



**Assessment of Areas
Susceptible to Coastal
Erosion Hazard**

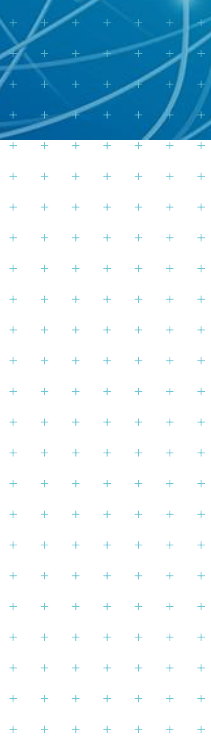
Update of T+T (2015) assessment

Prepared for
Gisborne District Council

Prepared by
Tonkin & Taylor Ltd

Date
August 2016

Job Number
30548.002.v1



Distribution:

Gisborne District Council

1 copies

Tonkin & Taylor Ltd (FILE)

1 copy

Table of contents

1	Introduction	1
2	Update of Areas Susceptible to Coastal Erosion Hazard	1
	2.1 Methodology	1
	2.2 Results	2
	2.2.1 Correction to previous assessment	2
	2.3 Maps and digital shapefiles	2
3	Summary and conclusions	3
4	Applicability	3
Appendix A :	Updated ASCE (m) at 10 yearly increments for unconsolidated beaches	
Appendix B :	ASCE maps	

Executive summary

Gisborne District Council (GDC) have requested that Tonkin & Taylor Ltd (T+T) update the previous Areas Susceptible to Coastal Erosion (ASCE) in the Gisborne District (T+T, 2015) to include additional time periods for unconsolidated beach shorelines.

This assessment has determined Areas Susceptible to Coastal Erosion for unconsolidated beach shorelines along Gisborne District coastline at 10 yearly increments between 2015 and 2115 and has mapped ASCEs for current (2015) and 50 year (2065) time frames. Previously mapped 100 year (2115) ASCE's for beach shorelines (T+T, 2015) have been updated to include an allowance for historic sea level rise and remapped along with adjacent cliff ASCE's to maintain a smooth transition.

The current ASCE width is between 5 and 70% (average 30%) of the 2115 ASCE width depending on whether short-term effects dominate erosion (values closer) or long-term trends and sea level rise effect dominate (2115 values greatly exceed 2015). The 2065 ASCE width is between 35 and 80% (average 55%) of the 2115 ASCE.

1 Introduction

Gisborne District Council (GDC) have requested that Tonkin & Taylor Ltd (T+T) update the previous Areas Susceptible to Coastal Erosion (ASCE) in the Gisborne District (T+T, 2015) to include additional time periods for unconsolidated beach shorelines. This letter report sets out a summary of the method and results including maps showing the present day, 2065 and 2115 ASCE lines.

2 Update of Areas Susceptible to Coastal Erosion Hazard

Our previous assessment¹ provided ASCE for the Gisborne District over a 100 year timeframe. We have now updated the ASCE's for unconsolidated beach shorelines along Gisborne District coastline to include ASCEs for current (2015) and 50 year (2065) time frames. Existing information presented in T+T (2015) has been used to update the previous assessment and the ASCE have been calculated at 10 yearly increments from the present day to 2115 for unconsolidated beach shorelines.

The ASCE for consolidated cliff shorelines are unlikely to change significantly as the majority of the hazard width is due to the stable angle of repose of the cliff and would give approximately similar ASCE for the present day and 2065 as for 2115. Exceptions to this are for low, soft cliffs where long-term retreat is more important. ASCE for consolidated cliff shorelines have therefore not been included in this update.

2.1 Methodology

As per the T+T report "Update of Areas Susceptible to Coastal Erosion Hazard" (2015), the ASCE were used to calculate the setback from the existing shoreline. The ASCE for unconsolidated beach shorelines is calculated as follows:

$$ASCE_{Beach} = [ST + DS + (LT \times T) + SL] \quad (1)$$

Where:

- S = Short-term changes in horizontal shoreline position related to storm erosion (m)
- DS = Dune stability allowance. This is the horizontal distance from the base of the eroded dune to the dune crest at a stable angle of repose (m)
- LT = Long term rate of horizontal coastline movement (m/yr)
- T = Timeframe (years)
- SL = Horizontal coastline retreat due to the effects of increased mean sea level (m).

