676948.83 6032963.49

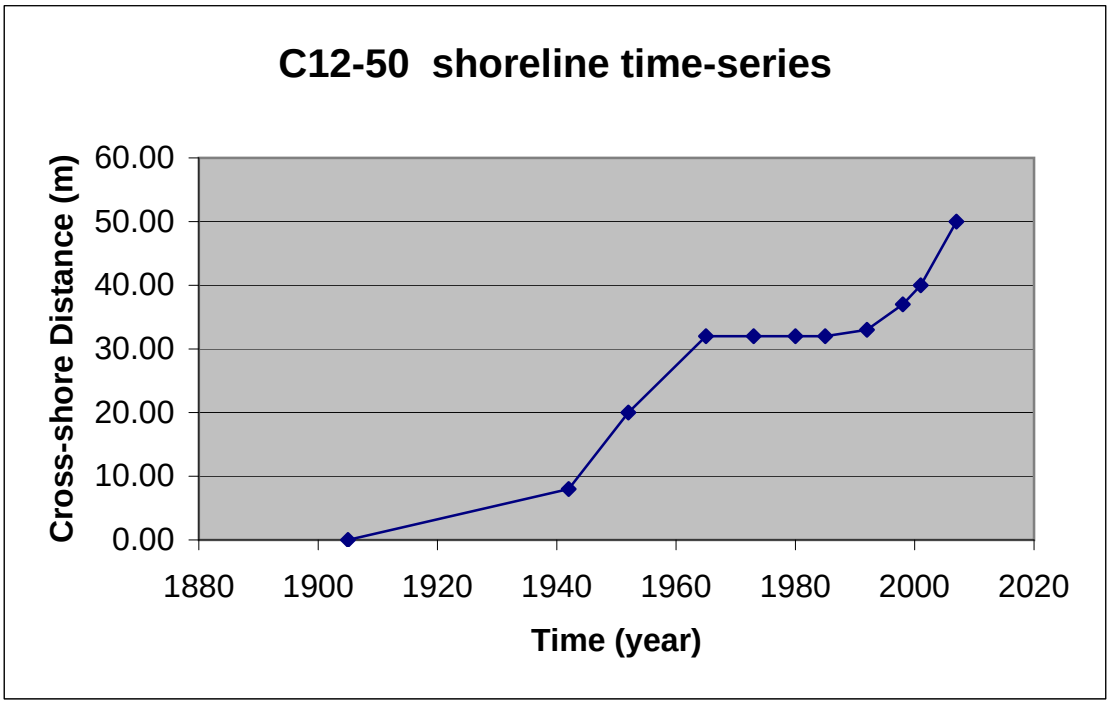
Relationship to other reference systems:

None

Key

date_ Year of survey for site_
chron_ Chronology (yrs) from 1870 for site_
mmt_ Cross-shore distance (m) for shoreline from refn point for site_ A49
dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_12-50	chron_12-50	mmt_12-50	dis_12-50
1905	35.00	158.00	0.00
1942	72.00	166.00	8.00
1952	82.00	178.00	20.00
1965	95.00	190.00	32.00
1973	103.00	190.00	32.00
1980	110.00	190.00	32.00
1985	115.00	190.00	32.00
1992	122.00	191.00	33.00
1998	128.00	195.00	37.00
2001	131.00	198.00	40.00
2007	137.00	208.00	50.00



Shoreline change modelling:

Earlier period (1905 - 1952)
dE = 0.369*tE - 13.893
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1952 - 2007). Note no weighting
dL = 0.511*tL - 25.244 SEE = 3.882
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C12-50				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
158	0.511	-25.244	45.274	203.3

Hazard line locations for ***seawalls repair*** scenario				
CEHD (Appen B-2)	Setback rel to C12-50	Co-odinates (NZMG)		
-20.37	192	C12-50	2676761.39	6033003.55

Bruied seawall will affect erosion.
Open Coast CEHD = 20.37 m landward of shoreline which is 10 to 20 m seaward of seawall.
So wall failure only after considerable erosion, assume wall will hold, so = set-back location

Hazard line locations for ***seawalls remove*** scenario				
CEHD (Appen B-3)	Setback rel to C12.50	Co-odinates (NZMG)		
-38.02	165.3	C12-50	2676788.46	6032999.28

Coastal Hazard Measurement site C12-77

Type of shoreline:

Natural

Location

12125m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C12-77 reference point co-ordinates: C12-77 2676939.99 6033234.06

Relationship to other reference systems:

KCDC profile 20 online and 67.2 m seaward of C12-77

Key

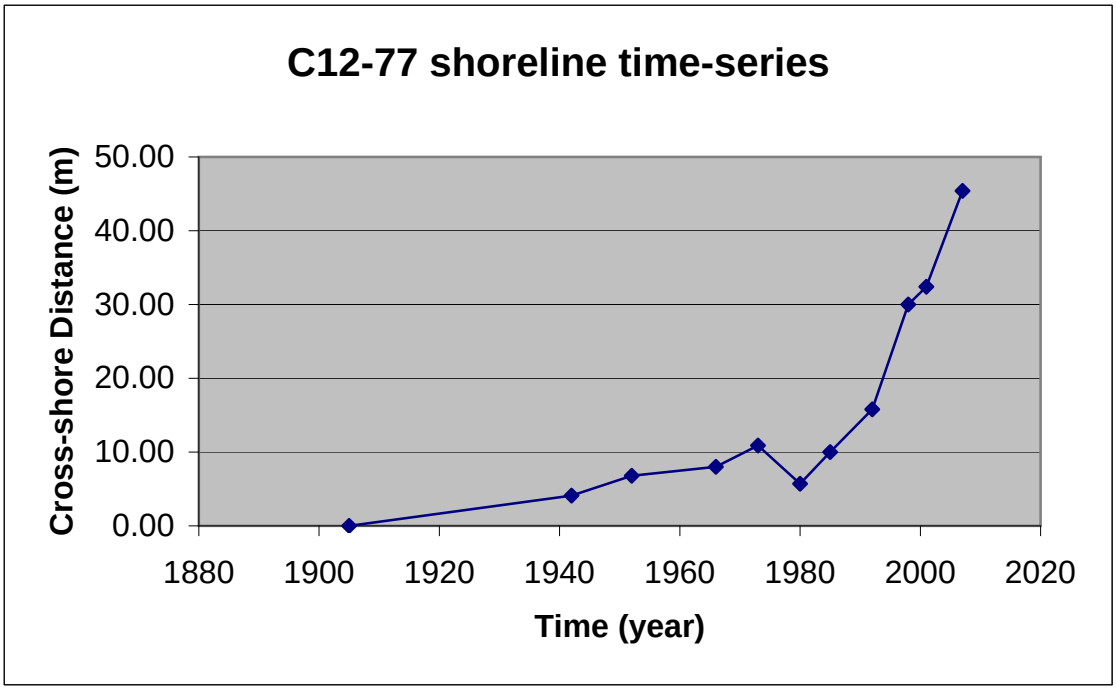
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_ A48

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_12-77	chron_12-77	mmt_12-77	dis_12-77
1905	35.00	68.60	0.00
1942	72.00	72.70	4.10
1952	82.00	75.40	6.80
1966	96.00	76.60	8.00
1973	103.00	79.50	10.90
1980	110.00	74.30	5.70
1985	115.00	78.60	10.00
1992	122.00	84.40	15.80
1998	128.00	98.60	30.00
2001	131.00	101.00	32.40
2007	137.00	114.00	45.40



Shoreline change modelling:

Earlier period (1905 - 1952)
dE = 0.135*tE - 4.902
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007), weighted to 1980 to 2007
dL = 1.474*tL - 159.302 SEE = 3.184
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C12-77				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
68.6	1.474	-159.302	44.11	112.71

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C12-77	Co-odinates (NZMG)		
-43.94	68.77	C12-77	2676873.4	6033251.5

Coastal Hazard Measurement site C13-04

Type of shoreline:

Natural

Location

13038m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C13-04 reference point co-ordinates:	C13-04	2677036.11	6033479.7

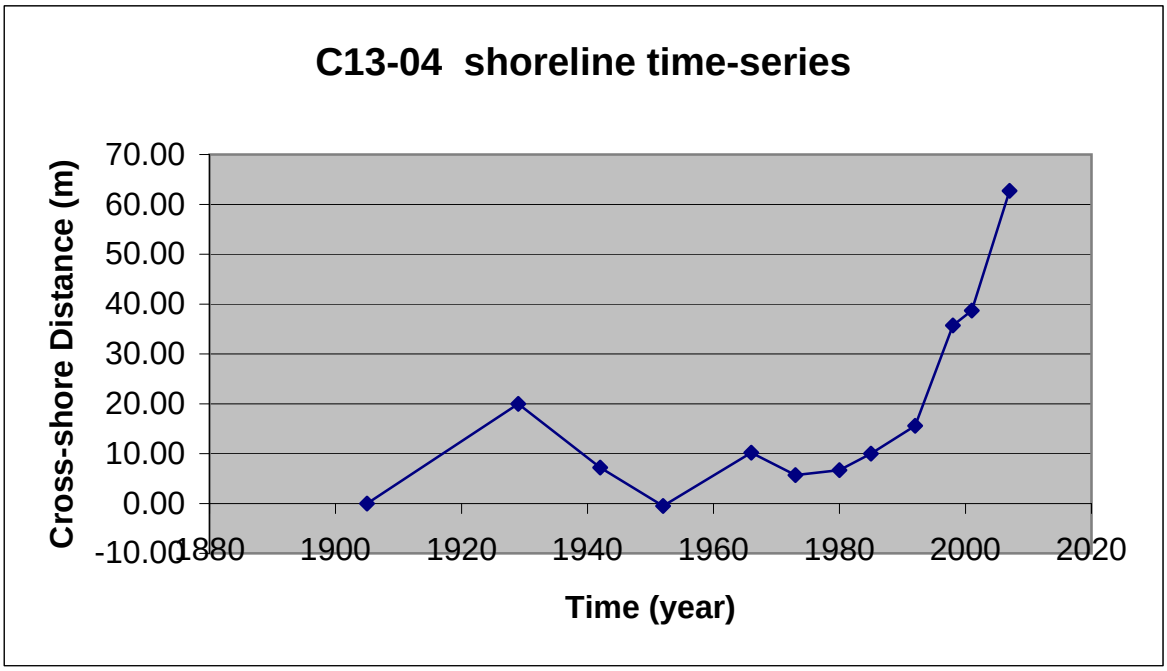
Relationship to other reference systems:

KCDC profile 310 (previously 151) is online with, and 63.5 m seaward of, C13-04

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_
mmt_	Cross-shore distance (m) for shoreline from refn point for site_
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_13-04	chron_13-04	mmt_13-04	dis_13-04
1905	35.00	68.30	0.00
1929	59.00	88.30	20.00
1942	72.00	75.50	7.20
1952	82.00	67.80	-0.50
1966	96.00	78.50	10.20
1973	103.00	74.00	5.70
1980	110.00	75.00	6.70
1985	115.00	78.30	10.00
1992	122.00	83.90	15.60
1998	128.00	104.00	35.70
2001	131.00	107.00	38.70
2007	137.00	131.00	62.70



Shoreline change modelling:

Earlier period (1905 - 1952)
dE = 0.002*tE - 6.575
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007), weighted to 1973 to 2007
dL = 1.629*tL - 171.824 SEE = 8.851
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C13-04				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
68.3	1.629	-171.824	52.978	121.28

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2	Setback rel to C13-04	Co-odinates (NZMG)		
-51.64	69.64	C13-04	2676969.63	6033500.65

Coastal Hazard Measurement site C13-24

Type of shoreline:

Natural

Location

13238 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C13-24 reference point co-ordinates: C13-24 2677118.46 6033657.09

Relationship to other reference systems:

None

Key

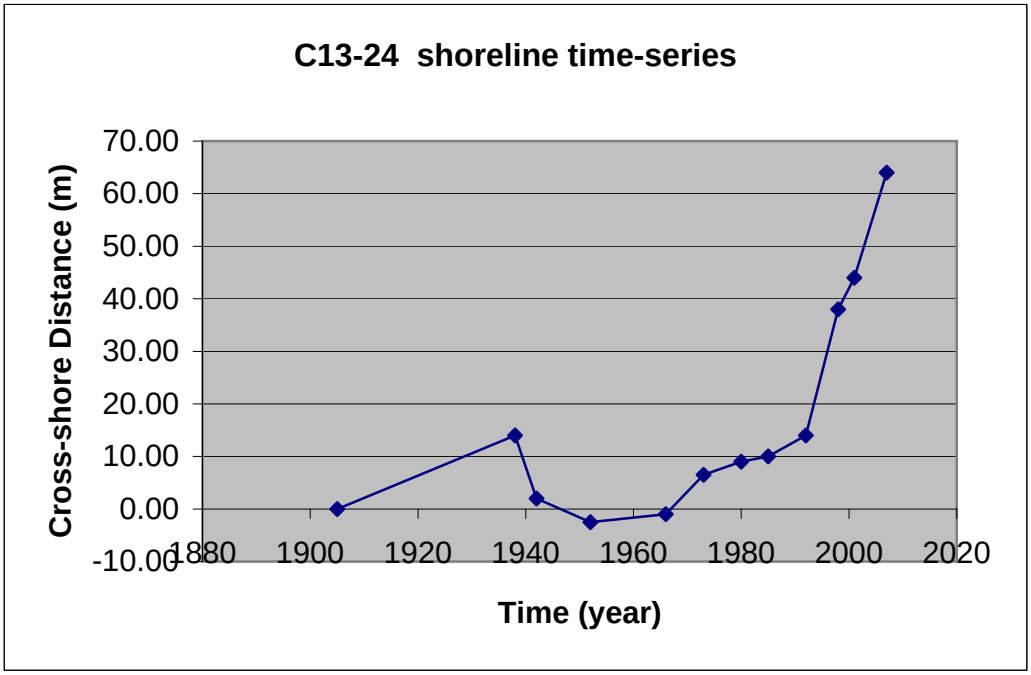
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_ A48

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_13-24	chron_13-24	mmt_13-24	dis_13-24
1905	35.00	73.00	0.00
1938	68.00	87.00	14.00
1942	72.00	75.00	2.00
1952	82.00	70.50	-2.50
1966	96.00	72.00	-1.00
1973	103.00	79.50	6.50
1980	110.00	82.00	9.00
1985	115.00	83.00	10.00
1992	122.00	87.00	14.00
1998	128.00	111.00	38.00
2001	131.00	117.00	44.00
2007	137.00	137.00	64.00



Shoreline change modelling:

Earlier period (1905 - 1952)
dE = 0.019*tE - 33.337
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007), weighted 1952 to 2007
dL = 1.466*tL - 149.552 SEE = 9.777
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C13-24				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
73	1.466	-149.552	52.756	125.756

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C13-24	Co-odinates (NZMG)		
-56.59	69.2	C13-24		

Coastal Hazard Measurement site C13-44

Type of shoreline:

Natural

Location

13443 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C13-44 reference point co-ordinates: C 13-44 2677216.82 6033837.19

Relationship to other reference systems:

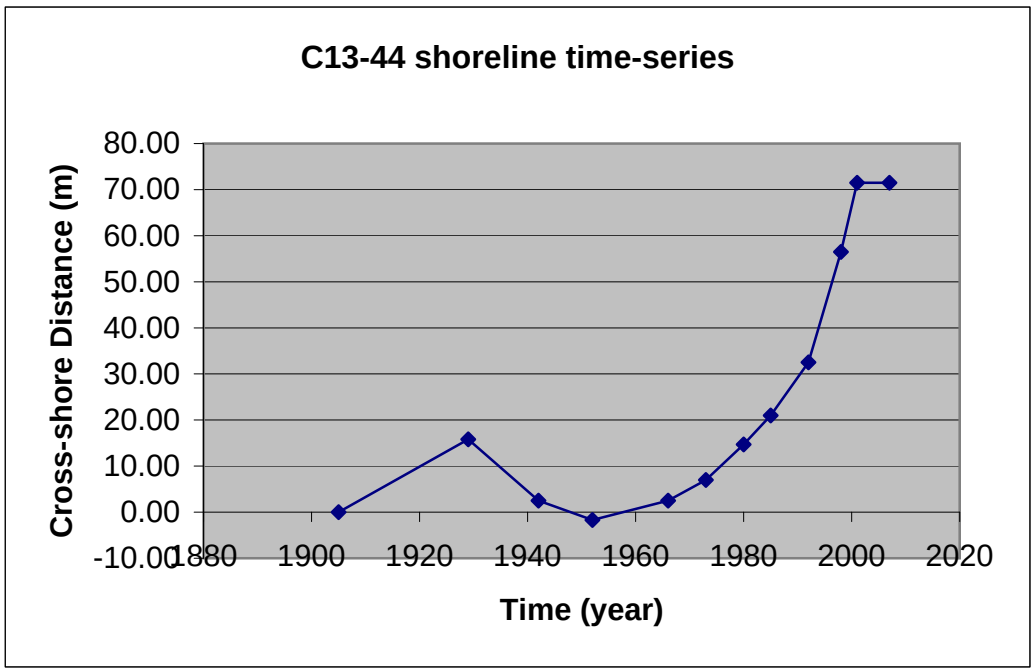
MWD profile 10 online and 74 m seaward of C13-44

KCDC profile 320 (previously 16) is online with, and 74 m seaward of, C13-44

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_
mmt_	Cross-shore distance (m) for shoreline from refn point for site_
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_13-44	chron_13-44	mmt_13-44	dis_13-44
1905	35.00	77.50	0.00
1929	59.00	93.30	15.80
1942	72.00	80.00	2.50
1952	82.00	75.80	-1.70
1966	96.00	80.00	2.50
1973	103.00	84.50	7.00
1980	110.00	92.20	14.70
1985	115.00	98.50	21.00
1992	122.00	110.00	32.50
1998	128.00	134.00	56.50
2001	131.00	149.00	71.50
2007	137.00	149.00	71.50



Shoreline change modelling:

Earlier period (1905 - 1952)
dE = -0.046*tE - 6.975
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007), weighted 1952 to 2007
dL = 1.508*tL - 141.009 SEE = 11.478
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C13-44				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
77.5	1.508	-141.009	67.095	144.6

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C13-44	Co-odinates (NZMG)		
-61.46	83.1	C13-44		

Coastal Hazard Measurement site C13-63

Type of shoreline:

Natural

Location

13631 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C13-63 reference point co-ordinates: C13-63 2677303.52 6033992.51

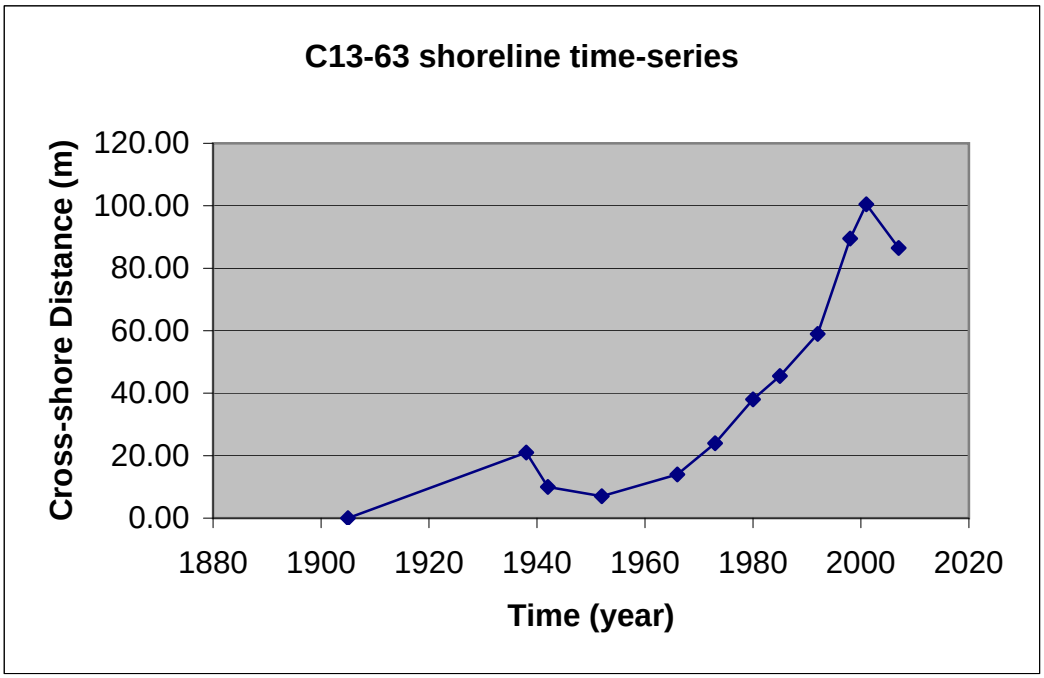
Relationship to other reference systems:

KCDC profile 18 is online with, and 92 m seaward of C13-63

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_ data
mmt_	Cross-shore distance (m) for shoreline from refn point for site_ data
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_13-63	chron_13-63	mmt_13-63	dis_13-63
1905	35.00	65.50	0.00
1938	68.00	86.50	21.00
1942	72.00	75.50	10.00
1952	82.00	72.50	7.00
1966	96.00	79.50	14.00
1973	103.00	89.50	24.00
1980	110.00	103.50	38.00
1985	115.00	111.00	45.50
1992	122.00	124.50	59.00
1998	128.00	155.00	89.50
2001	131.00	166.00	100.50
2007	137.00	152.00	86.50



Shoreline change modelling:

Earlier period (1905 - 1952)
dE = 0.225*tE - 4.979
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007), weighted 1952 to 2007
dL = 1.825*tL - 156.139 SEE = 11.618
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C13-63				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
65.5	1.825	-156.139	95.711	161.211

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C13-63	Co-odinates (NZMG)		
-64.02	97.2	C13-63		

Coastal Hazard Measurement site C13-89

Type of shoreline:

Natural

Location

13892 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C13-89 reference point co-ordinates: C13-89 2677437.19 6034185.27

