Kapiti Coast District Council

Coastal Management at Paraparaumu
Post-renourishment Trial Monitoring

Review Report No 2

February 1997

1. Introduction

Following a period of erosion continuing over at least ten years from 1983, a beach renourishment trial was carried out in 1994 at a 200 metre long site adjacent to the southern end of Marine Parade, Paraparaumu. At the time of the trial there was considered to be insufficient sand dune remaining for the provision of adequate protection to the roadway (Marine Parade) in the event of further erosion. The purpose of the trial, other than to augment the sand dune and provide improved protection along the most vulnerable part of the roadway, was to determine whether or not beach renourishment could provide a viable means of off-setting the impacts of any further erosion.

After obtaining the necessary resource consents, sand was obtained by scraping from the inter-tidal zone on a section of the beach fronting Manly Street in November 1994 and was transported south along the beach to replenish the dune face and upper part of the beach at the trial site. The amount of sand thus deposited was 6000 m^3 at a more less even distribution of 30 m^3 per metre of beach. The trial site and the area from where the sand was obtained are shown in Figure 1, attached to this report.

Fourteen profile sites were established for the purpose of monitoring the trial. Three profile lines (141, 142 and 143) crossed the renourishment zone and four profile lines (152, 16, 18 and 181) crossed the area from where the sand was obtained. Other profile lines were established (131, 132, 14, 144, 20, 151 and 182) to provide additional information concerning sand movements both close to and remote from the trial zone and the source area.

Each profile was surveyed across the dunes and to a point as far off-shore as could be reached by wading into the surf. The results of each survey were plotted, and the volumetric changes calculated, by staff at Wellington Regional Council. The first survey began on 26 October 1994, just prior to the renourishment trial commencing and surveys were carried out on five further occasions through to mid-September 1995. The data so obtained has provided a valuable insight into the mechanics of sediment movement around the headland at Paraparaumu.

The results of the trial and the monitoring period were presented in the report, *"Beach Renourishment Trial at Marine Parade Paraparaumu"*, J L Lumsden, March 1996.

Strong winds from the north-westerly quadrant occurred on several occasions during the trial resulting in erosion of the Paraparaumu shoreline including the trial zone. Despite this, the beach generally recovered and the trial was judged to have been successful in the conditions that prevailed during the twelve-month trial period. The two main reasons for reaching this conclusion were: firstly the volume of extra sand remaining in the trial area eleven months after deposition was nominally the same as had been originally placed and, secondly, the area from where the sand was taken recovered quickly. There have been no noticeable adverse effects from the renourishment trial.

The trial demonstrated that, from a technical point of view, beach renourishment is a viable proposition as a means of limiting the effects of further erosion at this location, and is consistent with the natural character of this part of the Kapiti coastline.

Among the recommendations included in the March 1996 report was the need for on-going monitoring. This recommendation also suggested that, for the time being, there was no need to continue surveying Profiles 132, 141, 143 and 152. Two new profiles have since been established. Profile 21 is located approximately 300 metres south of Profile 151, off the end of Kapiti Road, and this is to monitor the accretion that has been occurring around the tip of the Paraparaumu headland. Profile 17 has been established approximately 300 metres north of Profile 182 for the purpose of monitoring the on-going erosion at the north end of Manly Street. The profile lines currently being monitored are shown on Figure 1.

2. Description of Changes Since the End of the Trial Period

Since the renourishment trial period ended in mid-September 1995, further surveys have been carried out at the following times:

- 27-28 March 1996
- 24-29 April 1996
- 5-8 November 1996
- 9-10 December 1996

The March 1996 and November 1996 surveys were carried out as part of the regular biannual monitoring programme whereas both the April 1996 and December 1996 surveys were undertaken to record the effects of stormy north-westerly conditions. The volumetric changes that have occurred at each profile site are recorded in Table 1 attached to this report.

Profiles from three of the survey sites, No. 142 at the centre of the trial renourishment site, No. 16 through the original sand supply area, and No 182 towards the northern end of Manly Street, are appended to this report to show graphically the changes that have occurred at these locations since November 1994. Note these cross-sections have been redrawn from the survey plots produced by Wellington Regional Council.

Descriptions of the changes that have occurred at each profile site follow.

Profile 131 ~ 300 metres south of the trial site

Minor changes were recorded across the beach to LW with more noticeable growth near MSL and LW and bar movements off-shore. There has been a significant gain of 10.44 m^3/m between April 1996 and November 1996 and this was followed by a much larger and more rapid gain of 29.42 m^3/m during the subsequent month to December 1996. The December profile shows a large build up against the dune face that is unexplained at this stage but may be a survey anomaly, placing some doubt on the magnitude of the gain in volume recorded. MSL has moved 8 metres seaward since the conclusion of the Marine Parade replenishment contract in November 1994. Most of the more recent growth seems to have occurred below LW and this is an encouraging sign for the beach at this location.