The ASCE was calculated from 2015 (current) to 2115 at 10 yearly increments with each time increment considered, ST and DS were assumed to remain constant. LT rate remained constant, but the resultant distance was calculated for each increment. SL was calculated the same as previously:

$$SL = \left(\frac{L_*}{B+d_*} \right) S \quad (2)$$

Where:

- d* = maximum depth of sediment exchange (m)
- L* = horizontal distance from the shoreline to the offshore position of d* (m)
- B = height of berm/dune crest within the eroded backshore (m)

¹ Tonkin & Taylor (2015) Update of Areas Susceptible to Coastal Erosion Hazard. Report prepared for Gisborne District Council, August 2015.

S = sea level rise (m)

In Equation (2), the part between brackets represents the 'recession slope' upon which the shoreline position translates as sea level rises. The horizontal distance (SL) that represents the sea level rise component of the total ASCE, is the product of the recession slope times the sea level rise value (S).

Sea level rise for each increment was calculated based on Intergovernmental Panel on Climate Change (IPCC, 2014), using the mean RCP8.5 values, and subtracting 1.7 mm per year for the historic rate of sea level rise recorded over the last 100 years to provide a relative increase in sea level rise that could increase erosion from the historic erosion recorded (see Table 1).

Table 1 Sea level rise values for 10 yearly increments

Year	RCP8.5 ¹	Historic sea level rise	Adopted sea level rise (S)
2015	0.00	0.00	0.00
2025	0.05	0.017	0.03
2035	0.10	0.034	0.06
2045	0.16	0.051	0.11
2055	0.23	0.068	0.16
2065	0.31	0.085	0.23
2075	0.40	0.102	0.30
2085	0.51	0.119	0.39
2095	0.62	0.136	0.48
2105	0.75	0.153	0.59
2115	0.88	0.17	0.71

¹RCP8.5 values have been corrected to 0 m sea level rise in 2015

2.2 Results

Table A1 in Appendix A shows the updated ASCE in meters at 10 yearly increments for unconsolidated beach shorelines in the Gisborne District. A digital version of Table A1 in the form of a excel spreadsheet has been attached. The ST, DS, LT and SLR components for each cell are included in Table A1. Note that the recession slope has been tabulated in Table A1, which should be multiplied with the sea level rise value (S) in Table 1 for the selected year to calculate the SLR component for the selected year.

2.2.1 Correction to previous assessment

While assessing ASCE values for 10 yearly increments we found that the S component in Equation (2) calculated for the previously assessed 2115 ASCE (T+T, 2015) excluded the deduction of the historic sea level rise. This has likely led to 2115 ASCE for unconsolidated beaches being further landward than if a deduction of historic SLR was included. We have now adopted the appropriate sea level rise value for 2115 (refer to Table 1) and have updated the previously assessed 2115 values.

It can be seen from Table A1 in Appendix A that the 2115 ASCE values are between 10 to 40 m lower than was presented within T+T (2015).

2.3 Maps and digital shapefiles

The present day, 2065 and revised 2115 ASCE for unconsolidated beaches have been mapped digitally and have been provided in the form of GIS shapefiles for use in the Council's GIS viewer.

Figure B1 in Appendix B shows the beaches within Gisborne District that have been included in this assessment. An example of the present day, 2065 and 2115 ASCE for the Hick's Bay beach coastline is mapped on Figure B2 in Appendix B.

Digital shapefiles of the 2115 ASCE for cliff coastlines have been updated to provide a smooth transition to the updated beach ASCE. These have been provided in the form of GIS shapefiles.

3 Summary and conclusions

This assessment has determined Areas Susceptible to Coastal Erosion for unconsolidated beach shorelines along Gisborne District coastline at 10 yearly increments between 2015 and 2115 and has mapped ASCEs for current (2015) and 50 year (2065) time frames. Previously mapped 100 year (2115) ASCE's for beach shorelines (T+T, 2015) did not include an allowance for historic sea level rise and have been updated and remapped along with adjacent cliff ASCE's to maintain a smooth transition.

The current ASCE width is between 5 and 70% (average 30%) of the 2115 ASCE width depending on whether short-term effects dominate erosion (values closer) or long-term trends and sea level rise effect dominate (2115 values greatly exceed 2015). The 2065 ASCE width is between 35 and 80% (average 55%) of the 2115 ASCE.