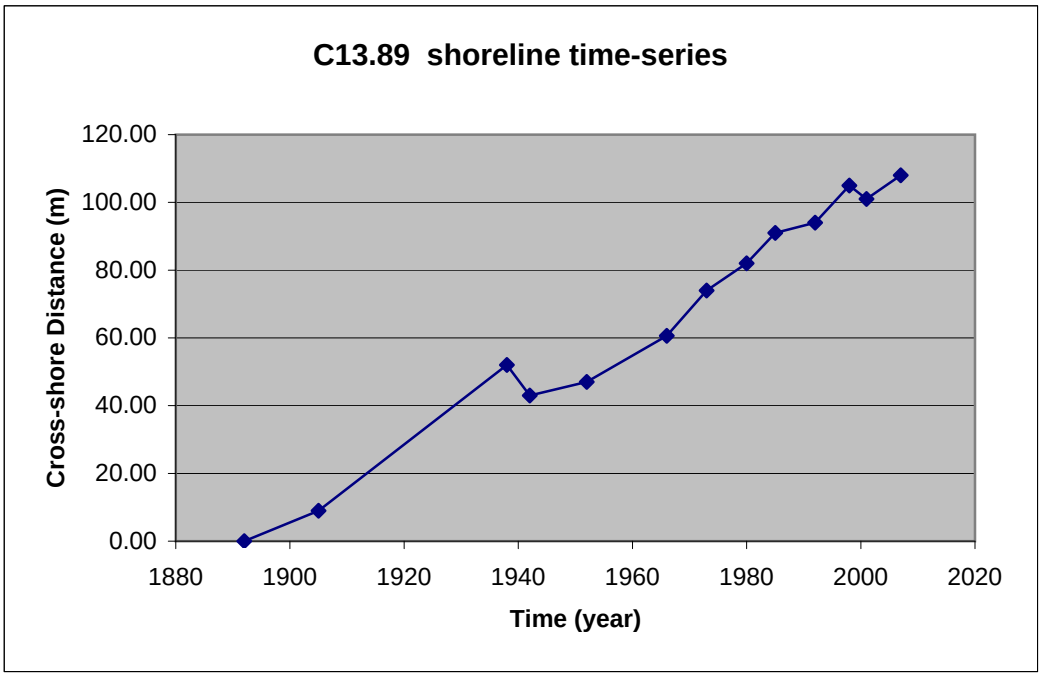
Relationship to other reference systems:

KCDC profile 330 (previously 181) is online with, and 64.8 m seaward of, C13-89

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_
mmt_	Cross-shore distance (m) for shoreline from refn point for site_
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_13-89	chron_13-89	mmt_13-89	dis_13-89
1892	22.00	30.00	0.00
1905	35.00	39.00	9.00
1938	68.00	82.00	52.00
1942	72.00	73.00	43.00
1952	82.00	77.00	47.00
1966	96.00	90.60	60.60
1973	103.00	104.00	74.00
1980	110.00	112.00	82.00
1985	115.00	121.00	91.00
1992	122.00	124.00	94.00
1998	128.00	135.00	105.00
2001	131.00	131.00	101.00
2007	137.00	138.00	108.00



Shoreline change modelling:

Earlier period (1892 - 1952)
dE = 0.889*tE - 19.387
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007), no weighting
dL = 1.092*tL - 39.152 SEE = 3.636
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C13-89				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
30	1.092	-39.152	111.54	141.54

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3	Setback rel to C13-89	Co-odinates (NZMG)		
-43.54	98	C13-89	2677367.72	6034254.41

Coastal Hazard Measurement site C14-20

Type of shoreline:

Natural

Location

14199 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C14-20 reference point co-ordinates: C14-20 2677685.63 6034385.45

Relationship to other reference systems:

KCDC profile 182 is online with, and 109.9 m seaward of, C14-20

Key

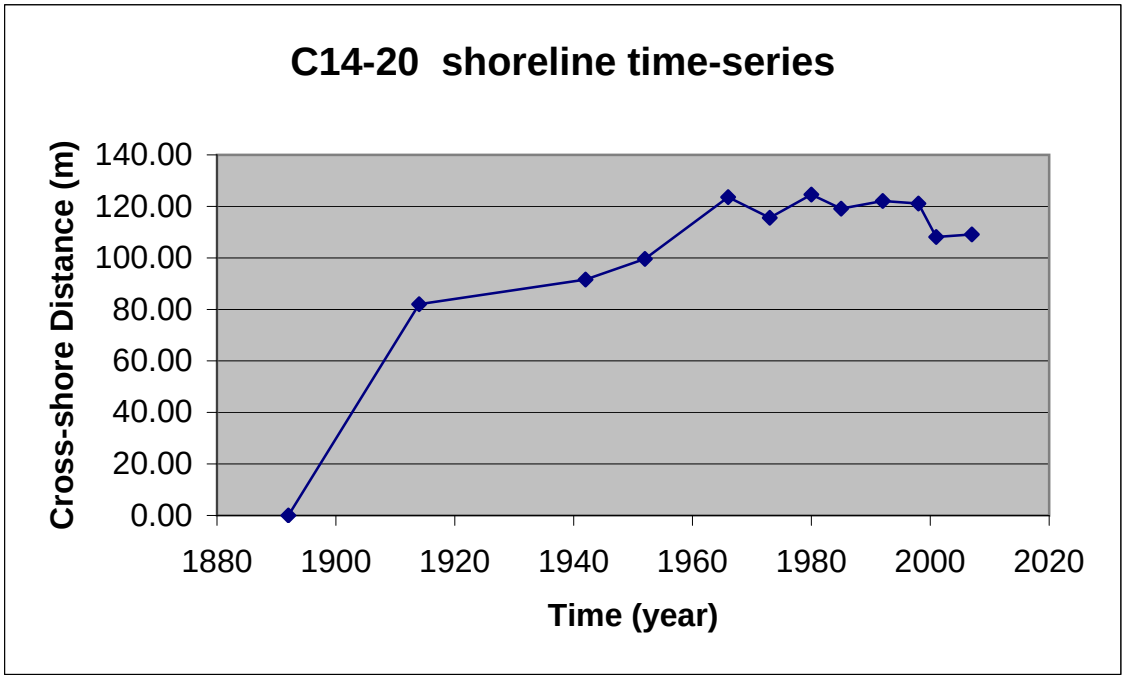
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_ data

mmt_ Cross-shore distance (m) for shoreline from refn point for site_ data

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_14-20	chron_14-20	mmt_14-20	dis_14-20
1892	22.00	11.90	0.00
1914	44.00	93.90	82.00
1942	72.00	103.50	91.60
1952	82.00	111.50	99.60
1966	96.00	135.50	123.60
1973	103.00	127.50	115.60
1980	110.00	136.50	124.60
1985	115.00	131.00	119.10
1992	122.00	134.00	122.10
1998	128.00	133.00	121.10
2001	131.00	120.00	108.10
2007	137.00	121.00	109.10



Shoreline change modelling:

Earlier period (1892 - 1952)
dE = 0.1.766*tE - 23.351
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007), weighting 1966+
dL = -0.276*tL + 150.402 SEE = 5.428
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C14-20				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
11.9	-0.276	150.402	112.314	124.21

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/	Setback rel to C14-20	Co-odinates (NZMG)		
-59.11	65.1	C14-20	2677643.6	6034435.2

Coastal Hazard Measurement site X14-48

Xtra site used to model 2008 shoreline, but not used for LT or ST modelling due to rivermouth influence mid record.

Type of shoreline:

Natural

Location

14483m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

x14-48 reference point co-ordinates: X14-48 2677991.135 6034410.667

Relationship to other reference systems:

MWD profile 11 is 269 m seaward of X14-48

KCDC profile 340 (previously profile 17) is online with, and 254 m seaward of, X14-48

Key

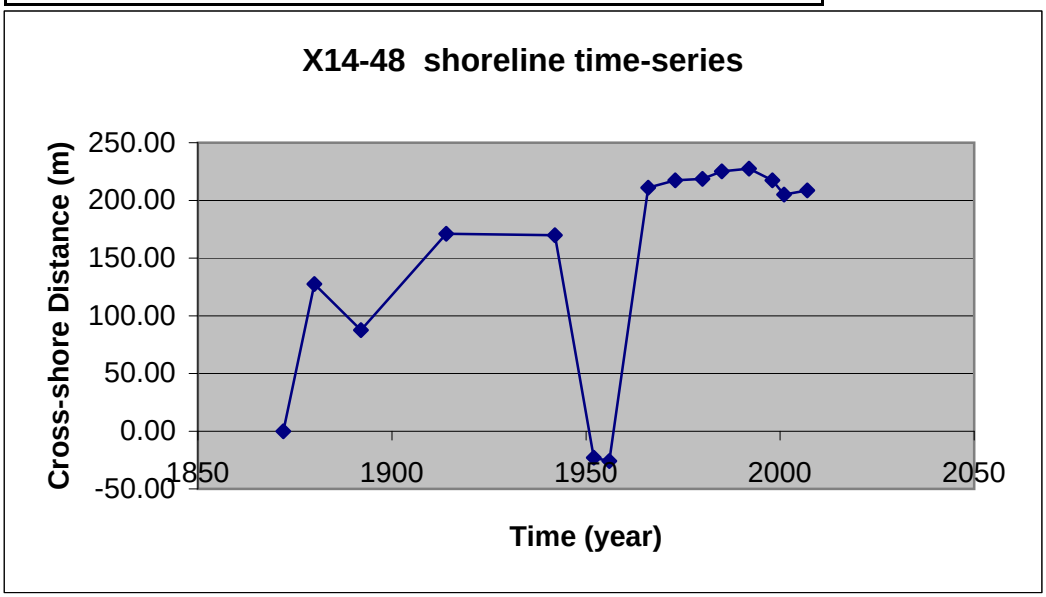
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_14-48	chron_14-48	mmt_14-48	dis_14-48
1872	2.00	58.40	0.00
1880	10.00	186.00	127.60
1892	22.00	146.00	87.60
1914	44.00	229.50	171.10
1942	72.00	228.30	169.90
1952	82.00	35.40	-23.00
1956	86.00	32.60	-25.80
1966	96.00	269.40	211.00
1973	103.00	275.80	217.40
1980	110.00	277.00	218.60
1985	115.00	283.60	225.20
1992	122.00	286.00	227.60
1998	128.00	275.80	217.40
2001	131.00	263.50	205.10
2007	137.00	267.00	208.60



Shoreline change modelling:

Earlier period (1892 - 1952)
River influence so no modelling

Later period (1942 - 2007)
River influence, but modelled 1966+ to get 2008 shoreline and then applied C14-20 hazard distance.
dL = -0.126*tL + 231.258
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to X14-48				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
58.4	-0.126	231.258	213.87	272.27

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to X14-48	Co-odinates (NZMG)		
-59.11	213.16	X14-48	2677874.6	6034588.1

Coastal Hazard Measurement site X16-16

Xtra site used to model 2008 shoreline, but not used for LT or ST modelling due to rivermouth influence early-mid record.

Type of shoreline:

Natural

Location

16157 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

X16-16 reference point co-ordinates: X16-16 2679361.36 6035383.11

Relationship to other reference systems:

MWD profile 12 is 118.1 m seaward of C16-16

Key

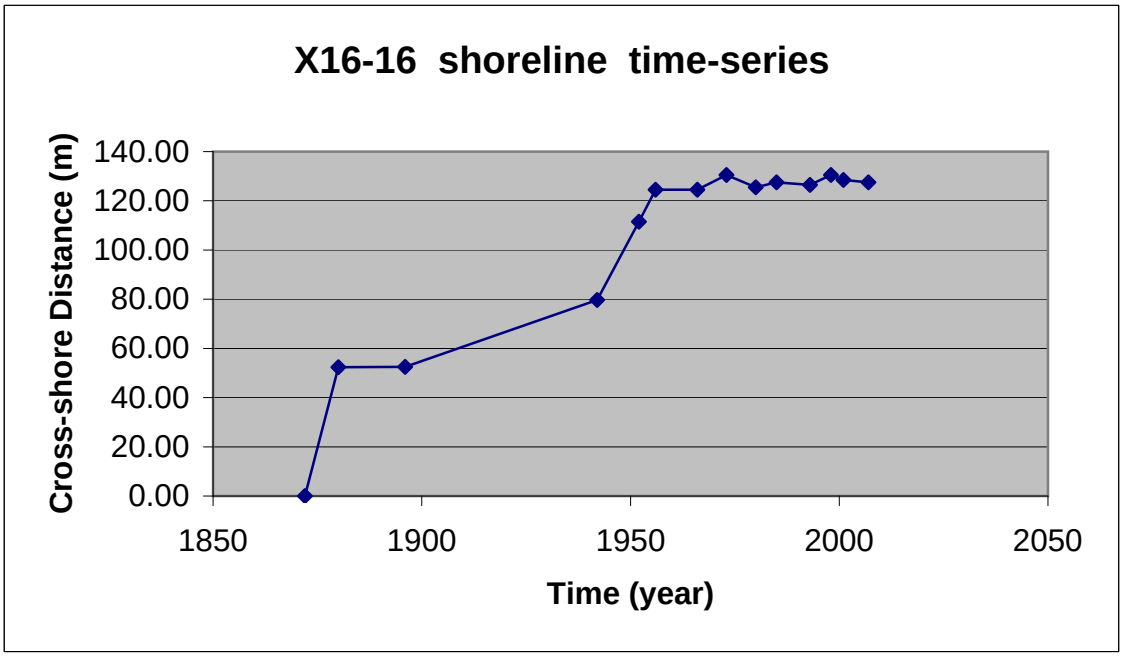
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_16-16	chron_16-16	mmt_16-16	dis_16-16
1872	2.00	1.50	0.00
1880	10.00	53.90	52.40
1896	26.00	54.00	52.50
1942	72.00	81.20	79.70
1952	82.00	113.00	111.50
1956	86.00	126.00	124.50
1966	96.00	126.00	124.50
1973	103.00	132.00	130.50
1980	110.00	127.00	125.50
1985	115.00	129.00	127.50
1993	123.00	128.00	126.50
1998	128.00	132.00	130.50
2001	131.00	130.00	128.50
2007	137.00	129.00	127.50



Shoreline change modelling:

Earlier period (1872 - 1952)
River influence so no modelling

Later period (1942 - 2007)
River influence, but modelled 1952+ to get 2008 shoreline and then applied C16-69 hazard distance.
dL = 0.190*tL + 104.61
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to X16-16				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
1.5	0.19	104.61	130.83	132.33

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/	Setback rel to X16-16	Co-odinates (NZMG)		
-39.34	92.99	X16-16	2679306.7	6035458.2

Coastal Hazard Measurement site C16-69

Type of shoreline:

Natural

Location

16686 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C16-69 reference point co-ordinates: C16-69 2679777.67 6035711.99

Relationship to other reference systems:

KCDC profile 370 (previously 42) is 211 m south of C16-69

Key

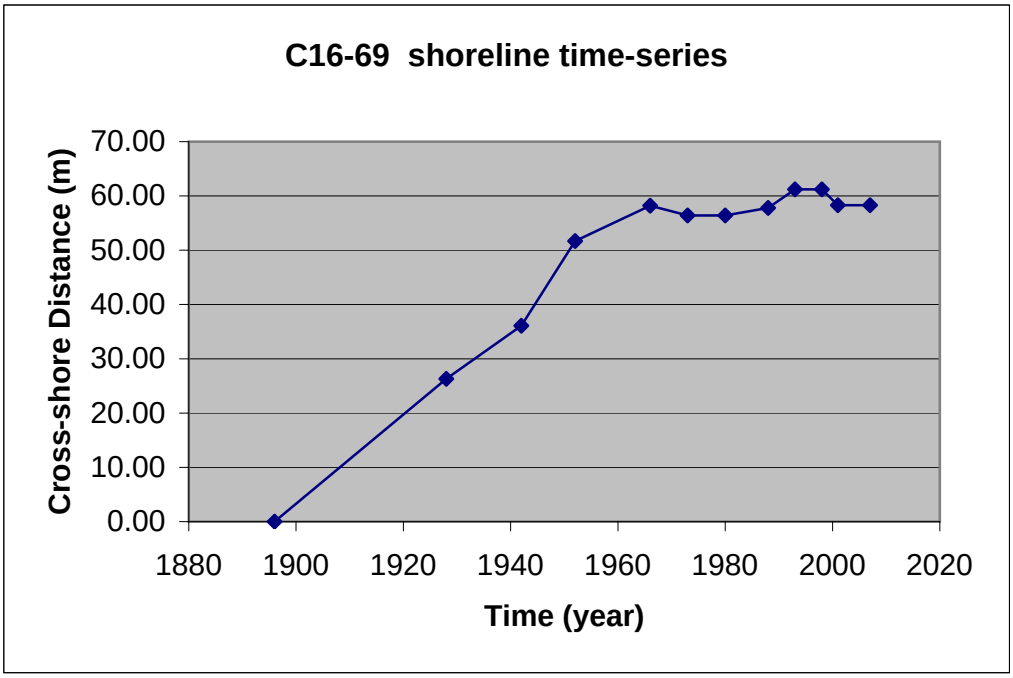
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_16-69	chron_16-69	mmt_16-69	dis_16-69
1896	26.00	40.80	0.00
1928	58.00	67.10	26.30
1942	72.00	76.90	36.10
1952	82.00	92.50	51.70
1966	96.00	99.00	58.20
1973	103.00	97.20	56.40
1980	110.00	97.20	56.40
1988	118.00	98.60	57.80
1993	123.00	102.00	61.20
1998	128.00	102.00	61.20
2001	131.00	99.10	58.30
2007	137.00	99.10	58.30



Shoreline change modelling:

Earlier period (1896 - 1952)
dE = 0.881*tE - 23.918
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007), no weighting
dL = 0.269*tL + 25.991 SEE = 4.772
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C16-69				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
40.8	0.269	25.991	63.113	103.91

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C16-69	Co-odinates (NZMG)		
-39.34	64.57	C16-69	2679738.91	6035763.61

Coastal Hazard Measurement site C17-31

Type of shoreline:

Natural

Location

17314 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C17-31 reference point co-ordinates: C17-31 2679777.67 6035711.99

Relationship to other reference systems:

MWD profile 13 is 138 m south of C17-31

KCDC profile 380 (previously 43) is 35 m north of C17-31

Key

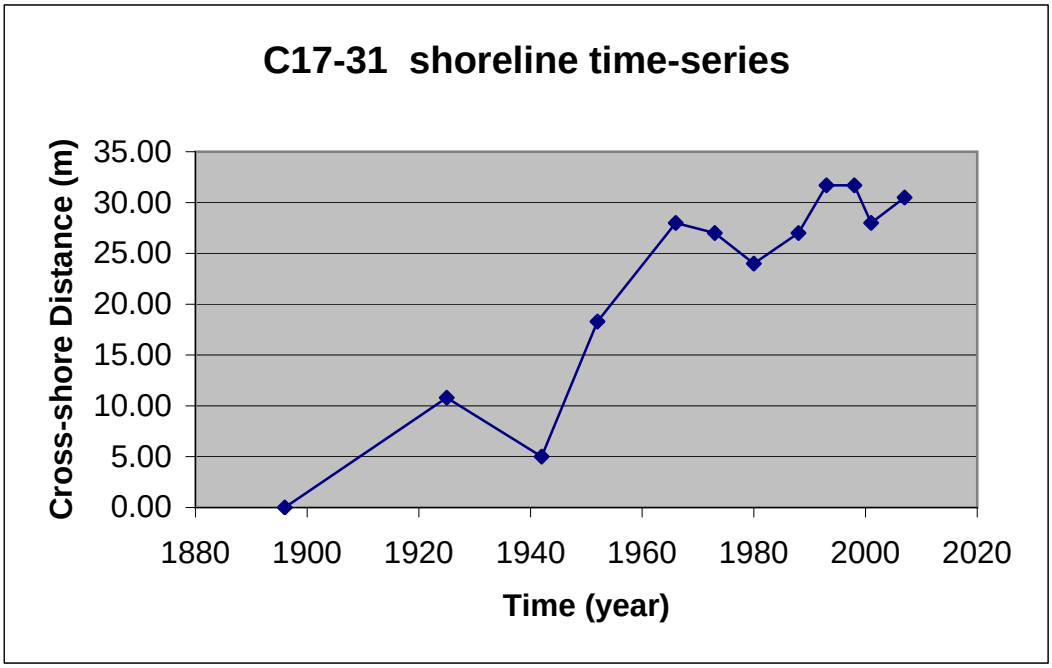
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_17-31	chron_17-31	mmt_17-31	dis_17-31
1896	26.00	77.00	0.00
1925	55.00	87.80	10.80
1942	72.00	82.00	5.00
1952	82.00	95.30	18.30
1966	96.00	105.00	28.00
1973	103.00	104.00	27.00
1980	110.00	101.00	24.00
1988	118.00	104.00	27.00
1993	123.00	108.70	31.70
1998	128.00	108.70	31.70
2001	131.00	105.00	28.00
2007	137.00	107.50	30.50



Shoreline change modelling:

Earlier period (1896 - 1952)
dE = 0.250*tE - 6.180
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007), no weighting
dL = 0.316*tL - 9.630 SEE = 4.645
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C17-31				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
77	0.316	-9.63	33.98	110.98

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C17-31	Co-odinates (NZMG)		
-38.59	72.39	C17-31	2680243.1	6036142.4

Coastal Hazard Measurement site C17-88

Type of shoreline:

Natural

Location

17879 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C17-88 reference point co-ordinates: C17-88 2680718.33 6036446.88

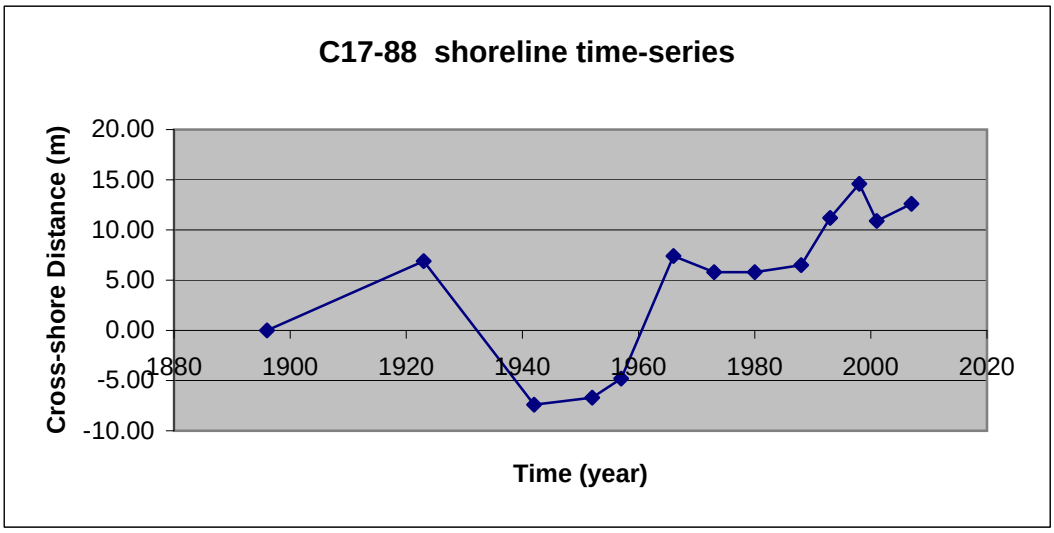
Relationship to other reference systems:

None

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_ data
mmt_	Cross-shore distance (m) for shoreline from refn point for site_ data
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_17-88	chron_17-88	mmt_17-88	dis_17-88
1896	26.00	88.40	0.00
1923	53.00	95.30	6.90
1942	72.00	81.00	-7.40
1952	82.00	81.70	-6.70
1957	87.00	83.60	-4.80
1966	96.00	95.80	7.40
1973	103.00	94.20	5.80
1980	110.00	94.20	5.80
1988	118.00	94.90	6.50
1993	123.00	99.60	11.20
1998	128.00	103.00	14.60
2001	131.00	99.30	10.90
2007	137.00	101.00	12.60



Shoreline change modelling:

Earlier period (1896 - 1952)
dE = -0.163*tE + 7.705
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007), no weighting
dL = 0.338*tL - 31.374 SEE = 3.070
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C17-88				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
88.4	0.338	-31.374	15.57	103.67

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C17-88	Co-odinates (NZMG)		
-35.59	68.08	C17-88	2680674.4	6036498.8

Coastal Hazard Measurement site C18-85

Type of shoreline:

Natural

Location

18848 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C18-85 reference point co-ordinates: C18-85 2681408.54 6037143.78

Relationship to other reference systems:

MWD profile 14 is 176 m south of C18-85

KCDC profile 390 (previously 44) is 201 m north of C18-85

Key

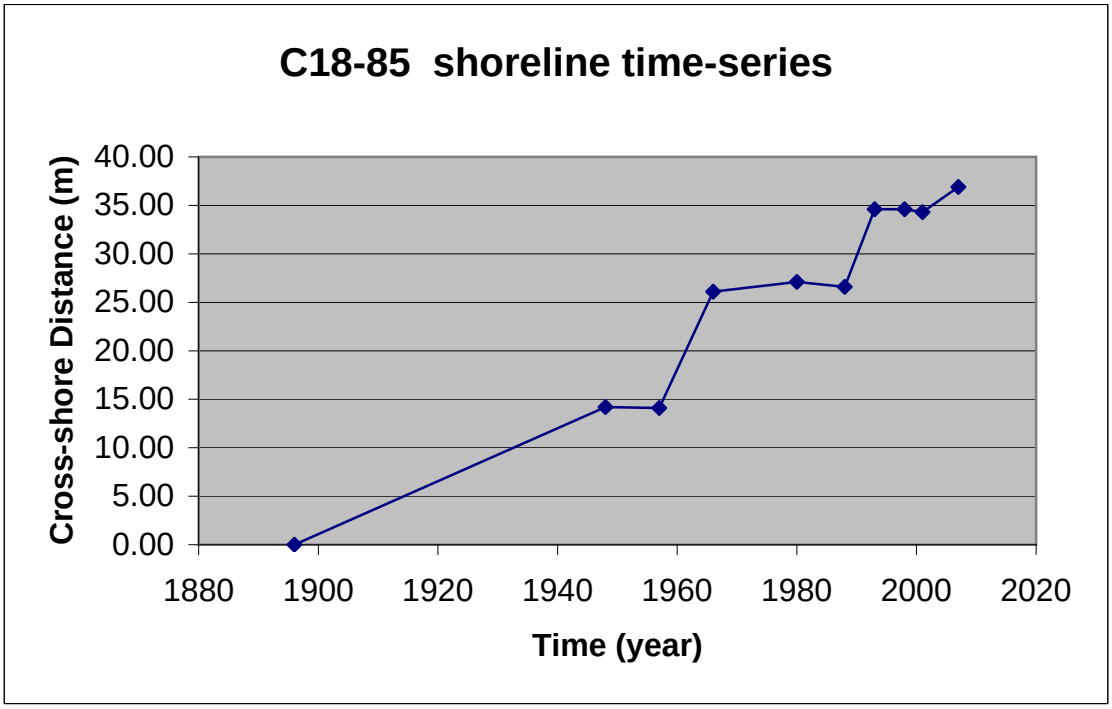
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_18-85	chron_18-85	mmt_18-85	dis_18-85
1896	26.00	41.70	0.00
1948	78.00	55.90	14.20
1957	87.00	55.80	14.10
1966	96.00	67.80	26.10
1980	110.00	68.80	27.10
1988	118.00	68.30	26.60
1993	123.00	76.30	34.60
1998	128.00	76.30	34.60
2001	131.00	76.00	34.30
2007	137.00	78.60	36.90



Shoreline change modelling:

Earlier period (1896 - 1948)
dE = 0.273*tE - 7.100
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1948 - 2007), no weighting
dL = 0.396*tL - 16.697 SEE = 2.836
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C18-85				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
41.7	0.396	-16.697	37.95	79.65

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C18-85	Co-odinates (NZMG)		
-35.00	44.65	C18-85	2681377.2	6037175.6

Coastal Hazard Measurement site C19-35

Type of shoreline:

Natural

Location

19354 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C19-35 reference point co-ordinates: C19-35 2681813.42 6037470.78

Relationship to other reference systems:

None

Key

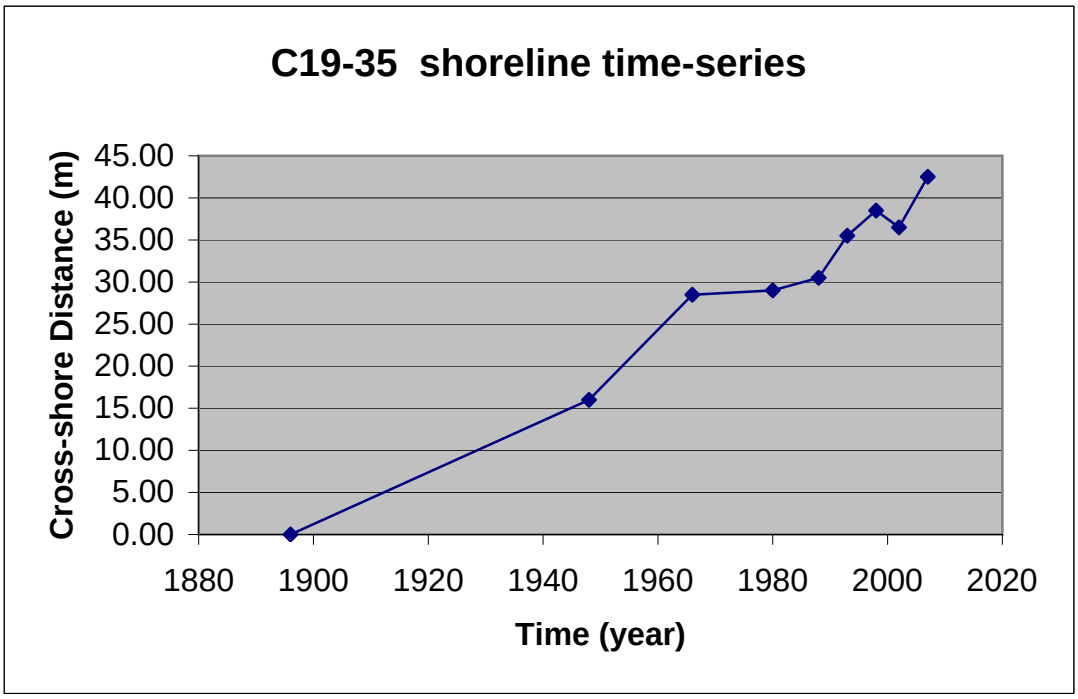
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_19-35	chron_19-35	mmt_19-35	dis_19-25
1896	26.00	110.50	0.00
1948	78.00	126.50	16.00
1966	96.00	139.00	28.50
1980	110.00	139.50	29.00
1988	118.00	141.00	30.50
1993	123.00	146.00	35.50
1998	128.00	149.00	38.50
2002	132.00	147.00	36.50
2007	137.00	153.00	42.50



Shoreline change modelling:

Earlier period (1896 - 1948)
dE = 0.308*tE - 8.0
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1948 - 2007), no weighting
dL = 0.393*tL - 13.182 SEE = 2.462
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C19-35				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
110.5	0.393	-13.182	41.05	151.55

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C19-35	Co-odinates (NZMG)		
-35.79	115.76	C19-35	2681724.33	6037544.59

Coastal Hazard Measurement site C20.30

Type of shoreline:

Natural

Location

20299 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C20-30 reference point co-ordinates: C20-30 2682478.05 6038164.26

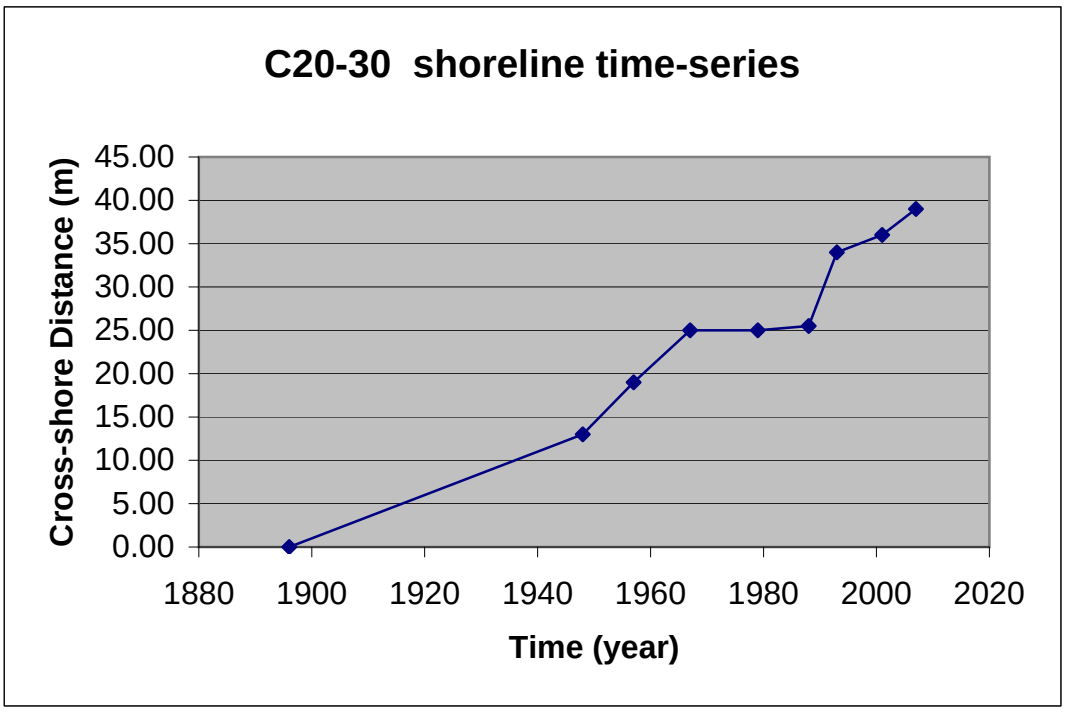
Relationship to other reference systems:

MWD profile 15 is 142 m south of C20-30

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_
mmt_	Cross-shore distance (m) for shoreline from refn point for site_
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_20-30	chron_20-30	mmt_20-30	dis_20-30
1896	26.00	167.00	0.00
1948	78.00	180.00	13.00
1957	87.00	186.00	19.00
1967	97.00	192.00	25.00
1979	107.00	192.00	25.00
1988	118.00	192.50	25.50
1993	123.00	201.00	34.00
2001	131.00	203.00	36.00
2007	137.00	206.00	39.00



Shoreline change modelling:

Earlier period (1896 - 1948)
dE = 0.250*tE - 6.5
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1948 - 2007), no weighting
dL = 0.401*tL - 16.933 SEE = 2.604
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C20-30				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
167	0.401	-16.933	38.41	205.41

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C20-30	Co-odinates (NZMG)		
-36.45	168.96	C20-30	2682342.24	6038264.92

Coastal Hazard Measurement site C20.79

Type of shoreline:

Natural

Location

20785 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C20-79 reference point co-ordinates: C20-79 2682768.27 6038564.23

Relationship to other reference systems:

None

Key

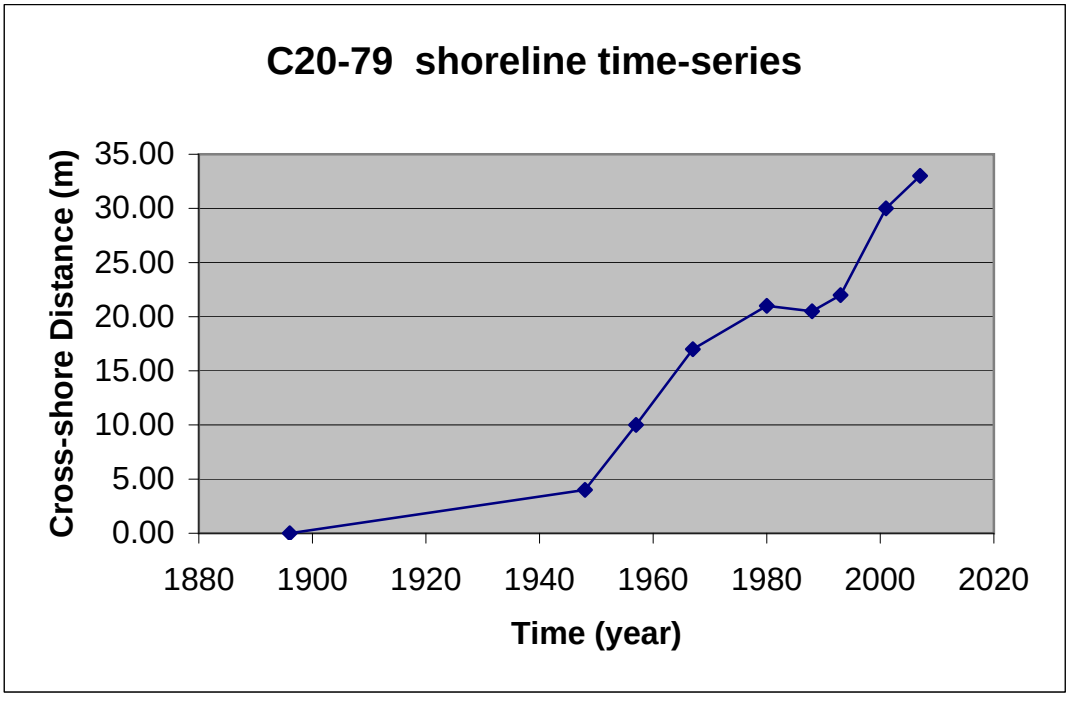
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_20-79	chron_20-79	mmt_20-79	dis_20-79
1896	26.00	158.00	0.00
1948	78.00	162.00	4.00
1957	87.00	168.00	10.00
1967	97.00	175.00	17.00
1980	110.00	179.00	21.00
1988	118.00	178.50	20.50
1993	123.00	180.00	22.00
2001	131.00	188.00	30.00
2007	137.00	191.00	33.00



Shoreline change modelling:

Earlier period (1896 - 1948)
dE = 0.077*tE - 2.0
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1948 - 2007), no weighting
dL = 0.439*tL - 28.675 SEE = 2.443
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C20-79				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
158	0.439	-28.675	31.91	189.91

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C20.79	Co-odinates (NZMG)		
-36.98	152.93	C20-79		

Coastal Hazard Measurement site C21-26

Type of shoreline:

Natural

Location

21260 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C21-26 reference point co-ordinates: C21-26 2683076.91 6038936.11

Relationship to other reference systems:

None

Key

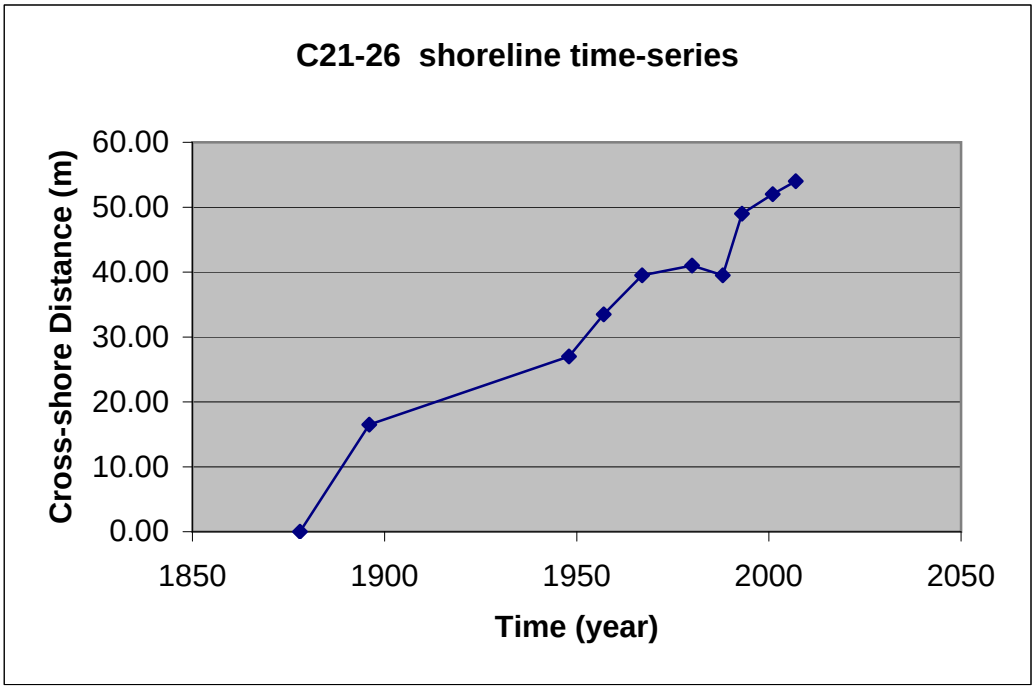
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_21-26	chron_21-26	mmt_21-26	dis_21-26
1878	8.00	171.00	0.00
1896	26.00	187.50	16.50
1948	78.00	198.00	27.00
1957	87.00	204.50	33.50
1967	97.00	210.50	39.50
1980	110.00	212.00	41.00
1988	118.00	210.50	39.50
1993	123.00	220.00	49.00
2001	131.00	223.00	52.00
2007	137.00	225.00	54.00



Shoreline change modelling:

Earlier period (1878 - 1948)
dE = 0.345*tE + 1.630
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1948 - 2007), no weighting
dL = 0.420*tL - 4.337 SEE = 2.943
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C21.26				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
171	0.42	-4.337	53.62	224.62

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C21.26	Co-odinates (NZMG)		
-37.65	186.97	C21.26		

Coastal Hazard Measurement site C21-73

Type of shoreline:

Natural

Location

21727 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C21-73 reference point co-ordinates: C21-73 2683413.79 6039277.65

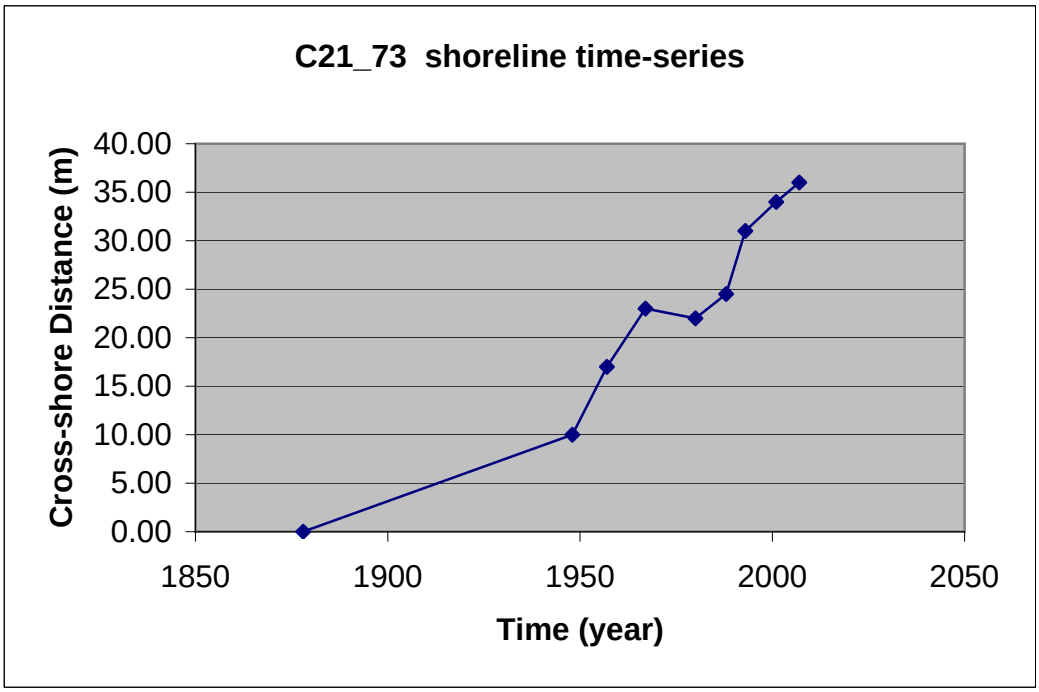
Relationship to other reference systems:

None

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_
mmt_	Cross-shore distance (m) for shoreline from refn point for site_
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_21-73	chron_21-73	mmt_21-73	dis_21-73
1878	8.00	276.00	0.00
1948	78.00	286.00	10.00
1957	87.00	293.00	17.00
1967	97.00	299.00	23.00
1980	110.00	298.00	22.00
1988	118.00	300.50	24.50
1993	123.00	307.00	31.00
2001	131.00	310.00	34.00
2007	137.00	312.00	36.00



Shoreline change modelling:

Earlier period (1878 - 1948)
dE = 0.143*tE -1.143
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1948 - 2007), no weighting
dL = 0.400*tL - 19.375 SEE = 2.556
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C21.73				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
276	0.4	-19.375	35.83	311.83

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C21.73	Co-odinates (NZMG)		
-38.60	273.23	C21.73		

Coastal Hazard Measurement site C22-06

Type of shoreline:

Natural

Location

22060 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C22-06 reference point co-ordinates:	C22-06	2683602.93	6039555.41

Relationship to other reference systems:

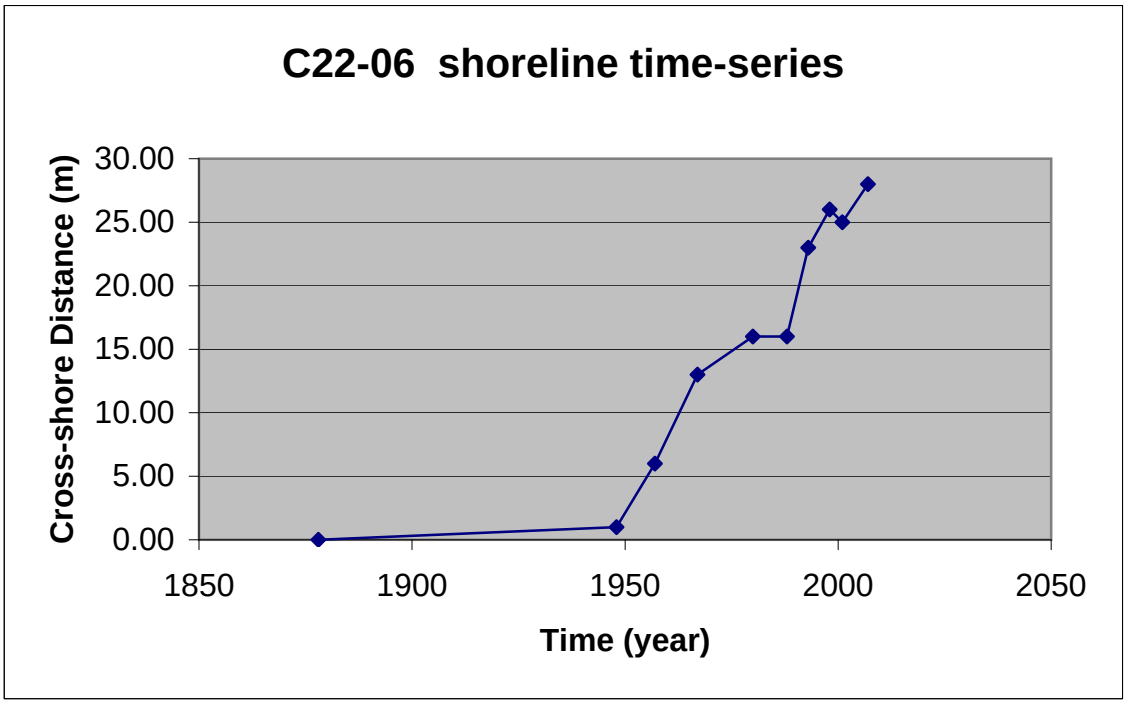
MWD profile 16 is online and 128 m south of C22-06

KCDC profile 400 (previously 45) is online and 127 m south of C22-06

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_
mmt_	Cross-shore distance (m) for shoreline from refn point for site_ A49
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_22-06	chron_22-06	mmt_22-06	dis_22-06
1878	8.00	294.00	0.00
1948	78.00	295.00	1.00
1957	87.00	300.00	6.00
1967	97.00	307.00	13.00
1980	110.00	310.00	16.00
1988	118.00	310.00	16.00
1993	123.00	317.00	23.00
1998	128.00	320.00	26.00
2001	131.00	319.00	25.00
2007	137.00	322.00	28.00



Shoreline change modelling:

Earlier period (1878 - 1948)
dE = 0.014*tE - 0.114
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1948 - 2007), no weighting
dL = 0.444*tL - 32.612 SEE = 1.940
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C22-06				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
294	0.444	-32.612	28.66	322.66

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C22-06	Co-odinates (NZMG)		
-40.09	282.57	C22-06	2683359.57	6039699

Coastal Hazard Measurement site C23-50

Type of shoreline:

Natural

Location

23499 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C23-50 reference point co-ordinates: C23-50 2684178.08 6040885.1

Relationship to other reference systems:

KCDC profile 410 (established 2005) is 346 m north of C23-50

Key

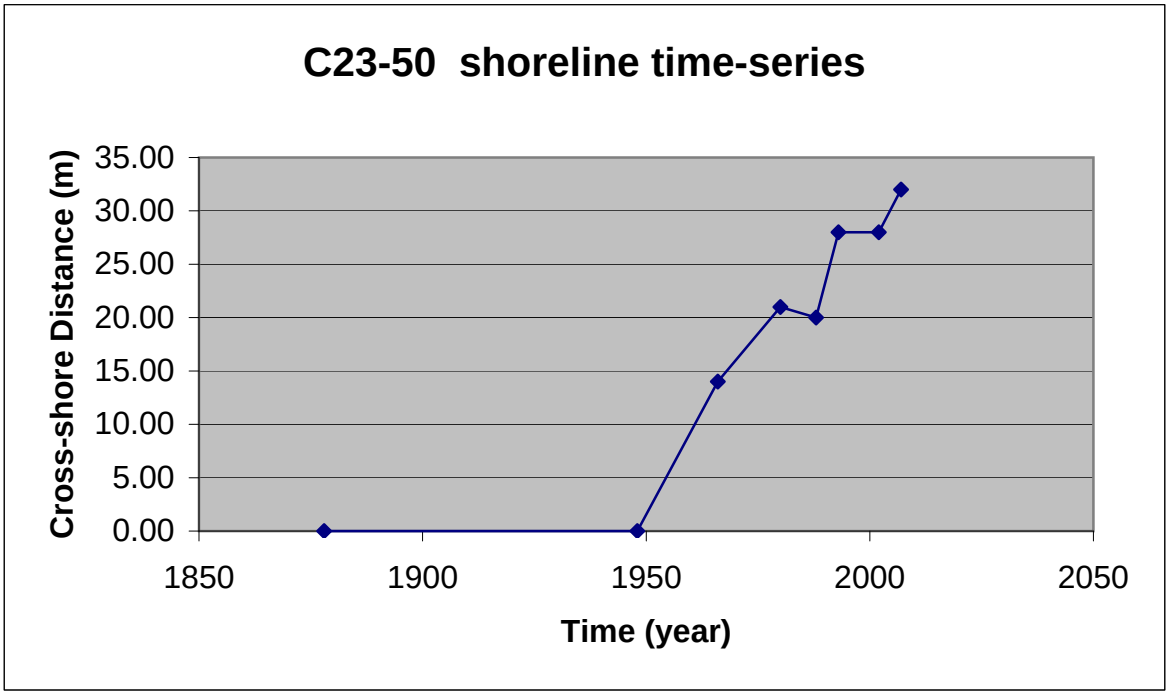
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_23-50	chron_23-50	mmt_23-50	dis_23-50
1878	8.00	100.00	0.00
1948	78.00	100.00	0.00
1966	96.00	114.00	14.00
1980	110.00	121.00	21.00
1988	118.00	120.00	20.00
1993	123.00	128.00	28.00
2002	132.00	128.00	28.00
2007	137.00	132.00	32.00



Shoreline change modelling:

Earlier period (1878 - 1948)
dE = 0*tE + 0 = 0
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1948 - 2007), no weighting
dL = 0.510*tL - 37.421 SEE = 2.671
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C23-50				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
100	0.51	-37.421	32.96	132.96

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C23-50	Co-odinates (NZMG)		
-37.50	95.46	C23-50	2684093.36	6040929.11

Coastal Hazard Measurement site C24-91

Type of shoreline:

Natural

Location

24906 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C24-91 reference point co-ordinates: C24-91 2684896.570 6042111.850

Relationship to other reference systems:

None

Key

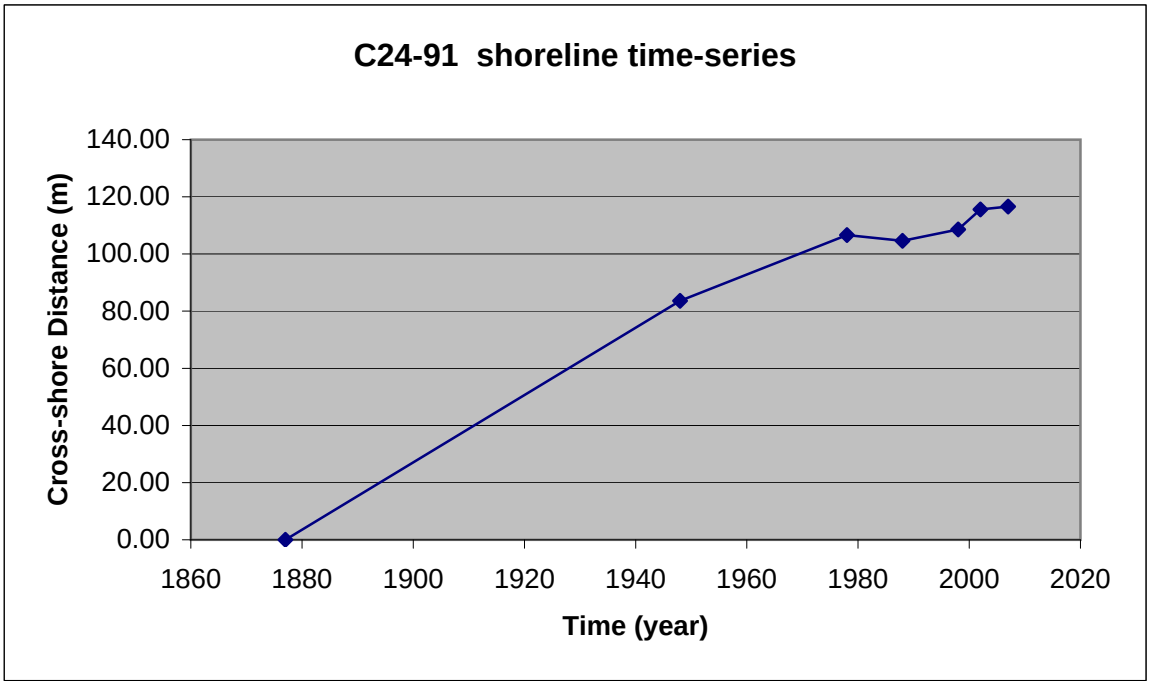
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_24-91	chron_24-91	mmt_24-91	dis_24-91
1877	7.00	35.40	0.00
1948	78.00	119.00	83.60
1978	108.00	142.00	106.60
1988	118.00	140.00	104.60
1998	128.00	144.00	108.60
2002	132.00	151.00	115.60
2007	137.00	152.00	116.60



Shoreline change modelling:

Earlier period (1877 - 1948)
dE = 1.177*tE - 8.242
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1948 - 2007), no weighting
dL = 0.533*tL + 43.691 SEE = 3.489
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C24-91				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
35.4	0.533	43.691	117.245	152.65

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C24-91	Co-odinates (NZMG)		
-36.22	116.43	C24-91		

Coastal Hazard Measurement site C25.70

Type of shoreline:

Natural

Location

25700 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C25-70 reference point co-ordinates:	C25-70	2685255.01	6042820.85

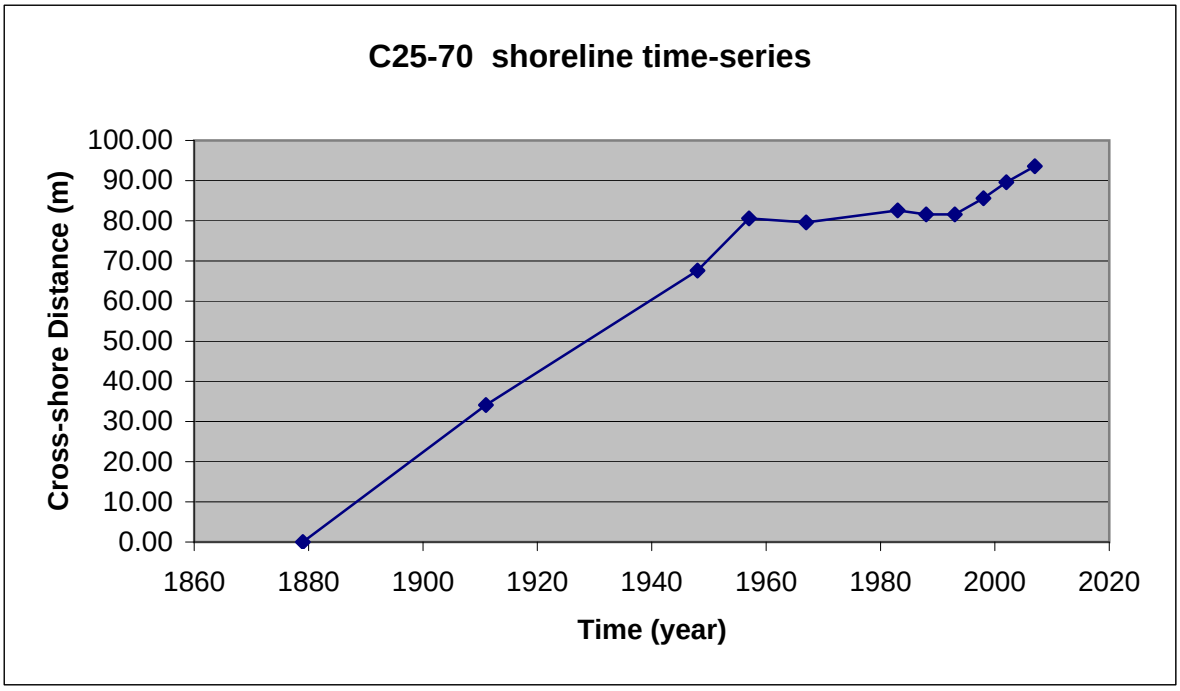
Relationship to other reference systems:

None

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_
mmt_	Cross-shore distance (m) for shoreline from refn point for site_
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_25-70	chron_25-70	mmt_25-70	dis_25-70
1879	9.00	34.40	0.00
1911	41.00	68.50	34.10
1948	78.00	102.00	67.60
1957	87.00	115.00	80.60
1967	97.00	114.00	79.60
1983	113.00	117.00	82.60
1988	118.00	116.00	81.60
1993	123.00	116.00	81.60
1998	128.00	120.00	85.60
2002	132.00	124.00	89.60
2007	137.00	128.00	93.60



Shoreline change modelling:

Earlier period (1879 - 1948)
dE = 0.856*tE + 2.670
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1948 - 2007), no weighting
dL = 0.305*tL + 48.105 SEE = 3.735
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C25-70				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
34.4	0.305	48.105	90.195	124.6

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C25-70	Co-odinates (NZMG)		
-33.84	90.76	C25-70	2685172.81	6042859.54

Coastal Hazard Measurement site C26-58

Type of shoreline:

Natural

Location

26578 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C26-58 reference point co-ordinates:	C26-58	2685751.45	6043553.76

Relationship to other reference systems:

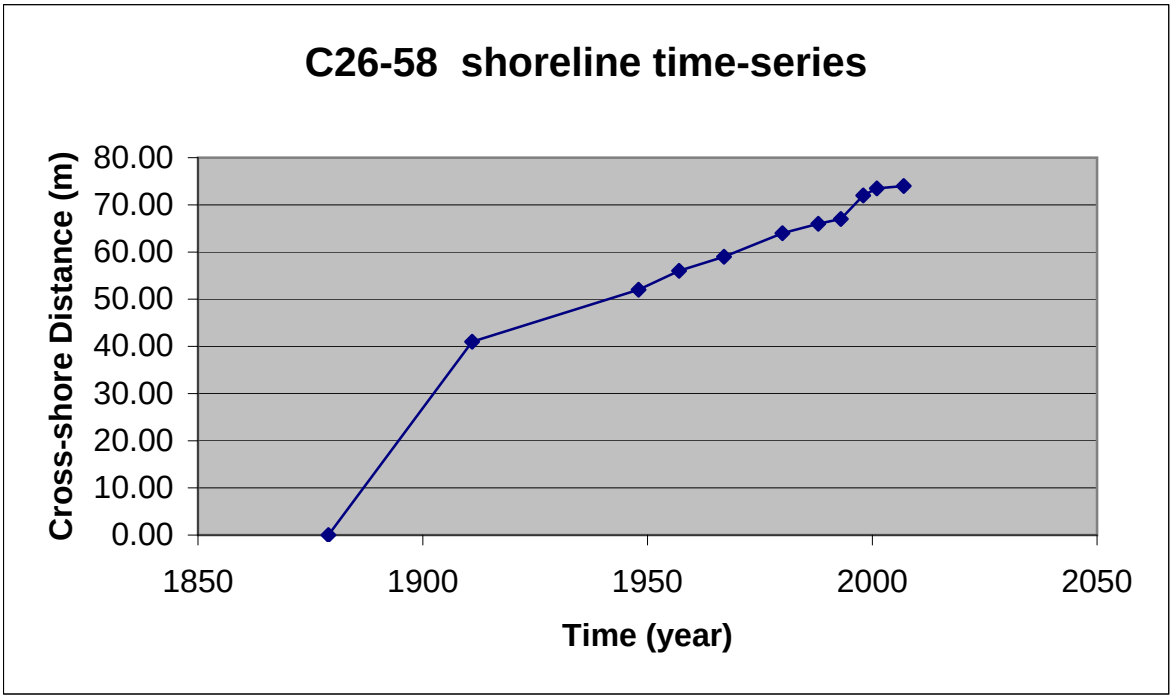
Horizons profile BM26 is 294 m north of C26-58

KCDC profile 420 (previously 46) is 432 m north of C26-58

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_ data
mmt_	Cross-shore distance (m) for shoreline from refn point for site_ data
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_26-58	chron_26-58	mmt_26-58	dis_26-58
1879	9.00	158.00	0.00
1911	41.00	199.00	41.00
1948	78.00	210.00	52.00
1957	87.00	214.00	56.00
1967	97.00	217.00	59.00
1980	110.00	222.00	64.00
1988	118.00	224.00	66.00
1993	123.00	225.00	67.00
1998	128.00	230.00	72.00
2001	132.00	231.50	73.50
2007	137.00	232.00	74.00



Shoreline change modelling:

Earlier period (1879 - 1948)
dE = 0.673*tE + 4.318
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1948 - 2007), no weighting
dL = 0.375*tL + 22.701 SEE = 1.073
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C26-58				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
158	0.375	22.701	74.45	232.45

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C26-58	Co-odinates (NZMG)		
-31.02	201.43	C26-58	2685571.68	6043644.72

Coastal Hazard Measurement site C27-63

Type of shoreline:

Natural

Location

27627 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C27-63 reference point co-ordinates: C27-63 2686354.72 6044437.66

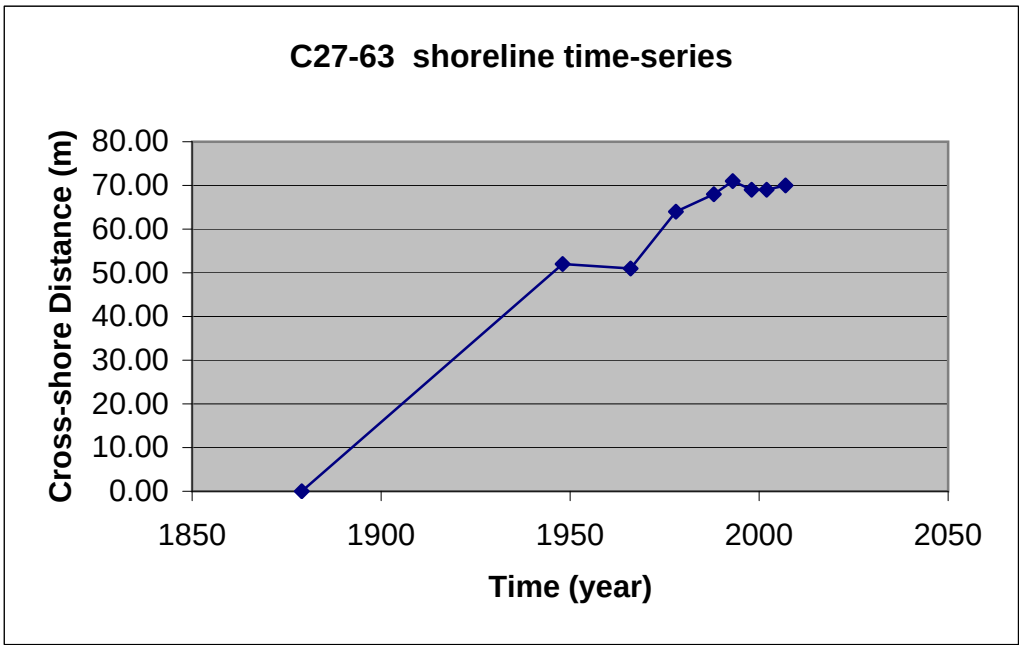
Relationship to other reference systems:

None

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_
mmt_	Cross-shore distance (m) for shoreline from refn point for site_
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_27-63	chron_27-63	mmt_27-63	dis_27-63
1879	9.00	319.00	0.00
1948	78.00	371.00	52.00
1966	96.00	370.00	51.00
1978	113.00	383.00	64.00
1988	118.00	387.00	68.00
1993	123.00	390.00	71.00
1998	128.00	388.00	69.00
2002	132.00	388.00	69.00
2007	137.00	389.00	70.00



Shoreline change modelling:

Earlier period (1879 - 1948)
dE = 0.754*tE - 6.783
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1948 - 2007), no weighting
dL = 0.379*tL + 20.468 SEE = 3.411
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C27-63				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
319	0.379	20.468	72.77	391.77

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C27-63	Co-odinates (NZMG)		
-27.64	364.13	C27-63	2686021.1	6044584.1

Coastal Hazard Measurement site C28-81

Type of shoreline:

Natural

Location

28805 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C28-81 reference point co-ordinates: C28-81 2686707.07 6045578.12