Profile 14 ~ Immediately south of the trial site

Variable changes have occurred across the beach to LW and there has been noticeable bar movement off-shore. Dune face remains unchanged but there has been some build up near HW and LW. MSL has moved seaward 11 metres since November 1994 but less change has occurred since November 1995. The beach gained in volume 15.94 m^3/m during April 1996 to November 1996 and the subsequent month's gain to December 1996 was much smaller at 1.19 m^3/m.

Profile 142 ~ Centre of renourishment trial site

There has been some loss of sand from the dune face between November 1996 and December 1996. Total recession of the dune since November 1994 equals approximately 4 metres. Notwithstanding this, levels across the beach down to LW are generally higher and the profile gained 13.46 m^3/m during the April 1996 to November 1996 period. This was followed by a further 5.92 m^3/m gain during the following month to December 1996. MSL has moved 9 metres seaward since November 1994. Significant movement in bar area off-shore noted. The changes that have occurred at Profile 142 since November 1994 are shown graphically on the cross-sections attached to this report.

Profile 144 ~ Just north of trial site opposite Tahi Street

Small loss of sand from dune face during November 1996 to December 1996 period. There has been 2 metres recession since November 1995. There is growth evident across the beach to LW with noticeable bar movement off-shore. This profile gained only 2.16 m^3/m during the April 1996 to November 1996 period but this was followed by a very large increase in volume of 23.15 m^3/m during the subsequent month to December 1996. MSL has moved seaward 16 metres since November 1994.

Profile 20 ~ 270 metres north of trial site opposite Rua Road

Growth at this profile has mainly occurred in the area between HW and MSL and there has been little change in the location of the dune face. Significant movement of sand in bar area off-shore. There have been small net gains in volume only (3.93 m^3/m between April - November 96 and 0.11 m^3/m between November - December 96). Despite small recent gains, MSL has moved seaward 16 m since November 1994 although most of this occurred during the post-trial period to April 1996.

Profile 21 ~ Opposite the end of Kapiti Road

This profile was established after completion of the trial period to monitor apparent accretion of the beach in this area. Profile 21 is located approximately 300 metres to the south of existing Profile 151 and has been surveyed on two previous occasions, firstly on 28 March 1996 and secondly on 26 April 1996. There was a large gain in volume of 42.27 m^3/m measured at this profile during the subsequent period between April 1996 and November 1996 and this was followed by a loss of 4.82 m^3/m during November 1996 to December 1996. Some of this growth has occurred across the beach with more noticeable change in the off-shore bar area and evidence of bar exposure at LW. There has been no change recorded at the dune face.

Profile 151 ~ 300 metres south of sand supply area (opp. 35 Manly St)

A further significant gain of 19.92 m^3/m in the beach volume occurred during the April 1996 to November 1996 period and this followed the consistent beach growth established at this profile during the trial period. A loss of 9.88 m^3/m occurred during the subsequent month to December 1996. Sizeable gains in sediment are also evident in the inter-tidal zone resulting from the shoreward movement of off-shore bar material. As a result of the growth that has occurred, HWST is now 25 metres seaward of its position in November 1994 and MSL is now 35 metres seaward.

Profile 16 ~ Through sand supply area opposite Nathan Street

Some growth in the beach is evident above HW, with beach lowering evident across the inter-tidal zone. Overall, this profile suffered a significant loss in volume of 29.25 m^3/m, mostly from the inter-tidal zone near MSL, during the April 1996 to November 1996 period but this was followed by a reasonable gain of 9.08 m^3/m during the subsequent month to December 1996. Movement in bar area also noted. MHWS has moved seawards 30 metres and MSL, 24 metres since November 1994. The changes that have occurred at Profile 16 since November 1994 are shown graphically on the cross-sections attached to this report.

Profile 18 ~ Through sand supply area (103 Manly St)

In contrast to Profile 16, the beach at this location gained 15.80 m^3/m during the April 1996 to November 1996 period and this was followed by a loss of 4.54 m^3/m during the following month to December 1996. Most of the growth appears to have occurred between MSL the base of the dunes. MHWS has moved seawards 22 metres and MSL 16 metres since November 1994.

Profile 181 ~ North end of sand supply area (131 Manly St)

There is clear evidence of loss of sand from the dunes and significant movement off-shore. The mobility of the beach sediments, particularly below MSL, during the survey period is highlighted by the survey results, which show that following a very large gain of 66.12 m^3/m during the April 1996 to November 1996 period, there was an even larger loss of 81.13 m^3/m during the subsequent one month period to December 1996. The profiles show uncharacteristic changes occurring at the dune face in the form of accretion

followed by erosion suggesting the possibility of a survey error. Despite these changes, the location of MHWS has not changed much although MSL has retreated 13 metres since November 1994.