4 Applicability

This report has been prepared for the exclusive use of our client Gisborne District Council, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Tonkin & Taylor Ltd

Report prepared by:

Authorised for Tonkin & Taylor Ltd by:

.....

.....

Patrick Knook

Richard Reinen-Hamill

Coastal Engineer

Project Director

Report reviewed by:



.....

Dr Tom Shand

Senior Coastal Engineer

PPK/TDS
p:\30548\30548.0020\workingmaterial\20160812.ppk.report.r1.docx

Appendix A: Updated ASCE (m) at 10 yearly increments for unconsolidated beaches

- **Table A1 Updated ASCE (m) for unconsolidated beaches at 10 yearly increments including ST, DS, LT and SLR components**
- **Spreadsheet 'ASCE beaches FINAL'**

Table A1 Updated ASCE (m) for unconsolidated beaches at 10 yearly increments including ST, DS, LT and SLR components

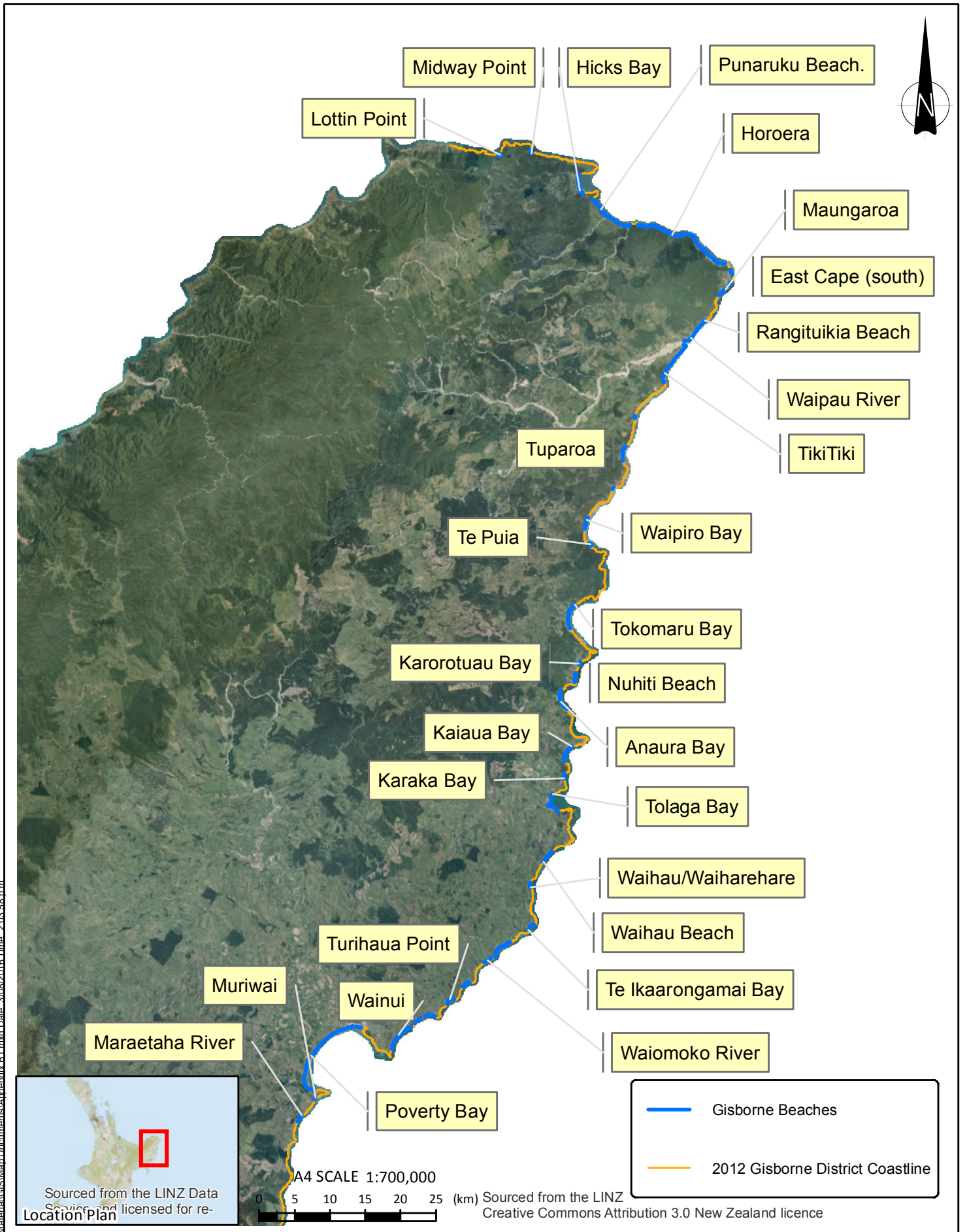
Beach No.	Beach name	Short-term erosion (m)	Dune slope allowance (m)	Long-term trend (m/year)	SLR recession slope (-)	ASCE (m) for year:										
						2015	2025	2035	2045	2055	2065	2075	2085	2095	2105	2115
1	Maraetaha River	60	5	0.00	0.011	65	68	70	75	80	86	92	100	109	119	130
2	Muriwai	30	5	-0.50	0.007	35	44	54	66	78	93	108	126	144	164	186
3	Poverty Bay	60	5	0.00	0.009	65	68	72	77	83	91	98	108	118	131	144
4		0	5	0.00	0.007	5	9	14	21	28	38	48	61	74	89	106
5		60	5	0.00	0.009	65	68	72	77	83	91	98	108	118	131	144
6	Wainui	25	15	-0.30	0.009	40	46	53	61	70	81	91	104	117	133	149
7	Makorori Point	25	5	0.00	0.008	30	34	38	44	50	59	68	79	90	104	119
8	Turihau Point	5	5	-0.15	0.007	10	16	22	30	39	50	62	76	91	108	126
9	Pouawa	30	5	-0.20	0.014	35	39	43	49	54	61	68	77	85	95	106
10		0	5	-0.20	0.015	5	9	13	18	24	30	37	45	53	62	72
11		30	5	-0.20	0.014	35	39	43	49	54	61	68	77	85	95	106
12	Waiomoko River	15	15	-0.20	0.032	30	33	36	39	43	47	51	56	61	66	72
13	Whanara	10	10	-0.15	0.017	20	23	27	31	35	41	47	53	60	68	77
14		30	20	-0.20	0.026	50	53	56	60	64	69	74	79	84	91	97
15		40	5	-0.20	0.020	45	49	52	57	61	67	72	79	85	93	101
16	Te Ikaaronga-mai Bay	40	5	-0.30	0.018	45	50	54	60	66	73	80	88	96	105	114
17	Waihau/Waiharehare	40	5	-0.10	0.018	45	48	50	54	58	63	68	74	80	87	94