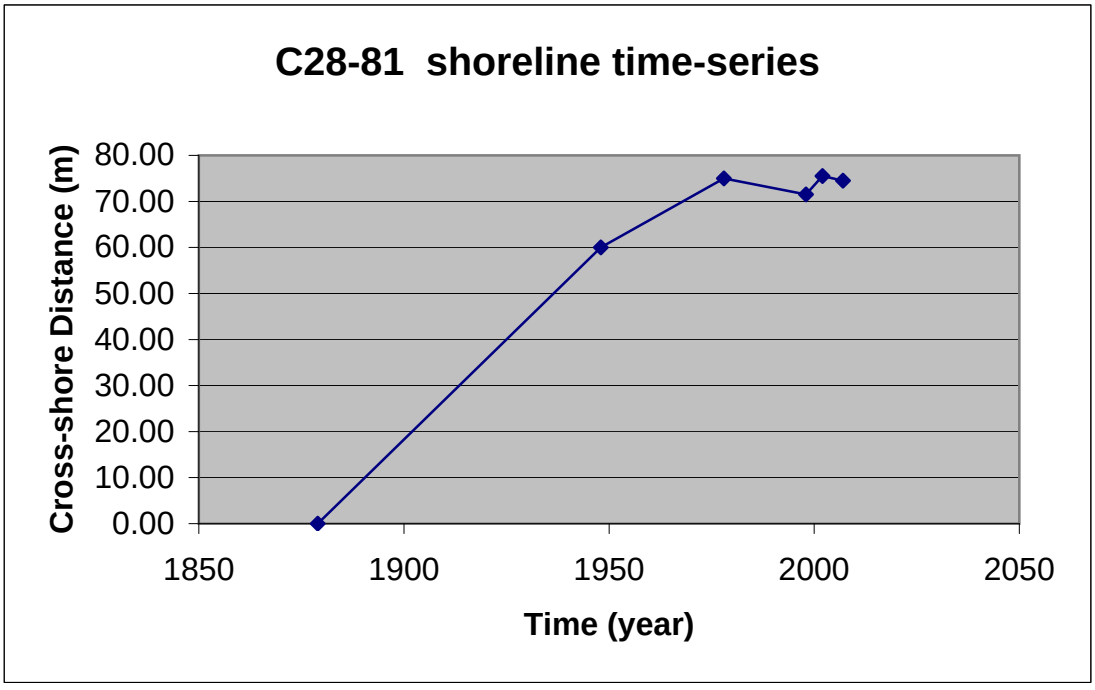
Relationship to other reference systems:

KCDC profile 430 (previously 47) is 302 m north of C28-81

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_ data
mmt_	Cross-shore distance (m) for shoreline from refn point for site_ data
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_28-81	chron_28-81	mmt_28-81	dis_28-81
1879	9.00	125.50	0.00
1948	78.00	185.50	60.00
1978	108.00	200.50	75.00
1998	128.00	197.00	71.50
2002	132.00	201.00	75.50
2007	137.00	200.00	74.50



Shoreline change modelling:

Earlier period (1879 - 1948)
dE = 0.870*tE - 7.826
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1948 - 2007), no weighting
dL = 0.229*tL + 44.644 SEE = 3.942
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C28-81				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
125.5	0.229	44.644	76.25	201.75

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C28-81	Co-odinates (NZMG)		
-25.63	176.12	C28-82		

Coastal Hazard Measurement site C30-16

Type of shoreline:

Natural

Location

30156 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C30-16 reference point co-ordinates: C30-16 2687604.97 6046660.28

Relationship to other reference systems:

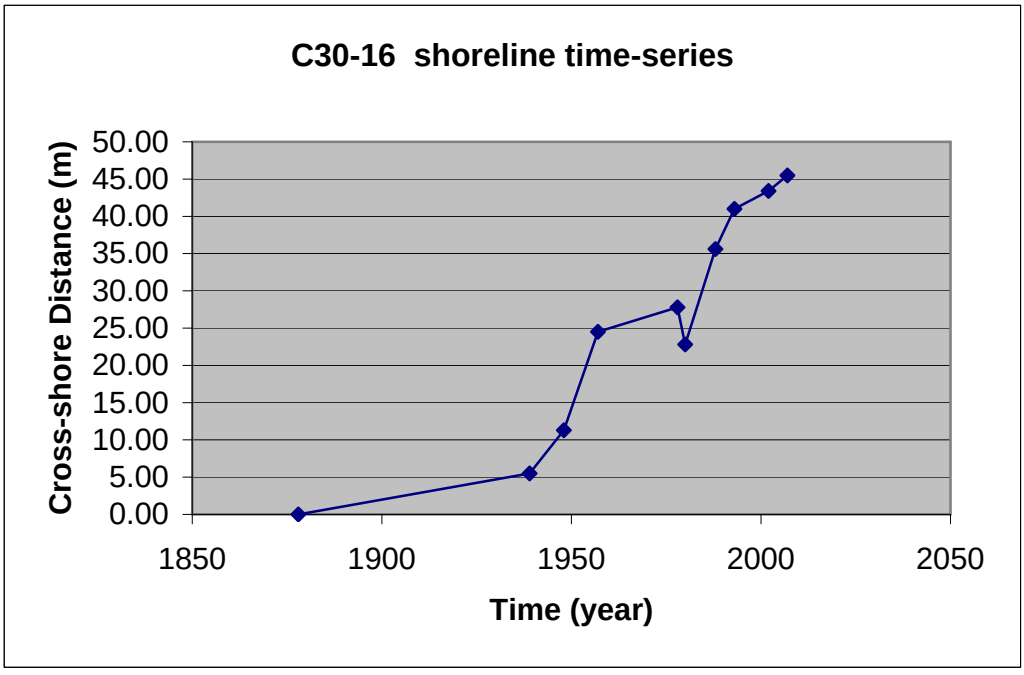
Horizons profile BM A6224 is online and 485 m seaward of C30-16

KCDC profile 440 (previously 48) is 329 m north of C30-16

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_ data
mmt_	Cross-shore distance (m) for shoreline from refn point for site_ data
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_30-16	chron_30-16	mmt_30-16	dis_30-16
1878	8.00	505.30	0.00
1939	69.00	510.80	5.50
1948	78.00	516.60	11.30
1957	87.00	529.80	24.50
1978	108.00	533.10	27.80
1980	110.00	528.10	22.80
1988	118.00	540.90	35.60
1993	123.00	546.30	41.00
2002	132.00	548.70	43.40
2007	137.00	550.80	45.50



Shoreline change modelling:

Earlier period (1879 - 1948)
dE = 0.135*tE - 1.398
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1939 - 2007), no weighting
dL = 0.565*tL - 31.756 SEE = 4.238
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C30-16				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
505.3	0.565	-31.756	46.21	551.51

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C30-16	Co-odinates (NZMG)		
-25.73	525.78	C30-16	2687112.16	6046845.13

Coastal Hazard Measurement site C32-54

Type of shoreline:

Natural

Location

32543 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C32-54 reference point co-ordinates: C32-54 2688231.09, 6048988.07

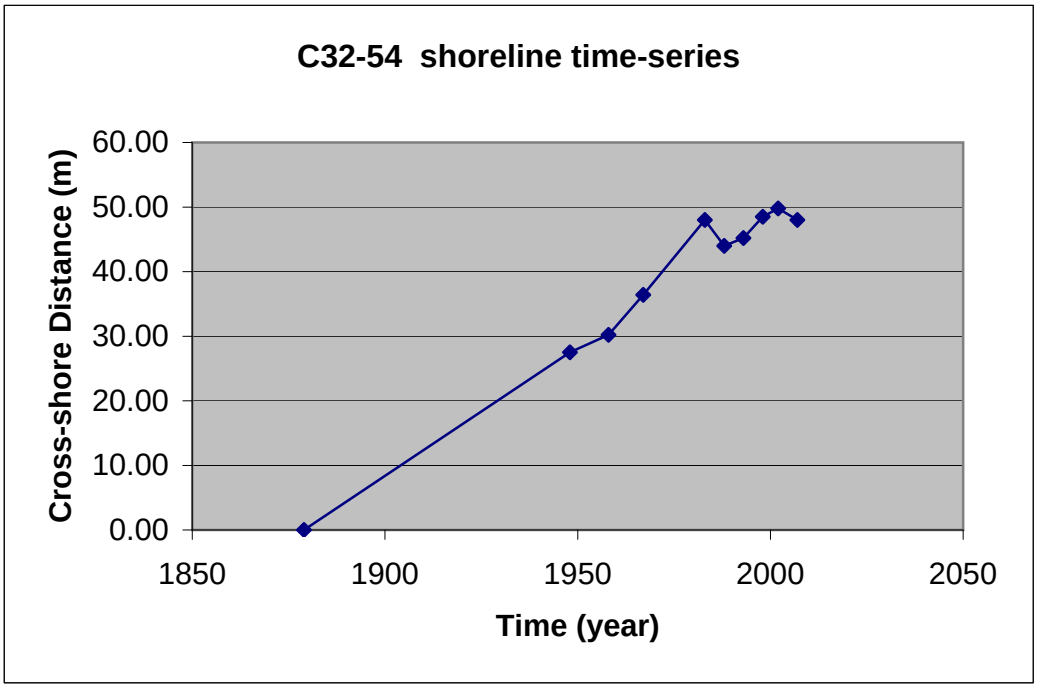
Relationship to other reference systems:

KCDC profile 450 (previously 49) is 239 m south of C32-54

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_
mmt_	Cross-shore distance (m) for shoreline from refn point for site_
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_32-54	chron_32-54	mmt_32-54	dis_32-54
1879	9.00	35.00	0.00
1948	78.00	62.50	27.50
1958	88.00	65.20	30.20
1967	97.00	71.40	36.40
1983	113.00	83.00	48.00
1988	118.00	79.00	44.00
1993	123.00	80.20	45.20
1998	128.00	83.50	48.50
2002	132.00	84.80	49.80
2007	137.00	83.00	48.00



Shoreline change modelling:

Earlier period (1897 - 1948)
dE = 0.399*tE - 3.587
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1948 - 2007), no weighting
dL = 0.390*tL - 2.011 SEE = 2.768
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C32-54				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
35	0.39	-2.011	51.81	86.81

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C32-54	Co-odinates (NZMG)		
-32.52	54.29	C32-54	2688180.69	6049008.44

Coastal Hazard Measurement site C33-05

Type of shoreline:

Natural

Location

33046 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C33-05 reference point co-ordinates: C33-05 2688487.72, 6049423.75

Relationship to other reference systems:

Horizons profile XS 23 is online and 83 m seaward of C33-05

Key

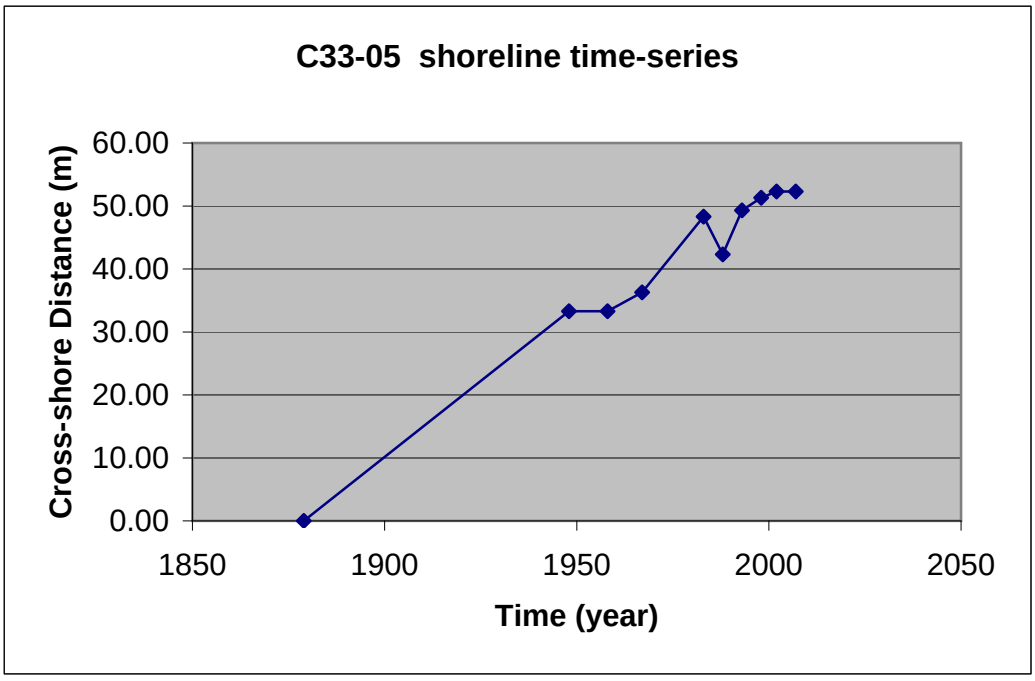
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_33-05	chron_33-05	mmt_33-05	dis_33-05
1879	9.00	64.70	0.00
1948	78.00	98.00	33.30
1958	88.00	98.00	33.30
1967	97.00	101.00	36.30
1983	113.00	113.00	48.30
1988	118.00	107.00	42.30
1993	123.00	114.00	49.30
1998	128.00	116.00	51.30
2002	132.00	117.00	52.30
2007	137.00	117.00	52.30



Shoreline change modelling:

Earlier period (1897 - 1948)
dE = 0.483*tE - 4.343
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1948 - 2007), no weighting
dL = 0.376*tL + 1.884 SEE = 2.598
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C33.05				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
64.7	0.376	1.884	53.77	118.47

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C33-05	Co-odinates (NZMG)		
-34.30	84.17	C33-05		

Coastal Hazard Measurement site C33-60

Type of shoreline:

Natural

Location

33600 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C33-60 reference point co-ordinates: C33-60 2688756. 2688756.300

Relationship to other reference systems:

None

Key

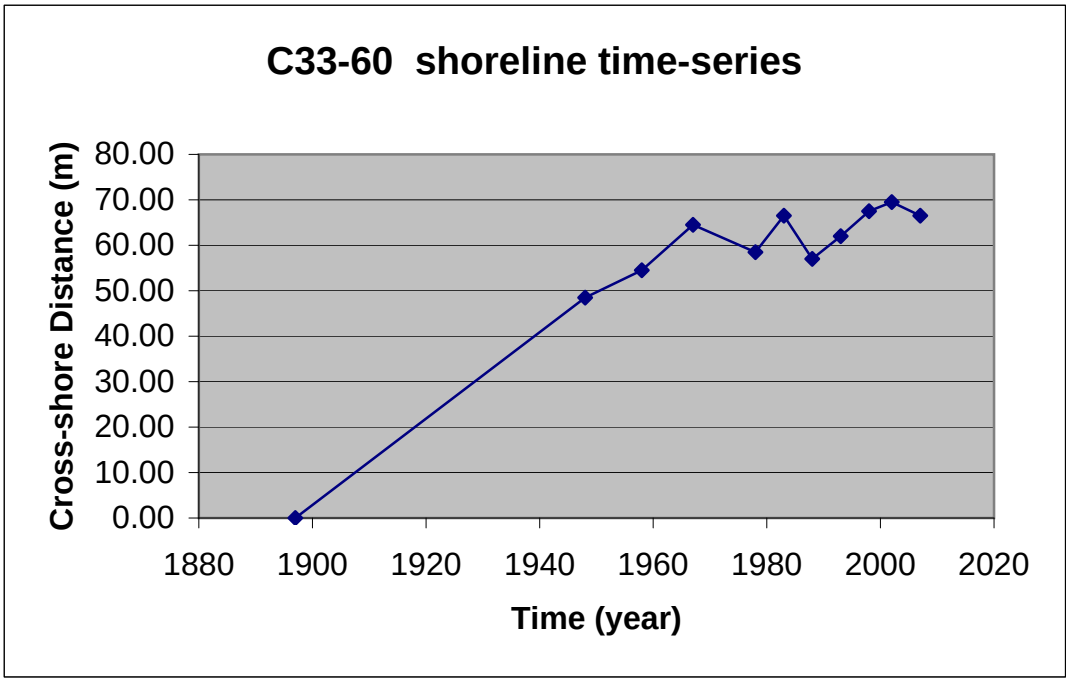
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_33-60	chron_33-60	mmt_33-60	dis_33-60
1897	27.00	66.50	0.00
1948	78.00	115.00	48.50
1958	88.00	121.00	54.50
1967	97.00	131.00	64.50
1978	108.00	125.00	58.50
1983	113.00	133.00	66.50
1988	118.00	123.50	57.00
1993	123.00	128.50	62.00
1998	128.00	134.00	67.50
2002	132.00	136.00	69.50
2007	137.00	133.00	66.50



Shoreline change modelling:

Earlier period (1897 - 1948)
dE = 0.951*tE - 25.676
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1948 - 2007), no weighting
dL = 0.276*tL + 30.536 SEE = 4.282
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C33.60				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
66.5	0.276	30.536	68.62	135.12

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C33-60	Co-odinates (NZMG)		
-38.01	97.11	C33-60	2688667.71	6049947.33

Coastal Hazard Measurement site C33-82

Type of shoreline:

Natural

Location

33819 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C33-82 reference point co-ordinates: C33-82 2688800.11, 6050123.49

Relationship to other reference systems:

KCDC profile 460 (previously 50) is 170 m north of C33-82

Key

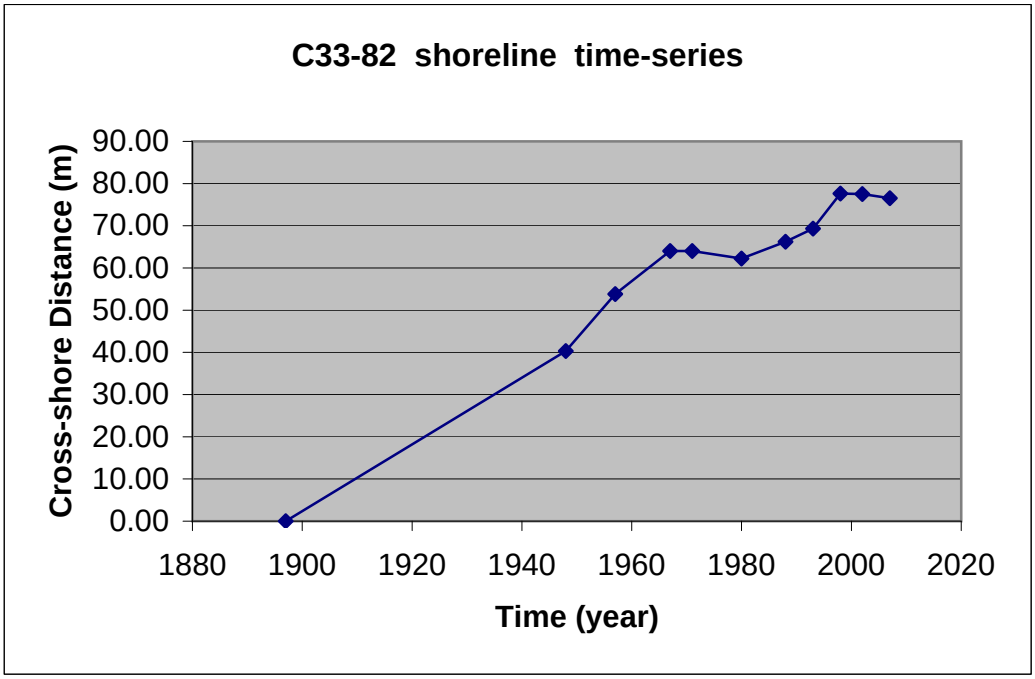
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_ A67

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_33-82	chron_33-82	mmt_33-82	dis_33-82
1897	27.00	8.07	0.00
1948	78.00	48.40	40.33
1957	87.00	61.90	53.83
1967	97.00	72.10	64.03
1971	101.00	72.10	64.03
1980	110.00	70.30	62.23
1988	118.00	74.30	66.23
1993	123.00	77.40	69.33
1998	128.00	85.70	77.63
2002	132.00	85.60	77.53
2007	137.00	84.60	76.53



Shoreline change modelling:

Earlier period (1897 - 1948)
dE = 0.791*tE - 21.351
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1948 - 2007), no weighting
dL = 0.547*tL + 4.447 SEE = 4.310
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C33.82				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
8.07	0.547	4.447	79.93	88

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C33-82	Co-odinates (NZMG)		
-39.26	48.74	C33-82	2688756.39	6050145.05

Coastal Hazard Measurement site C35-54

Type of shoreline:

Natural

Location

35540 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C35-54 reference point co-ordinates: C 35-54 2689524.96, 6051674.97

Relationship to other reference systems:

None

Key

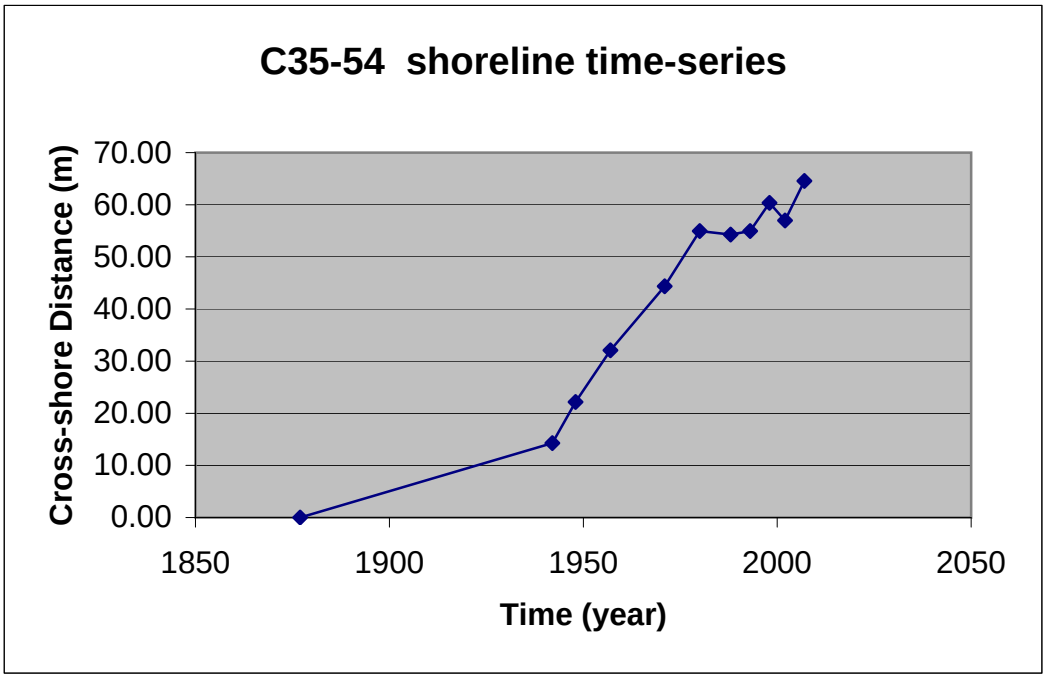
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_35-54	chron_35-54	mmt_35-54	dis_35-54
1877	7.00	5.33	0.00
1942	72.00	19.60	14.27
1948	78.00	27.50	22.17
1957	87.00	37.40	32.07
1971	101.00	49.70	44.37
1980	110.00	60.30	54.97
1988	118.00	59.60	54.27
1993	123.00	60.30	54.97
1998	128.00	65.70	60.37
2002	132.00	62.30	56.97
2007	137.00	69.90	64.57



Shoreline change modelling:

Earlier period (1877 - 1948)
dE = 0.274*tE - 2.194
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007), no weighting
dL = 0.722*tL -32.51 SEE = 4.406
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C35-54				
Offset dist from refn pt	Model Slope	Model constn	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
5.33	0.722	-32.51	67.13	72.46

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C35-54	Co-odinates (NZMG)		
-40.00	32.46	C35-54	2689494.7	6051686.82

Coastal Hazard Measurement site C36-89

Type of shoreline:

Natural

Location

36890 m north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

C36-89 reference point co-ordinates: C36-89 2690143.43 6052866.93

Relationship to other reference systems:

None

Key

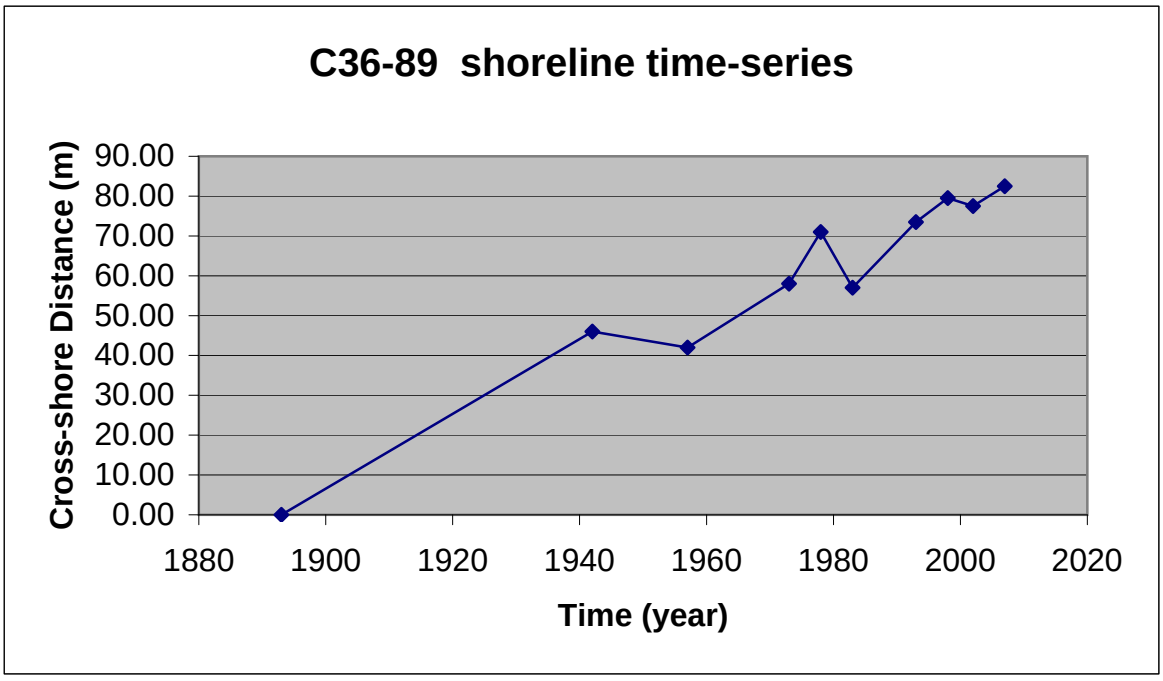
date_ Year of survey for site_

chron_ Chronology (yrs) from 1870 for site_

mmt_ Cross-shore distance (m) for shoreline from refn point for site_

dis_ Cross-shore distance (m) relative to first shoreline (negative is landward)

date_36-89	chron_36-89	mmt_36-89	dis_36-89
1893	23.00	75.50	0.00
1942	72.00	121.50	46.00
1957	87.00	117.50	42.00
1973	103.00	133.50	58.00
1978	108.00	146.50	71.00
1983	113.00	132.50	57.00
1993	123.00	149.00	73.50
1998	128.00	155.00	79.50
2002	132.00	153.00	77.50
2007	137.00	158.00	82.50



Shoreline change modelling:

Earlier period (1893 - 1942)
dE = 0.939*tE - 21.592
where dE = cross-shore **d**istance (m) for the **E**arly period
tE = **t**ime (yrs) for the **E**arly period

Later period (1942 - 2007), no weighting
dL = 0.639*tL - 6.039 SEE = 6.114
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to C36.89				
Offset dist from refn pt	Model Slope	Model constr	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
75.5	0.639	-6.039	82.14	157.64

Hazard line location (note seawall scenarios do not apply north of Tikotu Stream)				
CEHD (Appens B-1/2/3)	Setback rel to C36-89	Co-odinates (NZMG)		
-44.00	113.64	C36-89	2690037.79	6052908.89

Coastal Hazard Measurement site X38-11

Xtra site used to model 2008 shoreline, but not used for LT or ST modelling due to Waikawa Stream influence early-mid record.

Type of shoreline

Natural

Location

Northern boundary of KCDC

38111 north of Fishermans Restaurant datum (NZMG: 2673201.67, 6021248.27)

X38-11 reference point co-ordinates:	X38-11	2690786.03	6053930.89

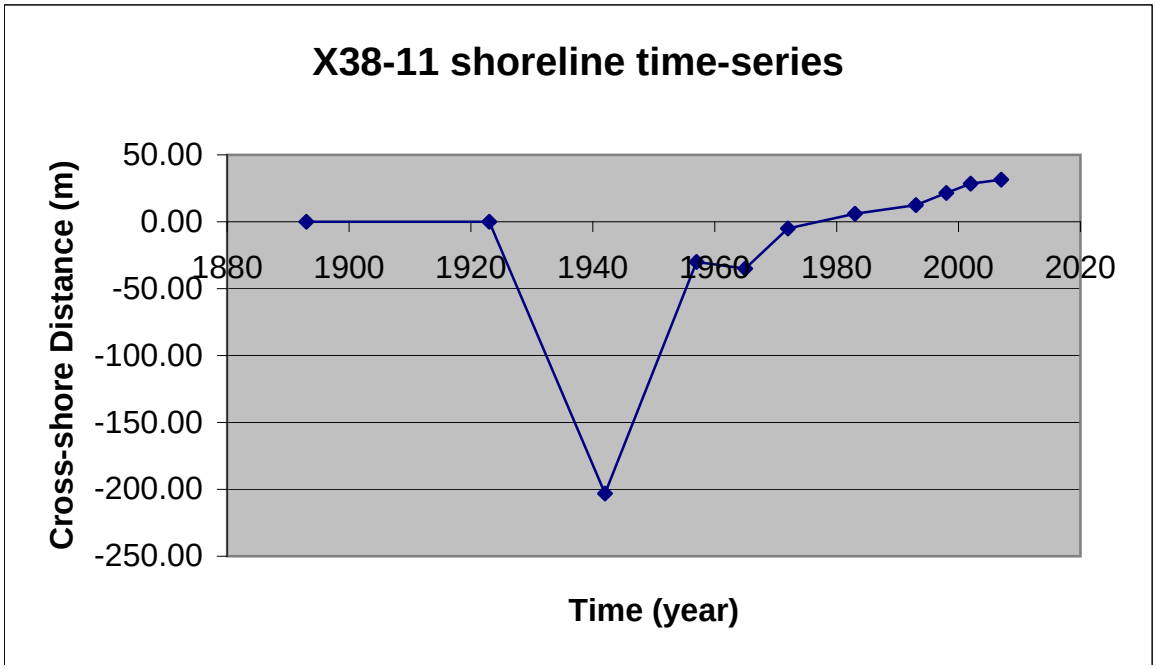
Relationship to other reference systems:

None

Key

date_	Year of survey for site_
chron_	Chronology (yrs) from 1870 for site_
mmt_	Cross-shore distance (m) for shoreline from refn point for site_
dis_	Cross-shore distance (m) relative to first shoreline (negative is landward)

date_38-11	chron_38-11	mmt_38-11	dis_38-11
1893	23.00	282.50	0.00
1923	53.00	282.50	0.00
1942	72.00	79.40	-203.10
1957	87.00	252.50	-30.00
1965	95.00	247.50	-35.00
1972	102.00	277.50	-5.00
1983	113.00	288.50	6.00
1993	123.00	295.00	12.50
1998	128.00	304.00	21.50
2002	132.00	311.00	28.50
2007	137.00	314.00	31.50



Shoreline change modelling:

Earlier period (1892 - 1942)
River influence so no modelling

Later period (1942 - 2007)
River influence occurs, but modelled 1972+ to get 2008 shoreline and then applied the C36-86 CEHD to locate erosion set-back .
dL = 1.067*tL - 114.819
where dL = cross-shore **d**istance (m) for the **L**ate period
tL = **t**ime (yrs) for the **L**ate period
SEE = **s**tandard **e**rror of **e**stimate

Reference Shoreline for 2008 relative to X38-11				
Offset dist from refn pt	Model Slope	Model constr	Modelled 2008 shoreline, t = 138	2008 reference shoreline (m)
282.5	1.067	-114.819	32.43	314.93

Hazard line location				
CEHD (Appens B-1/2/3)	Setback rel to X38-11	Co-odinates (NZMG)		
-44.00	270.93	X38-11	2690533.69	6054030.22

3 DERIVATION OF CHEDs

3.1 Introduction

This section contains the derivation of component values for LT, ST, SLR and DS and CU for each of the 3 seawall scenarios (5 worksheets), and the component output are then summed to calculate the actual CEHDs (cross-shore erosion hazard distances) for the 3 seawall scenarios (3 worksheets). Note that the 3 CEHD spreadsheets are also included as Appendices B-1, B-2 and B-3 in the *Open Coast Erosion Hazard Assessment* report.

Data are set out in rows corresponding to the 60 *coastal measurement sites* prefixed with **C** in Fig 1, i.e. those sites used to derive **C**omponent values. Spreadsheet columns relate to the derivation of the component values from raw/pre-modelled data through data processing and data modelling stages for the 3 seawall scenarios.

3.2 CEHD derivation.xls

Refer to the Excel Workbook file ***3.2 CEHD derivation for Data-Base.xls*** to view the 8 Worksheets**.**

Worksheet names:

LT-ALL: Long-term shoreline change
ST-ALL: Short-term shoreline change
SLR-ALL: Retreat from accelerated sea-level rise
DS-ALL: Retreat for dune-stability
CU-ALL: Combined uncertainty

CEHD-Hold: Cross-shore erosion hazard distances for the sea-wall hold scenario
CEHD-Repair: Cross-shore erosion hazard distances for the sea-wall repair scenario
CEHD-Remove: Cross-shore erosion hazard distances for the sea-wall remove scenario

Erosion hazard component development:

LONGER-TERM (LT)

Longer-term shoreline change

Key to Table

Distance: Refers to the longshore distance (km) to each *coastal measurement site* from (datum) Fisherman's Restaurant in the south to the KCDC boundary 38.11 km in the north.

Earlier_Rate: Refers to the rate of shoreline change (m/yr) derived by regression analysis of shorelines taken off cadastral maps and aerial photographs up until 1954 Derivation is shown on the *information worksheet* (Section 2.2) for each coastal site.

Later_Rate: Refers to the rate of shoreline change (m/yr) derived by regression analsysis of shorelines taken from the aerial photo record (1939 to 2007). Derivation is shown on the worksheet (Section 2.2) for each *coastal measurement site* and includes the weighting of these data prior to regression analysis.

LT_Hold: Refers to shoreline retreat (m) over 50 yrs for the *seawalls hold* scenario. Derivation of these values consisted of firstly "smoothing" the **Later_Rate** values in the longshore direction to detect the 95% (max) level while preserving longshore trends. Secondly, the smoothed values were negatively rounded to the nearest 0.01 metres as a further precautionary measure. Positive values (areas of shoreline advance) were set to zero (further precaution), The resulting values were used to represent physically comparable reaches of coast and are listed in the following table as **LT_Hold_Rates.** Finally, the **LT_Hold_Rates** were multiplied by 50 to give the **LT_Hold** shoreline retreat values for 50 yrs.

LT_Repair: Refers to shoreline retreat (m) over 50 yrs under the *seawalls repair* scenario. These values are the same as for **LT_Hold**, as upon failure the walls are assumed to be reconstructed at the same cross-shore location.

No_Seawall: Refers to shoreline retreat (m) over 50 yrs if no seawalls had ever been constructed. **Earlier_Rate** values were used for seawalled sites and **Later_Rates** for non-seawalled sites. Values were first smoothed in the longshore direction to detect the 95% max level to represent comparable reaches of coast (longshore trends were preserved), and then negatively rounded to the nearest 0.05 m to allow for the less reliable early (cadastral-based) data. Positive values (areas of shoreline advance) were set to zero for added precaution.The resulting rates are listed in the following table under **No_Wall_Rates.** Finally the **No_Wall_Rates** were multiplied by 50 to give the **No_Seawall** shoreline retreat values for 50 yrs.

Catch_up: Refers to an allowance made for additional erosion at those long-term eroding coastal sites where seawalls occur, to account for the previous (~50) years of erosion which the seawalls prevented. The catch-up value for each seawall site thus approximates the 50 yr **No_Seawall** value.

LT_Remove: Refers to shoreline retreat (m) over 50 yrs for the *seawalls remove* scenario.These values were derived by combining the **No_seawall** values with the **Catch-up** values.

Note:
1) Distances with no corresponding data points in the following table approximate the locations of river and stream mouths (see Fig 1 in erosion hazard assessments).
2) For additional explanation see Section 2 in the *Open Coast Erosion Hazard Assessment.*
3) Incorporates shoreline data derived from Jan 2007 district-wide aerial photos

Distance	Earlier_Rate	Later_Rate	LT_Hold_Rates	LT_Hold	LT_Repair
0.17	-0.063	.	0.000	0.0	0.0
0.40	-0.250	-0.150	-0.150	-7.5	-7.5
0.73	-0.200	-0.075	-0.075	-3.8	-3.8
1.51	-0.131	.	0.000	0.0	0.0
2.62	-0.062	.	0.000	0.0	0.0
3.30	.	.	.	.	.
3.60	-0.078	-0.282	-0.290	-14.5	-14.5
3.93	-0.004	-0.210	-0.350	-17.5	-17.5
4.18	-0.076	-0.392	-0.400	-20.0	-20.0
4.52	-0.154	-0.363	-0.450	-22.5	-22.5
4.93	-0.153	-0.364	-0.530	-26.5	-26.5
5.15	.	-0.548	-0.570	-28.5	-28.5
5.40	.	.	.	.	.
5.70	-0.239	-0.667	-0.670	-33.5	-33.5
6.04	-0.139	-0.805	-0.810	-40.5	-40.5
6.39	-0.179	-0.882	-1.000	-50.0	-50.0
6.57	-0.191	-1.476	-1.500	-75.0	-75.0
6.76	-0.193	.	0.000	0.0	0.0
7.10	-0.237	.	0.000	0.0	0.0
7.56	-0.231	.	0.000	0.0	0.0
8.02	-0.112	.	0.000	0.0	0.0
8.72	-0.231	.	0.000	0.0	0.0
9.11	-0.201	.	0.000	0.0	0.0
9.43	-0.021	.	0.000	0.0	0.0
10.00	.	.	.	.	.
10.29	0.205	-0.186	-0.190	-9.5	-9.5
10.40	0.168	.	0.000	0.0	0.0
10.61	0.078	-0.059	-0.190	-9.5	-9.5
11.17	0.353	-0.374	-0.380	-19.0	-19.0
11.41	-0.304	-0.778	0.000	0.0	0.0
11.64	-0.240	-0.591	0.000	0.0	0.0
12.12	0.138	0.410	0.000	0.0	0.0
12.50	0.369	0.511	0.000	0.0	0.0
12.60	.	.	.	.	.
12.77	0.135	1.474	0.000	0.0	0.0
13.04	0.002	1.629	0.000	0.0	0.0
13.24	0.019	1.466	0.000	0.0	0.0
13.44	-0.046	1.508	0.000	0.0	0.0
13.63	0.225	1.825	0.000	0.0	0.0
13.89	0.889	1.092	0.000	0.0	0.0
14.20	1.766	-0.276	-0.300	-15.0	-15.0
14.60	.	.	.	.	.
16.69	0.881	0.269	0.000	0.0	0.0
17.31	0.250	0.316	0.000	0.0	0.0
17.88	-0.163	0.338	0.000	0.0	0.0
18.30	.	.	.	.	.
18.85	0.273	0.396	0.000	0.0	0.0
19.35	0.308	0.393	0.000	0.0	0.0
20.30	0.250	0.401	0.000	0.0	0.0
20.79	0.077	0.439	0.000	0.0	0.0
21.26	0.345	0.420	0.000	0.0	0.0
21.73	0.143	0.400	0.000	0.0	0.0
22.06	0.014	0.444	0.000	0.0	0.0
22.60	.	.	.	.	.

23.50	0.000	0.510	0.000	0.0	0.0
24.91	1.177	0.533	0.000	0.0	0.0
25.70	0.856	0.305	0.000	0.0	0.0
26.58	0.673	0.375	0.000	0.0	0.0
27.30	.	.	.	.	.
27.63	0.754	0.379	0.000	0.0	0.0
28.81	0.870	0.229	0.000	0.0	0.0
30.16	0.135	0.565	0.000	0.0	0.0
31.00	.	.	.	.	.
32.54	0.399	0.390	0.000	0.0	0.0
33.05	0.483	0.376	0.000	0.0	0.0
33.60	0.951	0.276	0.000	0.0	0.0
33.82	0.791	0.547	0.000	0.0	0.0
34.50	.	.	.	.	.
35.54	0.274	0.722	0.000	0.0	0.0
36.89	0.936	0.639	0.000	0.0	0.0

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Distance	No_wall_rates	No_seawal	Catch_up	LT_Remove
0.17	-0.08	-4	-4.000	-8
0.40	-0.25	-12.5	0.000	-12.5
0.73	-0.20	-10.0	0.000	-10.0
1.51	-0.12	-6.0	-6.000	-12.0
2.62	-0.10	-5.0	-5.000	-10.0
3.30	.	.	.	.
3.60	-0.10	-5.0	0.000	-5.0
3.93	-0.10	-5.0	0.000	-5.0
4.18	-0.13	-6.3	0.000	-6.3
4.52	-0.15	-7.5	0.000	-7.5
4.93	-0.20	-10.0	0.000	-10.0
5.15	.	.	.	.
5.40	.	.	.	.
5.70	-0.25	-12.5	0.000	-12.5
6.04	-0.25	-12.5	0.000	-12.5
6.39	-0.25	-12.5	0.000	-12.5
6.57	-0.25	-12.5	0.000	-12.5
6.76	-0.25	-12.5	-12.500	-25.0
7.10	-0.25	-12.5	-12.500	-25.0
7.56	-0.25	-12.5	-12.500	-25.0
8.02	-0.25	-12.5	-12.500	-25.0
8.72	-0.25	-12.5	-12.500	-25.0
9.11	-0.20	-10.0	-10.000	-20.0
9.43	-0.10	-5.0	-5.000	-10.0
10.00	.	.	.	.
10.29	0.00	0.0	0.000	0.0
10.40	0.00	0.0	0.000	0.0
10.61	0.00	0.0	0.000	0.0
11.17	-0.40	-20.0	0.000	-20.0
11.41	-0.80	-40.0	0.000	-40.0
11.64	-0.60	-30.0	0.000	-30.0
12.12	0.00	0.0	0.000	0.0
12.50	0.00	0.0	0.000	0.0
12.60	.	.	.	.
12.77	0.00	0.0	0.000	0.0
13.04	0.00	0.0	0.000	0.0
13.24	0.00	0.0	0.000	0.0

13.44	0.00	0.0	0.000	0.0
13.63	0.00	0.0	0.000	0.0
13.89	0.00	0.0	0.000	0.0
14.20	-0.30	-15.0	0.000	-15.0
14.60	.	.	.	.
16.69	0.00	0.0	0.000	0.0
17.31	0.00	0.0	0.000	0.0
17.88	.	0.0	0.000	.
18.30	.	.	.	.
18.85	0.00	0.0	0.000	0.0
19.35	0.00	0.0	0.000	0.0
20.30	0.00	0.0	0.000	0.0
20.79	0.00	0.0	0.000	0.0
21.26	0.00	0.0	0.000	0.0
21.73	0.00	0.0	0.000	0.0
22.06	0.00	0.0	0.000	0.0
22.60	.	.	.	.
23.50	0.00	0.0	0.000	0.0
24.91	0.00	0.0	0.000	0.0
25.70	0.00	0.0	0.000	0.0
26.58	0.00	0.0	0.000	0.0
27.30	.	.	.	.
27.63	0.00	0.0	0.000	0.0
28.81	0.00	0.0	0.000	0.0
30.16	0.00	0.0	0.000	0.0
31.00	.	.	.	.
32.54	0.00	0.0	0.000	0.0
33.05	0.00	0.0	0.000	0.0
33.60	0.00	0.0	0.000	0.0
33.82	0.00	0.0	0.000	0.0
34.50	.	.	.	.
35.54	0.00	0.0	0.000	0.0
36.89	0.00	0.0	.	0.0

Erosion hazard component development:

SHORTER-TERM (ST)

Shorter-term shoreline fluctuations

Key to Table

Distance: Refers to the longshore distance (km) to each coastal measurement site from (datum)
Fisherman's Restaurant in the south to the KCDC boundary 38.11 km in the north.

SEE: Standard error of estimate (m) for the *later period* and incorporating weighting of data
prior to regression analysis, as detailed on the *information worksheet* for each *coastal*
measeurement site .Note that *earlier period* data was too sparce to use for variability
analysis.

ST: Shorter-term retreat (m) as derrived by multiplying the SEE values by 3 (NB ±3*SEE gives 99% certainty of accounting for the highest population value, see Section
3.3 of text), then smoothing alongshore to the 95% level, interpolating across sea-walled
areas which for areas with
insufficient data, and also incorporating the highest observed cut during storm events
(see Section 3 of text). Note that 3*SEE criterion was relaxed slightly for south Paekakariki as a more intense longshore sampling regime was used in this area during
the South Paekakariki Study (Appendix A) compared with that used for the reminder of
the Kapiti Coast.

ST_Hold: Under the *sewalls hold* scenario the short-term values at seawall sites = 0

ST_Repair: Under the *seawalls repair* scenario the short-term values = ST. But note that more
intense scour is expected when failure does occur because of systematic steepening of
the profile, and allowance had been made for this in the uncertainty component.