Beach No.	Beach name	Short-term erosion (m)	Dune slope allowance (m)	Long-term trend (m/year)	SLR recession slope (-)	ASCE (m) for year:										
						2015	2025	2035	2045	2055	2065	2075	2085	2095	2105	2115
18	Waihau Beach	15	20	-0.10	0.036	35	37	39	41	43	46	49	53	56	60	65
19	Tolaga Bay	30	5	0.00	0.013	35	37	40	43	47	53	58	65	72	80	90
20		30	5	-0.70	0.011	35	45	54	66	78	91	104	119	135	152	170
21		0	5	0.00	0.011	5	8	10	15	20	26	32	40	49	59	70
22	Karaka Bay	10	5	-0.10	0.009	15	19	24	30	37	46	54	65	76	90	104
23		10	7	-0.15	0.017	17	20	24	28	32	38	44	50	57	65	74
24	Anaura Bay	15	5	0.00	0.009	20	23	27	32	38	46	53	63	73	86	99
25		15	5	0.00	0.013	20	22	25	28	32	38	43	50	57	65	75
26	Nuhiti Beach	15	7	-0.40	0.017	22	28	34	40	47	56	64	73	82	93	104
27		15	7	0.00	0.010	22	25	28	33	38	45	52	61	70	81	93
28	Karorotuu Bay	15	5	-0.40	0.014	20	26	32	40	47	56	65	76	86	98	111
29	Tokomaru Bay	30	5	0.00	0.014	35	37	39	43	46	51	56	63	69	77	86
30		30	5	0.00	0.016	35	37	39	42	45	49	54	59	65	72	79
31		30	5	0.00	0.014	35	37	39	43	46	51	56	63	69	77	86
32	Te Puia	5	5	0.00	0.015	10	12	14	17	21	25	30	36	42	49	57
33	Waipiro Bay	15	5	-0.27	0.018	20	24	29	34	40	46	53	61	68	77	86
34	Whareponga	15	5	-0.20	0.013	20	24	29	34	40	48	55	64	73	83	95
35	Tuparoa	20	5	0.00	0.015	25	27	29	32	36	40	45	51	57	64	72
36	Repoua	15	5	-0.75	0.013	20	30	40	51	62	75	88	103	117	133	150
37	TikiTiki	30	5	0.00	0.008	35	39	43	49	55	64	73	84	95	109	124
38	Waipau River	100	5	0.00	0.009	105	108	112	117	123	131	138	148	158	171	184