ST_Remove: Under the *seawall remove* scenario, the short-term values are = ST values.

Notes: 1) Distances with no corresponding data points provide approximate the locations of river
and stream mouths (see Fig 1 in *Open Coast Erosion Hazard Assessment Report*).

2) For additional explanation see Section 3 in the *Open Coast Erosion Hazard Assessment.*

3) Incorporates shoreline data derived from Jan 2007 district-wide aerial photos

Distance	SEE	ST	ST_Hold	ST_Repair	ST_Remove
0.17	.	-15.0	0	-15.0	-15.0
0.40	5.500	-15.0	-15.0	-15.0	-15.0
0.73	6.500	-15.0	-15.0	-15.0	-15.0
1.51	.	-15.0	0.0	-15.0	-15.0
2.62	.	-15.0	0.0	-15.0	-15.0
3.30	.				
3.60	1.822	-10.0	-10.0	-10.0	-10.0
3.93	2.237	-10.0	-10.0	-10.0	-10.0
4.18	2.119	-10.0	-10.0	-10.0	-10.0
4.52	1.983	-10.0	-10.0	-10.0	-10.0
4.93	3.097	-10.0	-10.0	-10.0	-10.0
5.15	3.082	-10.0	-10.0	-10.0	-10.0
5.40	.				
5.70	2.470	-10.0	-10.0	-10.0	-10.0
6.04	2.176	-10.0	-10.0	-10.0	-10.0
6.39	3.660	-13.0	-13.0	-13.0	-13.0
6.57	5.657	-15.0	-15.0	-15.0	-15.0
6.76	.	-15.0	0.0	-15.0	-15.0
7.10	.	-15.0	0.0	-15.0	-15.0
7.56	.	-15.0	0.0	-15.0	-15.0
8.02	.	-15.0	0.0	-15.0	-15.0
8.72	.	-15.0	0.0	-15.0	-15.0
9.11	.	-15.0	0.0	-15.0	-15.0
9.43	.	-15.0	0.0	-15.0	-15.0
10.00	0.679				
10.29	0.679	-10.0	-10.0	-10.0	-10.0
10.40	.	-10.0	0.0	-10.0	-10.0
10.61	0.251	-10.0	-10.0	-10.0	-10.0
11.17	1.674	-10.0	-10.0	-10.0	-10.0
11.41	2.993	-10.0	0.0	-10.0	-10.0
11.64	2.955	-10.0	0.0	-10.0	-10.0
12.12	2.504	-10.0	-10.0	-10.0	-10.0
12.50	3.882	-12.0	-12.0	-12.0	-12.0
12.60	.				
12.77	3.184	-18.0	-18.0	-18.0	-18.0
13.04	8.851	-26.0	-26.0	-26.0	-26.0
13.24	9.777	-30.0	-30.0	-30.0	-30.0
13.44	11.478	-34.5	-34.5	-34.5	-34.5
13.63	11.618	-36.0	-36.0	-36.0	-36.0
13.89	3.636	-15.0	-15.0	-15.0	-15.0
14.20	5.428	-15.0	-15.0	-15.0	-15.0
14.60	.				
16.69	4.772	-15.0	-15.0	-15.0	-15.0
17.31	4.645	-15.0	-15.0	-15.0	-15.0
17.88	3.070	-12.0	-12.0	-12.0	-12.0
18.30	.				
18.85	2.836	-12.0	-12.0	-12.0	-12.0
19.35	2.462	-12.0	-12.0	-12.0	-12.0
20.30	2.604	-12.0	-12.0	-12.0	-12.0
20.79	2.443	-12.0	-12.0	-12.0	-12.0
21.26	2.943	-12.0	-12.0	-12.0	-12.0
21.73	2.556	-12.0	-12.0	-12.0	-12.0
22.06	1.940	-12.0	-12.0	-12.0	-12.0
22.60	.				
23.50	2.671	-12.0	-12.0	-12.0	-12.0

Distance	SEE	ST	ST_Hold	ST_Repair	ST_Remove
24.91	3.489	-12.0	-12.0	-12.0	-12.0
25.70	3.735	-12.0	-12.0	-12.0	-12.0
26.58	1.073	-12.0	-12.0	-12.0	-12.0
27.30	.				
27.63	3.411	-12.0	-12.0	-12.0	-12.0
28.81	3.942	-12.0	-12.0	-12.0	-12.0
30.16	4.238	-14.0	-14.0	-14.0	-14.0
31.00	.				
32.54	2.768	-14.0	-14.0	-14.0	-14.0
33.05	2.598	-14.0	-14.0	-14.0	-14.0
33.60	4.282	-14.0	-14.0	-14.0	-14.0
33.82	4.310	-14.0	-14.0	-14.0	-14.0
34.50	.				
35.54	4.406	-14.0	-14.0	-14.0	-14.0
36.89	6.114	-18.0	-18.0	-18.0	-18.0

Erosion hazard component development:

SEA-LEVEL RISE (SLR)

Shoreline retreat from sea-level rise associated with global warming

A. Profile samples and associated average beach slopes

Key to Table

Profile_Refn: References for profiles surveyed by KCDC (earlier referencing system, current referencing system), and Horizons Regional Council (BM_).

Prof_dists: Longshore distance (km) to each ***profile measurement site*** from (datum) Fisherman's Restaurant in the south to the KCDC boundary 38.11 km in the north.

Prof_slopes: Average cross-shore slope (tanβ) between MSL ± 1 m (approx spring tide range) for each ***profile measurement site***

N: Number of profiles used in the analysis. Note that at least 6 months separated sucessive samples.

Sample Refn: Month and year of each profile sample.

Notes: 1) Based on the results of the *Inlet Erosion Hazard Assessment*, the only river/stream likely to be influencing the surveyed beach slopes is 48/440 at 30.5 kms which is approx 500 m south of the Otaki River. The coarse river sediment causes localised steepening of the inter-tidal beach.

2) For addition explanation see Section 4 in the *Open Coast Erosion Hazard Assessment.*

Profile_Refn	Prof_dists	Prof_slopes	N	Sample Refn
1, 210	0.4	0.049	4	6/2000, 9/2001, 11/2005, 12/2007
4, 240	5.3	0.022	4	6/2000, 9/2001, 11/2005, 12/2007
142, 290	11.3	0.02	8	12/96, 2/00, 10/00, 4/02, 2/03, 10/03, 11/05, 12/07
15, 300	12.1	0.018	7	10/00, 9/01, 4/02, 2/03, 10/03, 11/05, 12/07
151, 310	13	0.018	8	12/96, 3/00, 10/00, 4/02, 2/03, 10/03, 11/05. 12/07
16, 320	13.4	0.016	8	12/96, 3/00, 10/00, 4/02, 2/03, 10/03, 11/05, 12/07
181, 330	13.9	0.014	8	12/96, 3/00, 10/00, 4/02, 2/03, 10/03, 11/05, 12/07
17, 340	14.5	0.017	8	12/96, 3/00, 10/00, 4/02, 2/03, 10/03, 11/05, 12/07
42, 370	16.5	0.02	6	8/00, 4/02, 2/03, 10/03, 11/05, 12/07
43, 380	17.3	0.022	6	8/00, 4/02, 2/03, 10/03, 11/05, 12/07
44, 390	19.2	0.02	6	8/00, 4/02, 2/03, 10/03, 11/05, 12/07
45, 400	21.9	0.016	4	6/00, 7/01, 11/05, 12/07
new, 410	24.75	0.018	2	11/05, 12/07
46, 420, BM_26	26.9	0.025	5	6/00, 9/01, 11/05, 12/07, Horizons 2/05
BM_25	28.1	0.051	1	Horizons, 2/2005
47, 430	29	0.049	4	6/00, 9/01, 11/05, 12/07
BM_24	30.16	0.061	1	Horizons, 2/2005
48, 440	30.5	0.083	4	6/00, 9/01, 11/05, 12/07
49, 450	32.3	0.029	4	6/00, 9/01, 11/05, 12/07
Otaki_Bch	33.1	0.025	1	Horizons, 2/2005
50, 460	34	0.017	4	6/00, 9/01, 11/05, 12/07

B. Deriving slopes for Coastal Sites and SLR retreat

Key to Table

Distance: Refers to the longshore distance (km) to each ***coastal measurement site*** from (datum) Fisherman's Restaurant in the south to the KCDC boundary 38.11 km in the north.

Slope_Interp: Average beach slope assigned to each ***coastal measurement site*** by linear interpolation of **Prof_slopes** values while preserving longshore trends, along with negatively rounding to the nearest 0.001 (tanβ) thereby maximizing RSLR values (see below). Adjustments were also made to allow for the influence of the Otaki River (see note 1 above) and for low N.

RSLR_0.3m: Shoreline **R**etreat associated with an 0.3 m **S**ea-**L**evel **R**ise induced by global warming was based on the model described in Section 4.3 and Appendix D. In particular:

$$RSLR\_0.3m = -0.3/Slope\_Interp$$

SLR_Hold: Shoreline retreat from acccelerated sea-level rise for the *seawalls hold* scenario = **RSLR_0.3m** for all locations except the sea-wall sites which equal zero.

SLR_Repair: Shoreline retreat from acccelerated sea-level rise for the *seawalls repair* scenario = **RSLR_0.3m** for all locations except seawalls = 0 as failed walls are re-established in same location.

SLR_Remove: Shoreline retreat from acccelerated sea-level rise for the *seawalls remove* scenario. Values at all sites equal **RSLR_0.3m.**

Notes:
1) Distances in Table with no corresponding data points provide approximate locations of river and stream mouths (see Fig 1 in *Open Coast Erosion Hazard Assessment Report*).
2) For additional explanation see Section 4 in the *Open Coast Erosion Hazard Assessment* Report.
3) Incorporates slope data from Dec 2007 district-wide beach profiles .
4) Incorporates IPCC 2007 projections and NIWA/MFE 2008 (Draft) guidelines .

Distance	Slope_Interp	RSLR_0.3m	SLR_Hold	SLR_Repair	SLR_Remove
0.17	0.056	-5.4	0	0	-5.4
0.40	0.049	-6.12	-6.12	-6.12	-6.12
0.73	0.046	-6.52	-6.52	-6.52	-6.52
1.51	0.038	-7.89	0.00	0.00	-7.89
2.62	0.028	-10.71	0.00	0.00	-10.71
3.30	.	.	.	.	.
3.60	0.022	-13.64	-13.64	-13.64	-13.64
3.93	0.022	-13.64	-13.64	-13.64	-13.64
4.18	0.022	-13.64	-13.64	-13.64	-13.64
4.52	0.022	-13.64	-13.64	-13.64	-13.64
4.93	0.022	-13.64	-13.64	-13.64	-13.64
5.15	0.022	-13.64	-13.64	-13.64	-13.64
5.40	.	.	.	.	.
5.70	0.021	-14.29	-14.29	-14.29	-14.29
6.04	0.021	-14.29	-14.29	-14.29	-14.29

Distance	Slope_Interp	RSLR_0.3m	SLR_Hold	SLR_Repair	SLR_Remove
6.39	0.021	-14.29	-14.29	-14.29	-14.29
6.57	0.021	-14.29	-14.29	-14.29	-14.29
6.76	0.021	-14.29	0.00	0.00	-14.29
7.10	0.021	-14.29	0.00	0.00	-14.29
7.56	0.021	-14.29	0.00	0.00	-14.29
8.02	0.020	-15.00	0.00	0.00	-15.00
8.72	0.020	-15.00	0.00	0.00	-15.00
9.11	0.020	-15.00	0.00	0.00	-15.00
9.43	0.020	-15.00	0.00	0.00	-15.00
10.00	.	.	.	.	.
10.29	0.020	-15.00	-15.00	-15.00	-15.00
10.40	0.020	-15.00	0.00	0.00	-15.00
10.61	0.019	-15.79	-15.79	-15.79	-15.79
11.17	0.019	-15.79	-15.79	-15.79	-15.79
11.41	0.019	-15.79	0.00	0.00	-15.79
11.64	0.018	-16.67	0.00	0.00	-16.67
12.12	0.017	-17.65	-17.65	-17.65	-17.65
12.50	0.017	-17.65	0.00	0.00	-17.65
12.60	.	.	.	.	.
12.77	0.016	-18.75	-18.75	-18.75	-18.75
13.04	0.016	-18.75	-18.75	-18.75	-18.75
13.24	0.015	-20.00	-20.00	-20.00	-20.00
13.44	0.015	-20.00	-20.00	-20.00	-20.00
13.63	0.014	-21.43	-21.43	-21.43	-21.43
13.89	0.014	-21.43	-21.43	-21.43	-21.43
14.20	0.015	-20.00	-20.00	-20.00	-20.00
14.60	.	.	.	.	.
16.69	0.020	-15.00	-15.00	-15.00	-15.00
17.31	0.020	-15.00	-15.00	-15.00	-15.00
17.88	0.020	-15.00	-15.00	-15.00	-15.00
18.30	.	.	.	.	.
18.85	0.020	-15.00	-15.00	-15.00	-15.00
19.35	0.019	-15.79	-15.79	-15.79	-15.79
20.30	0.018	-16.67	-16.67	-16.67	-16.67
20.79	0.017	-17.65	-17.65	-17.65	-17.65
21.26	0.017	-17.65	-17.65	-17.65	-17.65
21.73	0.016	-18.75	-18.75	-18.75	-18.75
22.06	0.016	-18.75	-18.75	-18.75	-18.75
22.60	.	.	.	.	.
23.50	0.017	-17.65	-17.65	-17.65	-17.65
24.91	0.018	-16.67	-16.67	-16.67	-16.67
25.70	0.021	-14.29	-14.29	-14.29	-14.29
26.58	0.024	-12.50	-12.50	-12.50	-12.50
27.30	.	.	.	.	.
27.63	0.034	-8.82	-8.82	-8.82	-8.82
28.81	0.046	-6.52	-6.52	-6.52	-6.52
30.16	0.062	-4.84	-4.84	-4.84	-4.84
31.00	.	.	.	.	.
32.54	0.027	-11.11	-11.11	-11.11	-11.11
33.05	0.023	-13.04	-13.04	-13.04	-13.04
33.60	0.019	-15.79	-15.79	-15.79	-15.79
33.82	0.018	-16.67	-16.67	-16.67	-16.67
34.50	.	.	.	.	.
35.54	0.018	-16.67	-16.67	-16.67	-16.67
36.89	0.018	-16.67	-16.67	-16.67	-16.67

Erosion hazard component development:

DUNE STABILITY (DS)

Shoreline retreat of scarp top following wave cut of foredune toe

Key to Table

Distance: Refers to the longshore distance (km) to each coastal measurement site from (datum) Fisherman's Restaurant in the south to the KCDC boundary 38.11 km in the north.

Scarp_Height: Using LIDAR data (see section 5.2), the highest elevation was selected within the longshore sector represented by each *coastal measurement site* and a landward distance as determined by the sum of the remaining hazard components. The dune-toe was used as the height and cross-shore distance datums; this location was identified by overlaying a recent aerial photo upon the LIDAR surface. No LIDAR data was available north of Otaki Beach, so the greatest height occuring along the northern coast, i.e. north of the Waikanae River (4.5 m), was applied.

Scarp_Retreat: Scarp-top retreat associated with each *coastal measurement site's* representative scarp height was determined using the model described in Section 5.2 and Appendix E. In particular,

*Scarp-top retreat = Scarp_Height/2*tan 34° = Scarp_Height/1.349*

DS_Hold: Scarp-top retreat (to attain **D**une **S**tability) for the *seawalls hold* scenario equals **Scarp_Retreat** values for all locations except the sea-walled sites which equals zero.

DS_Repair: Scarp top-retreat (to attain **D**une **S**tability) for the *seawalls repair* scenario equals **Scarp_Retreat** values for all locations.

DS_Remove: Scarp top-retreat (to attain Dune Stability) for the *seawalls remove* scenario = **Scarp_Retreat** values for all locations.

Notes: 1) Distances in Table with no corresponding data points provide approximate locations of river and stream mouths (see Fig 1 in *Open Coast Erosion Hazard Assessment)*

2) For additional explanation see Section 5 in the *Open Coast Erosion Hazard Assessment* Report.

Distance	Scarp_Height	Scarp_Retreat	DS_Hold	DS_Repair	DS_Remove
0.17	9	-6.7	0	-6.7	-6.7
0.40	20.00	-14.83	-14.83	-14.83	-14.83
0.73	25.30	-18.75	-18.75	-18.75	-18.75
1.51	15.80	-11.71	0.00	-11.71	-11.71
2.62	6.00	-4.45	0.00	-4.45	-4.45
3.30					
3.60	9.00	-6.67	-6.67	-6.67	-6.67
3.93	13.80	-10.23	-10.23	-10.23	-10.23
4.18	14.50	-10.75	-10.75	-10.75	-10.75
4.52	13.50	-10.01	-10.01	-10.01	-10.01
4.93	15.20	-11.27	-11.27	-11.27	-11.27
5.15	15.20	-11.27	-11.27	-11.27	-11.27
5.40					
5.70	17.50	-12.97	-12.97	-12.97	-12.97
6.04	14.60	-10.82	-10.82	-10.82	-10.82
6.39	20.10	-14.90	-14.90	-14.90	-14.90
6.57	13.00	-9.64	-9.64	-9.64	-9.64
6.76	5.50	-4.08	0.00	-4.08	-4.08
7.10	13.00	-9.64	0.00	-9.64	-9.64
7.56	16.00	-11.86	0.00	-11.86	-11.86
8.02	10.80	-8.01	0.00	-8.01	-8.01
8.72	9.00	-6.67	0.00	-6.67	-6.67
9.11	7.50	-5.56	0.00	-5.56	-5.56
9.43	6.20	-4.60	0.00	-4.60	-4.60
10.00					
10.29	7.20	-5.34	-5.34	-5.34	-5.34
10.40	2.50	-1.85	0.00	-1.85	-1.85
10.61	7.00	-5.19	-5.19	-5.19	-5.19
11.17	3.50	-2.59	-2.59	-2.59	-2.59
11.41	2.80	-2.08	0.00	-2.08	-2.08
11.64	2.70	-2.00	0.00	-2.00	-2.00
12.12	2.70	-2.00	-2.00	-2.00	-2.00
12.50	3.20	-2.37	-2.37	-2.37	-2.37
12.60					
12.77	1.60	-1.19	-1.19	-1.19	-1.19
13.04	1.20	-0.89	-0.89	-0.89	-0.89
13.24	0.80	-0.59	-0.59	-0.59	-0.59
13.44	1.30	-0.96	-0.96	-0.96	-0.96
13.63	0.80	-0.59	-0.59	-0.59	-0.59
13.89	1.50	-1.11	-1.11	-1.11	-1.11
14.20	4.20	-3.11	-3.11	-3.11	-3.11
14.60					
16.69	4.50	-3.34	-3.34	-3.34	-3.34
17.31	3.50	-2.59	-2.59	-2.59	-2.59
17.88	3.50	-2.59	-2.59	-2.59	-2.59
18.30					
18.85	2.70	-2.00	-2.00	-2.00	-2.00
19.35	2.70	-2.00	-2.00	-2.00	-2.00
20.30	2.40	-1.78	-1.78	-1.78	-1.78
20.79	1.80	-1.33	-1.33	-1.33	-1.33
21.26	2.70	-2.00	-2.00	-2.00	-2.00
21.73	2.50	-1.85	-1.85	-1.85	-1.85
22.06	4.50	-3.34	-3.34	-3.34	-3.34
22.60					
23.50	2.50	-1.85	-1.85	-1.85	-1.85

Distance	Scarp_Height	Scarp_Retreat	DS_Hold	DS_Repair	DS_Remove
24.91	2.10	-1.56	-1.56	-1.56	-1.56
25.70	2.10	-1.56	-1.56	-1.56	-1.56
26.58	0.70	-0.52	-0.52	-0.52	-0.52
27.30					
27.63	1.10	-0.82	-0.82	-0.82	-0.82
28.81	1.50	-1.11	-1.11	-1.11	-1.11
30.16	1.20	-0.89	-0.89	-0.89	-0.89
31.00					
32.54	1.90	-1.41	-1.41	-1.41	-1.41
33.05	1.70	-1.26	-1.26	-1.26	-1.26
33.60	3.00	-2.22	-2.22	-2.22	-2.22
33.82	3.50	-2.59	-2.59	-2.59	-2.59
34.50					
35.54	4.50	-3.34	-3.34	-3.34	-3.34
36.89	4.50	-3.34	-3.34	-3.34	-3.34

Erosion hazard component development:

COMBINED UNCERTAINTY (CU)

Shoreline retreat associated with measurement errors and quantifiable safety margins

Key to Table

Distance: Refers to the longshore distance (km) to each coastal measurement site from (datum) Fisherman's Restaurant in the south to the KCDC boundary 38.11 km in the north.

CU_Hold: Under the *seawalls hold* scenario, CU for seawalled sections of coast equals zero, and for non-seawalled sections equals the sum of measurement errors for the four components which equals 5.3 m and this was then rounded up to 6 m for additional precaution.

CU_Repair: Under the *seawalls repair* scenario, CU for seawalled sections of coast is the measurement error for ST and DS only (as LT and SLR = 0) which equals 3.5 m and this was rounded up to 4 m for additional precaution, PLUS a safety margin of 5 m to account for intensive scour associated with the systematically over steepening of the profile fronting seawalls (see Section 3.5). CU for the non-seawalled coast is the measurement error for the four components rounded up to 6 m.

CU_ Remove: Under the *seawalls remove* scenario, CU for the entire coast is the measurement error for the four components rounded up to 6 m.

Notes: 1) Distances in Table with no corresponding data points provide approximate locations of river and stream mouths (see Fig 1 in *Open Coast Erosion Hazard Assessment*)

2) For additional explanation see Section 6 in the *Open Coast Erosion Hazard Assessment* Report.