Beach No.	Beach name	Short-term erosion (m)	Dune slope allowance (m)	Long-term trend (m/year)	SLR recession slope (-)	ASCE (m) for year:										
						2015	2025	2035	2045	2055	2065	2075	2085	2095	2105	2115
39	Rangituikia Beach	60	6	0.00	0.011	66	69	71	76	81	87	93	101	110	120	131
40	Maungaroa	20	8	-0.20	0.010	28	33	38	45	52	61	70	81	92	105	119
41	East Cape (south)	10	10	0.00	0.014	20	22	24	28	31	36	41	48	54	62	71
42	East Cape (north)	15	8	0.00	0.008	23	27	31	37	43	52	61	72	83	97	112
43	Horoera	30	5	0.00	0.012	35	38	40	44	48	54	60	68	75	84	94
44		15	15	-0.40	0.017	30	36	42	48	55	64	72	81	90	101	112
45		30	3	0.00	0.011	33	36	38	43	48	54	60	68	77	87	98
46		5	9	-0.05	0.015	14	17	19	23	27	32	37	44	50	58	66
47	Haupara Point	40	4	-0.60	0.011	44	53	61	72	83	95	107	121	136	152	169
48	Karakatu-whero River	80	3	0.00	0.010	83	86	89	94	99	106	113	122	131	142	154
49	Haupara Point	40	4	-0.60	0.010	44	53	62	73	84	97	110	125	140	157	175
50	Punaruku Beach	30	5	0.00	0.010	35	38	41	46	51	58	65	74	83	94	106
51	Hicks Bay	20	3	0.00	0.011	23	26	28	33	38	44	50	58	67	77	88
52		100	4	0.00	0.015	104	106	108	111	115	119	124	130	136	143	151
53	Midway Point	2	5	0.00	0.019	7	8	10	12	15	19	22	27	32	38	44
54		2	5	0.00	0.019	7	8	10	12	15	19	22	27	32	38	44
55	Lottin Point	2	5	0.00	0.019	7	8	10	12	15	19	22	27	32	38	44

Appendix B: ASCE maps

- **Figure B1 – Beach coastline within the Gisborne District**
- **Figure B2 – Example of mapped ASCE for beach coastline**
- **Digital GIS shapefiles (Provided Electronically):**
 - **Beach shoreline 2012**
 - **Beach ASCE 2015**
 - **Beach ASCE 2065**
 - **Beach ASCE 2115**
 - **Cliff shoreline 2012**
 - **Cliff shoreline 2115**
 - **Cliff ASCE 2115**



Path: P:\30548\30548_002\Working\GIS\Map Documents\Appendix B1.mxd Date: 3/08/2016 Time: 2:03:58 p.m.

Sourced from the LINZ Data Service and licensed for re-Location Plan

Sourced from the LINZ Creative Commons Attribution 3.0 New Zealand licence

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

DRAWN	PPK	Aug.16
CHECKED		
APPROVED		
ARCFILE		
Appendix B1.mxd		
SCALE (AT A4 SIZE)		
1:700,000		
PROJECT No.		
30548.002		