Distance	CU_Hold	CU_Repair	CU_Remove
0.17	0	-9	-6
0.40	-6.0	-6.0	-6.0
0.73	-6.0	-6.0	-6.0
1.51	0.0	-9.0	-6.0
2.62	0.0	-9.0	-6.0
3.30	.		.
3.60	-6.0	-6.0	-6.0
3.93	-6.0	-6.0	-6.0
4.18	-6.0	-6.0	-6.0
4.52	-6.0	-6.0	-6.0
4.93	-6.0	-6.0	-6.0
5.15	-6.0	-6.0	-6.0
5.40	.		.
5.70	-6.0	-6.0	-6.0
6.04	-6.0	-6.0	-6.0
6.39	-6.0	-6.0	-6.0
6.57	-6.0	-6.0	-6.0

Distance	CU_Hold	CU_Repair	CU_Remove
6.76	0.0	-9.0	-6.0
7.10	0.0	-9.0	-6.0
7.56	0.0	-9.0	-6.0
8.02	0.0	-9.0	-6.0
8.72	0.0	-9.0	-6.0
9.11	0.0	-9.0	-6.0
9.43	0.0	-9.0	-6.0
10.00	.		.
10.29	-6.0	-6.0	-6.0
10.40	0.0	-9.0	-6.0
10.61	-6.0	-6.0	-6.0
11.17	-6.0	-6.0	-6.0
11.41	0.0	-9.0	-6.0
11.64	0.0	-9.0	-6.0
12.12	-6.0	-6.0	-6.0
12.50	-6.0	-6.0	-6.0
12.60	.		.
12.77	-6.0	-6.0	-6.0
13.04	-6.0	-6.0	-6.0
13.24	-6.0	-6.0	-6.0
13.44	-6.0	-6.0	-6.0
13.63	-6.0	-6.0	-6.0
13.89	-6.0	-6.0	-6.0
14.20	-6.0	-6.0	-6.0
14.60	.		.
16.69	-6.0	-6.0	-6.0
17.31	-6.0	-6.0	-6.0
17.88	-6.0	-6.0	-6.0
18.30	.		.
18.85	-6.0	-6.0	-6.0
19.35	-6.0	-6.0	-6.0
20.30	-6.0	-6.0	-6.0
20.79	-6.0	-6.0	-6.0
21.26	-6.0	-6.0	-6.0
21.73	-6.0	-6.0	-6.0
22.06	-6.0	-6.0	-6.0
22.60	.		.
23.50	-6.0	-6.0	-6.0
24.91	-6.0	-6.0	-6.0
25.70	-6.0	-6.0	-6.0
26.58	-6.0	-6.0	-6.0
27.30	.		.
27.63	-6.0	-6.0	-6.0
28.81	-6.0	-6.0	-6.0
30.16	-6.0	-6.0	-6.0
31.00	.		.
32.54	-6.0	-6.0	-6.0
33.05	-6.0	-6.0	-6.0
33.60	-6.0	-6.0	-6.0
33.82	-6.0	-6.0	-6.0
34.50	.		.
35.54	-6.0	-6.0	-6.0
36.89	-6.0	-6.0	-6.0

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Coastal Erosion Hazard Distances (CEHD):

SEAWALLS HOLD SCENARIO

Seawalls are maintained and **do not fail** during the hazard prediction period

Key to Table

Distance: Refers to the longshore distance (km) to each coastal measurement site from (datum) Fisherman's Restaurant in the south to the KCDC boundary 38.11 km in the north.

LT_Hold: Long-term retreat (m) as given in previous Worksheet **LT-ALL**

ST_Hold: Short-term (landward) fluctuation (m) given in previous Worksheet **ST-ALL**

SLR_Hold: Retreat from global warming-associated sea-level rise (m) as given in previous Worksheet **SLR-ALL**

DS_Hold: Scarp-top retreat (m) required to achieve dune stability give in previous Worksheet **DS-ALL**

CU_Hold: Combined uncertainty (m) given in previous Worksheet **CU-ALL**

CEHD: **C**oastal (open) **E**rosion **H**azard **D**istance (from modelled 2008 shoreline) = sum of the above five components.

Notes:
1) Distances in Table with no corresponding data points provide approximate locations of river and stream mouths (see Fig 1 in *Open Coast Erosion Hazard Assessment)* .
2) For additional explanation see Section 6 in the *Open Coast Erosion Hazard Assessment* Report.
3) These data are reproduced in *Open Coast Erosion Hazard Assessment* Report as Appendix B-1.

Distance	LT_Hold	ST_Hold	SLR_Hold	DS_Hold	CU_Hold	CEHD
0.17	0.00	0.00	0.00	0.00	0.00	0.00
0.40	-7.50	-15.00	-6.12	-14.83	-6.00	-49.45
0.73	-3.75	-15.00	-6.52	-18.75	-6.00	-50.03
1.51	0.00	0.00	0.00	0.00	0.00	0.00
2.62	0.00	0.00	0.00	0.00	0.00	0.00
3.30	.	.	.	.	.	.
3.60	-14.50	-10.00	-13.64	-6.67	-6.00	-50.81
3.93	-17.50	-10.00	-13.64	-10.23	-6.00	-57.37
4.18	-20.00	-10.00	-13.64	-10.75	-6.00	-60.39
4.52	-22.50	-10.00	-13.64	-10.01	-6.00	-62.14
4.93	-26.50	-10.00	-13.64	-11.27	-6.00	-67.40
5.15	-28.50	-10.00	-13.64	-11.27	-6.00	-69.40
5.40	.	.	.	.	.	.
5.70	-33.50	-10.00	-14.29	-12.97	-6.00	-76.76
6.04	-40.50	-10.00	-14.29	-10.82	-6.00	-81.61
6.39	-50.00	-13.00	-14.29	-14.90	-6.00	-98.19
6.57	-75.00	-15.00	-14.29	-9.64	-6.00	-119.92
6.76	0.00	0.00	0.00	0.00	0.00	0.00

Distance	LT_Hold	ST_Hold	SLR_Hold	DS_Hold	CU_Hold	CEHD
7.10	0.00	0.00	0.00	0.00	0.00	0.00
7.56	0.00	0.00	0.00	0.00	0.00	0.00
8.02	0.00	0.00	0.00	0.00	0.00	0.00
8.72	0.00	0.00	0.00	0.00	0.00	0.00
9.11	0.00	0.00	0.00	0.00	0.00	0.00
9.43	0.00	0.00	0.00	0.00	0.00	0.00
10.00	.	.	.	.	.	.
10.29	-9.50	-10.00	-15.00	-5.34	-6.00	-45.84
10.40	0.00	0.00	0.00	0.00	0.00	0.00
10.61	-9.50	-10.00	-15.79	-5.19	-6.00	-46.48
11.17	-19.00	-10.00	-15.79	-2.59	-6.00	-53.38
11.41	0.00	0.00	0.00	0.00	0.00	0.00
11.64	0.00	0.00	0.00	0.00	0.00	0.00
12.12	0.00	-10.00	-17.65	-2.00	-6.00	-35.65
12.50	0.00	-12.00	0.00	-2.37	-6.00	-20.37
12.60	.	.	.	.	.	.
12.77	0.00	-18.00	-18.75	-1.19	-6.00	-43.94
13.04	0.00	-26.00	-18.75	-0.89	-6.00	-51.64
13.24	0.00	-30.00	-20.00	-0.59	-6.00	-56.59
13.44	0.00	-34.50	-20.00	-0.96	-6.00	-61.46
13.63	0.00	-36.00	-21.43	-0.59	-6.00	-64.02
13.89	0.00	-15.00	-21.43	-1.11	-6.00	-43.54
14.20	-15.00	-15.00	-20.00	-3.11	-6.00	-59.11
14.60	.	.	.	.	.	.
16.69	0.00	-15.00	-15.00	-3.34	-6.00	-39.34
17.31	0.00	-15.00	-15.00	-2.59	-6.00	-38.59
17.88	0.00	-12.00	-15.00	-2.59	-6.00	-35.59
18.30	.	.	.	.	.	.
18.85	0.00	-12.00	-15.00	-2.00	-6.00	-35.00
19.35	0.00	-12.00	-15.79	-2.00	-6.00	-35.79
20.30	0.00	-12.00	-16.67	-1.78	-6.00	-36.45
20.79	0.00	-12.00	-17.65	-1.33	-6.00	-36.98
21.26	0.00	-12.00	-17.65	-2.00	-6.00	-37.65
21.73	0.00	-12.00	-18.75	-1.85	-6.00	-38.60
22.06	0.00	-12.00	-18.75	-3.34	-6.00	-40.09
22.60	.	.	.	.	.	.
23.50	0.00	-12.00	-17.65	-1.85	-6.00	-37.50
24.91	0.00	-12.00	-16.67	-1.56	-6.00	-36.22
25.70	0.00	-12.00	-14.29	-1.56	-6.00	-33.84
26.58	0.00	-12.00	-12.50	-0.52	-6.00	-31.02
27.30	.	.	.	.	.	.
27.63	0.00	-12.00	-8.82	-0.82	-6.00	-27.64
28.81	0.00	-12.00	-6.52	-1.11	-6.00	-25.63
30.16	0.00	-14.00	-4.84	-0.89	-6.00	-25.73
31.00	.	.	.	.	.	.
32.54	0.00	-14.00	-11.11	-1.41	-6.00	-32.52
33.05	0.00	-14.00	-13.04	-1.26	-6.00	-34.30
33.60	0.00	-14.00	-15.79	-2.22	-6.00	-38.01
33.82	0.00	-14.00	-16.67	-2.59	-6.00	-39.26
34.50	.	.	.	.	.	.
35.54	0.00	-14.00	-16.67	-3.34	-6.00	-40.00
36.89	0.00	-18.00	-16.67	-3.34	-6.00	-44.00

Coastal Erosion Hazard Distances (CEHD):

SEAWALLS REPAIR SCENARIO

Seawalls do occationally fail, but are then repaired

Key to Table

Distance: Refers to the longshore distance (km) to each coastal measurement site from (datum) Fisherman's Restaurant in the south to the KCDC boundary 38.11 km in the north.

LT_Repair: Long-term retreat (m) as given in previous Worksheet **LT-ALL**

ST_Repair: Short-term (landward) fluctuation (m) given in previous Worksheet **ST-ALL**

SLR_Repair: Retreat from global warming-associated sea-level rise (m) as given in previous Worksheet **SLR-ALL**

DS_Repair: Scarp-top retreat (m) required to achieve dune stability give in previosu Worksheet **DS-ALL**

CU_Repair: Combined uncertainty (m) given in previosu Worksheet **CU-ALL.**

CEHD: **C**oastal (open) **E**rosion **H**azard **D**istance (from modelled 2008 shoreline) = sum of the above five components.

Notes:
1) Distances in Table with no corresponding data points provide approximate locations of river and stream mouths (see Fig 1 in *Open Coast Erosion Hazard Assessment*).
2) For additional explanation see Section 6 in the *Open Coast Erosion Hazard Assessment* Report.
3) These data are reproduced in *Open Coast Erosion Hazard Assessment* Report as Appendix B-2.

Distance	LT_Repair	ST_Repair	SLR_Repair	DS_Repair	CU_Repair	CEHD
0.17	0.00	-15.00	0.00	-6.70	-9.00	-30.70
0.40	-7.50	-15.00	-6.12	-14.83	-6.00	-49.45
0.73	-3.75	-15.00	-6.52	-18.75	-6.00	-50.03
1.51	0.00	-15.00	0.00	-11.71	-9.00	-35.71
2.62	0.00	-15.00	0.00	-4.45	-9.00	-28.45
3.30	.		.			.
3.60	-14.50	-10.00	-13.64	-6.67	-6.00	-50.81
3.93	-17.50	-10.00	-13.64	-10.23	-6.00	-57.37
4.18	-20.00	-10.00	-13.64	-10.75	-6.00	-60.39
4.52	-22.50	-10.00	-13.64	-10.01	-6.00	-62.14
4.93	-26.50	-10.00	-13.64	-11.27	-6.00	-67.40
5.15	-28.50	-10.00	-13.64	-11.27	-6.00	-69.40
5.40	.		.			.
5.70	-33.50	-10.00	-14.29	-12.97	-6.00	-76.76
6.04	-40.50	-10.00	-14.29	-10.82	-6.00	-81.61
6.39	-50.00	-13.00	-14.29	-14.90	-6.00	-98.19
6.57	-75.00	-15.00	-14.29	-9.64	-6.00	-119.92
6.76	0.00	-15.00	0.00	-4.08	-9.00	-28.08

Distance	LT_Repair	ST_Repair	SLR_Repair	DS_Repair	CU_Repair	CEHD
7.10	0.00	-15.00	0.00	-9.64	-9.00	-33.64
7.56	0.00	-15.00	0.00	-11.86	-9.00	-35.86
8.02	0.00	-15.00	0.00	-8.01	-9.00	-32.01
8.72	0.00	-15.00	0.00	-6.67	-9.00	-30.67
9.11	0.00	-15.00	0.00	-5.56	-9.00	-29.56
9.43	0.00	-15.00	0.00	-4.60	-9.00	-28.60
10.00	.		.			.
10.29	-9.50	-10.00	-15.00	-5.34	-6.00	-45.84
10.40	0.00	-10.00	0.00	-1.85	-9.00	-20.85
10.61	-9.50	-10.00	-15.79	-5.19	-6.00	-46.48
11.17	-19.00	-10.00	-15.79	-2.59	-6.00	-53.38
11.41	0.00	-10.00	0.00	-2.08	-9.00	-21.08
11.64	0.00	-10.00	0.00	-2.00	-9.00	-21.00
12.12	0.00	-10.00	-17.65	-2.00	-6.00	-35.65
12.50	0.00	-12.00	0.00	-2.37	-6.00	-20.37
12.60	.		.			.
12.77	0.00	-18.00	-18.75	-1.19	-6.00	-43.94
13.04	0.00	-26.00	-18.75	-0.89	-6.00	-51.64
13.24	0.00	-30.00	-20.00	-0.59	-6.00	-56.59
13.44	0.00	-34.50	-20.00	-0.96	-6.00	-61.46
13.63	0.00	-36.00	-21.43	-0.59	-6.00	-64.02
13.89	0.00	-15.00	-21.43	-1.11	-6.00	-43.54
14.20	-15.00	-15.00	-20.00	-3.11	-6.00	-59.11
14.60	.		.			.
16.69	0.00	-15.00	-15.00	-3.34	-6.00	-39.34
17.31	0.00	-15.00	-15.00	-2.59	-6.00	-38.59
17.88	0.00	-12.00	-15.00	-2.59	-6.00	-35.59
18.30	.		.			.
18.85	0.00	-12.00	-15.00	-2.00	-6.00	-35.00
19.35	0.00	-12.00	-15.79	-2.00	-6.00	-35.79
20.30	0.00	-12.00	-16.67	-1.78	-6.00	-36.45
20.79	0.00	-12.00	-17.65	-1.33	-6.00	-36.98
21.26	0.00	-12.00	-17.65	-2.00	-6.00	-37.65
21.73	0.00	-12.00	-18.75	-1.85	-6.00	-38.60
22.06	0.00	-12.00	-18.75	-3.34	-6.00	-40.09
22.60	.		.			.
23.50	0.00	-12.00	-17.65	-1.85	-6.00	-37.50
24.91	0.00	-12.00	-16.67	-1.56	-6.00	-36.22
25.70	0.00	-12.00	-14.29	-1.56	-6.00	-33.84
26.58	0.00	-12.00	-12.50	-0.52	-6.00	-31.02
27.30	.		.			.
27.63	0.00	-12.00	-8.82	-0.82	-6.00	-27.64
28.81	0.00	-12.00	-6.52	-1.11	-6.00	-25.63
30.16	0.00	-14.00	-4.84	-0.89	-6.00	-25.73
31.00	.		.			.
32.54	0.00	-14.00	-11.11	-1.41	-6.00	-32.52
33.05	0.00	-14.00	-13.04	-1.26	-6.00	-34.30
33.60	0.00	-14.00	-15.79	-2.22	-6.00	-38.01
33.82	0.00	-14.00	-16.67	-2.59	-6.00	-39.26
34.50	.		.			.
35.54	0.00	-14.00	-16.67	-3.34	-6.00	-40.00
36.89	0.00	-18.00	-16.67	-3.34	-6.00	-44.00

Coastal Erosion Hazard Distances (CEHD):

SEAWALLS REMOVE SCENARIO

Seawalls are removed

Key to Table

Distance: Refers to the longshore distance (km) to each coastal measurement site from (datum)
Fisherman's Restaurant in the south to the KCDC boundary 38.11 km in the north.

LT_Remove: Long-term retreat (m) as given in previous Worksheet **LT-ALL**

ST_Remove: Short-term (landward) fluctuation (m) given in previosu Worksheet **ST-ALL**

SLR_Remove: Retreat from global warming-associated sea-level rise (m) as given in previous
Worksheet **SLR-ALL**

DS_Remove: Scarp-top retreat (m) required to achieve dune stability give in Worksheet **DS-ALL**

CU_Remove: Combined uncertainty (m) given in Worksheet **CU-ALL**

CEHD: **C**oastal (open) **E**rosion **H**azard **D**istance (from modelled 2008 shoreline) = sum of
the five components.

Notes:
1) Distances in Table with no corresponding data points provide approximate locations of river and stream mouths (see Fig 1 in Open Coast Erosion Hazard Assessment).
2) For additional explanation see Section 6 in the Open Coast Erosion Hazard Assessment Report.
3) These data are reproduced in Open Coast Erosion Hazard Assessment Report as
Appendix B-3.

Distance	LT_Remove	ST_Remove	SLR_Remove	DS_Remove	CU_Remove	CEHD
0.2	-8.00	-15.00	-5.40	-6.70	-6.00	-41.10
0.4	-12.50	-15.00	-6.12	-14.83	-6.00	-54.45
0.7	-10.00	-15.00	-6.52	-18.75	-6.00	-56.28
1.5	-12.00	-15.00	-7.89	-11.71	-6.00	-52.61
2.6	-10.00	-15.00	-10.71	-4.45	-6.00	-46.16
3.3	.		.		.	.
3.6	-5.00	-10.00	-13.64	-6.67	-6.00	-41.31
3.9	-5.00	-10.00	-13.64	-10.23	-6.00	-44.87
4.2	-6.25	-10.00	-13.64	-10.75	-6.00	-46.64
4.5	-7.50	-10.00	-13.64	-10.01	-6.00	-47.14
4.9	-10.00	-10.00	-13.64	-11.27	-6.00	-50.90
5.2	.	-10.00	-13.64	-11.27	-6.00	.
5.4	.		.		.	.
5.7	-12.50	-10.00	-14.29	-12.97	-6.00	-55.76

Distance	LT_Remove	ST_Remove	SLR_Remove	DS_Remove	CU_Remove	CEHD
6.0	-12.50	-10.00	-14.29	-10.82	-6.00	-53.61
6.4	-12.50	-13.00	-14.29	-14.90	-6.00	-60.69
6.6	-12.50	-15.00	-14.29	-9.64	-6.00	-57.42
6.8	-25.00	-15.00	-14.29	-4.08	-6.00	-64.36
7.1	-25.00	-15.00	-14.29	-9.64	-6.00	-69.92
7.6	-25.00	-15.00	-14.29	-11.86	-6.00	-72.15
8.0	-25.00	-15.00	-15.00	-8.01	-6.00	-69.01
8.7	-25.00	-15.00	-15.00	-6.67	-6.00	-67.67
9.1	-20.00	-15.00	-15.00	-5.56	-6.00	-61.56
9.4	-10.00	-15.00	-15.00	-4.60	-6.00	-50.60
10.0	.		.		.	.
10.3	0.00	-10.00	-15.00	-5.34	-6.00	-36.34
10.4	0.00	-10.00	-15.00	-1.85	-6.00	-32.85
10.6	0.00	-10.00	-15.79	-5.19	-6.00	-36.98
11.2	-20.00	-10.00	-15.79	-2.59	-6.00	-54.38
11.4	-40.00	-10.00	-15.79	-2.08	-6.00	-73.87
11.6	-30.00	-10.00	-16.67	-2.00	-6.00	-64.67
12.1	0.00	-10.00	-17.65	-2.00	-6.00	-35.65
12.5	0.00	-12.00	-17.65	-2.37	-6.00	-38.02
12.6	.		.		.	.
12.8	0.00	-18.00	-18.75	-1.19	-6.00	-43.94
13.0	0.00	-26.00	-18.75	-0.89	-6.00	-51.64
13.2	0.00	-30.00	-20.00	-0.59	-6.00	-56.59
13.4	0.00	-34.50	-20.00	-0.96	-6.00	-61.46
13.6	0.00	-36.00	-21.43	-0.59	-6.00	-64.02
13.9	0.00	-15.00	-21.43	-1.11	-6.00	-43.54
14.2	-15.00	-15.00	-20.00	-3.11	-6.00	-59.11
14.6	.		.		.	.
16.7	0.00	-15.00	-15.00	-3.34	-6.00	-39.34
17.3	0.00	-15.00	-15.00	-2.59	-6.00	-38.59
17.9	.	-12.00	-15.00	-2.59	-6.00	-35.59
18.3	.		.		.	.
18.9	0.00	-12.00	-15.00	-2.00	-6.00	-35.00
19.4	0.00	-12.00	-15.79	-2.00	-6.00	-35.79
20.3	0.00	-12.00	-16.67	-1.78	-6.00	-36.45
20.8	0.00	-12.00	-17.65	-1.33	-6.00	-36.98
21.3	0.00	-12.00	-17.65	-2.00	-6.00	-37.65
21.7	0.00	-12.00	-18.75	-1.85	-6.00	-38.60
22.1	0.00	-12.00	-18.75	-3.34	-6.00	-40.09
22.6	.		.		.	.
23.5	0.00	-12.00	-17.65	-1.85	-6.00	-37.50
24.9	0.00	-12.00	-16.67	-1.56	-6.00	-36.22
25.7	0.00	-12.00	-14.29	-1.56	-6.00	-33.84
26.6	0.00	-12.00	-12.50	-0.52	-6.00	-31.02
27.3	.		.		.	.
27.6	0.00	-12.00	-8.82	-0.82	-6.00	-27.64
28.8	0.00	-12.00	-6.52	-1.11	-6.00	-25.63
30.2	0.00	-14.00	-4.84	-0.89	-6.00	-25.73
31.0	.		.		.	.
32.5	0.00	-14.00	-11.11	-1.41	-6.00	-32.52
33.1	0.00	-14.00	-13.04	-1.26	-6.00	-34.30
33.6	0.00	-14.00	-15.79	-2.22	-6.00	-38.01
33.8	0.00	-14.00	-16.67	-2.59	-6.00	-39.26
34.5	.		.		.	.
35.5	0.00	-14.00	-16.67	-3.34	-6.00	-40.00
36.9	0.00	-18.00	-16.67	-3.34	-6.00	-44.00