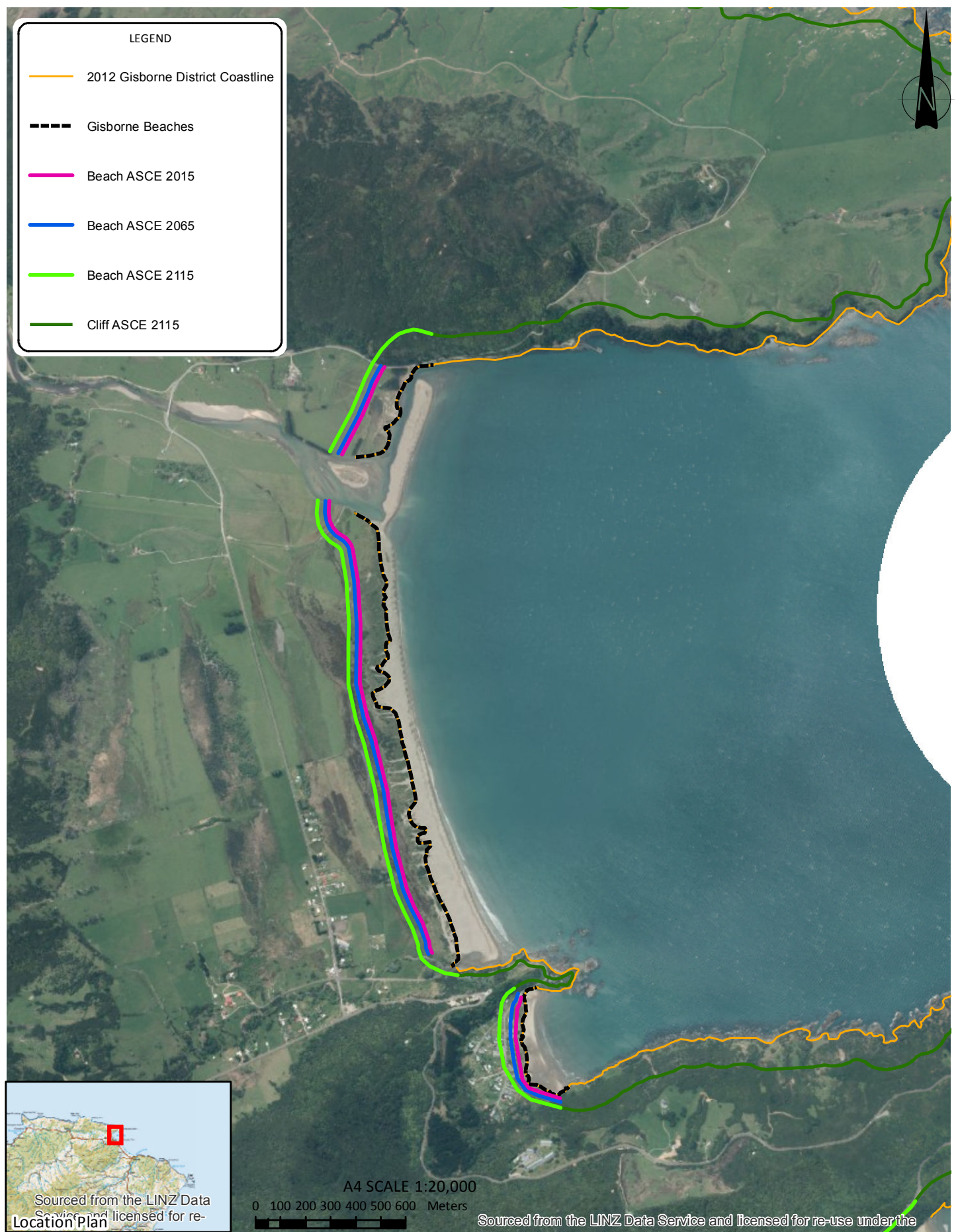
Gisborne District Council
Assessment of ASCE - Udate of T+T (2015)
Beach coastline within the Gisborne District

FIGURE No. **Figure B1**

	Rev. 0
--	---------------

LEGEND

- 2012 Gisborne District Coastline
- - - Gisborne Beaches
- Beach ASCE 2015
- Beach ASCE 2065
- Beach ASCE 2115
- Cliff ASCE 2115



Sourced from the LINZ Data Service and licensed for re-use under the
Location Plan

A4 SCALE 1:20,000
 0 100 200 300 400 500 600 Meters

Sourced from the LINZ Data Service and licensed for re-use under the

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

DRAWN	PPK	Aug.16
CHECKED		
APPROVED		
ARCFILE		
Appendix B2.mxd		
SCALE (AT A4 SIZE)		
1:20,000		
PROJECT No.		
30548.002		

Gisborne District Council
 Assessment of ASCE - Update T+T (2015)
 Example of mapped ASCE for beach coastline

FIGURE No.	Figure B2	Rev.	0
------------	-----------	------	---

Path: P:\30548\30548.002\WorkingMaterial\GIS\Map Documents\Appendix B2.mxd Date: 3/08/2016 Time: 2:03:18 p.m.