Profile 182 ~ 300 metres north of sand supply area (163 Manly St)

Approximately 3 metres has been lost from the dune face at this profile since April 1996 and sand levels are generally lower across the beach to MSL. Below MSL there is significant sediment mobility. The recorded loss during the April 1996 to November 1996 period was small (0.95 m^3/m) but this was followed by a large loss of 32.85 m^3/m during the following month. Both the dune face as well as HW have retreated approximately 10 metres since November 1994. MSL has moved shoreward 13 metres during the same period. Lowering of the beach against the toe of the dune is noted.

Profile 17 ~ Opposite 202 Manly Street

This is a new profile, located to the north of Profile 182 for the purpose of providing additional monitoring of the erosion that has been occurring along the northern end of Manly Street. This profile was first surveyed on 29 April 1996. Although the current surveys indicate little change in the dune face, HW has retreated 6 metres since April 1996 and is now only 14 metres from the toe of the dune. A modest gain of 5.95 m^3/m above MSL occurred during the April 1996 to November 1996 period was followed by a more significant loss of 16.27 m^3/m during the following month to December 1996. The beach here is noticeably narrower than further south along Manly Street and the steepness of the profile indicates a deficit in the sediment budget.

3. Discussion

During the seven-month period (April to November 1996) covering winter and spring, strong growth was recorded at all survey sites except at Profiles 16 and 182 along Manly Street. The loss at Profile 182 was small (0.95 m^3/m) and it is noted that at Profile 17 to the north, a gain of 5.95 m^3/m was recorded. Both these two profiles are in the zone at the north end of Manly Street that has suffered net erosion during the last two years.

A much more significant volume of sand (29.25 m^3/m) was lost at Profile 16, which was unusual in that this part of the Manly Street beach has experienced consistently strong growth in the two years since November 1994 when the sand replenishment exercise was completed.

An atypical result was also obtained at Profile 181, situated just south of Profile 182, where a substantial gain of 66.12 m^3/m was recorded during the same period. The beach at this profile, however, has been consistently losing sand since November 1994 and this result should treated with caution at this stage.

As noted, the December survey was carried out to record the impact of strong north-west conditions that prevailed during the previous month. The results show that significant losses occurred at Profiles 182 and 17 at the north end of Manly Street but, apart from relatively smaller losses also occurring at Profiles 21 and 151, other sites generally fared

much better with sizeable gains (29.42 m^3/m and 23.15 m^3/m) being recorded at Profiles 131 and 144, respectively.

The more recent behaviour of the beach at Profile 131 is noteworthy in that there were only minor changes in sand volume during the renourishment trial and the subsequent monitoring period. Since September 1995, however, despite there being some doubt about the validity of the December 1996 survey result, this part of the coast has experienced steady growth apart from a loss of sand that occurred during adverse conditions in March/April 1996. Importantly, this growth has not been at the expense of the renourished site, 300 metres to the north at Marine Parade, as this has also accreted during the same period. While it is too soon to suggest development of a trend towards growth in the longer term, the continuing accumulation of sand along the coast south of the Paraparaumu headland does indicate a positive sediment budget during the two-year interval since the renourishment trial, and a reverse for a time at least in the erosion cycle.

An alternative means of illustrating the changes in beach shape is to consider the lateral (horizontal) displacement in sea level resulting from erosion or accretion over a period of time. This perhaps gives a more easily visualised indication of beach change. The horizontal displacement of Mean Sea Level has been measured for each profile location where surveys have been carried out over the two-year period since the renourishment trial. The results have been added to Figure 1.

The measurements illustrate the net growth that has been occurring at all sites around the headland, from Profile 18 at 103 Manly Street, south to Profile 131. The maximum seaward displacement of Mean Sea Level is 35 metres measured at Profile 151 and this is commensurate with the very large gain in sand volume (142 m^3/m) that has occurred at this site during the same period. Such gains clearly exceed the volumes required for adequate sand dune conservation and storm protection, and does raise the question of whether or not some of this excess sand might be made available for use in areas where there is a deficit in the sediment budget, for the benefit of the wider community. The general accretion, particularly south of the headland, is encouraging.

North of Profile 18 the opposite is the case and, at Profiles 181 and 182, Mean Sea Level has receded 13 metres since November 1994 in both cases. The possible relationship of this erosion to changes in the mouth of the Waikanae River has been discussed in earlier reports but, until the outlet reverts to its former position prior to re-alignment, the extent to which the river may or may not be to blame is uncertain at this stage.

Even if the changes to the river mouth can eventually be identified as the cause, it is considered unwise to wait until this happens, and it is appropriate for Council to review its obligations in regard to this matter and to continue regular monitoring of this area. While the prospect of on-going erosion will be a matter of concern to residents in the area, proposals for mitigation have not been considered at this stage although the need for positive action at some time in the future cannot be ruled out.

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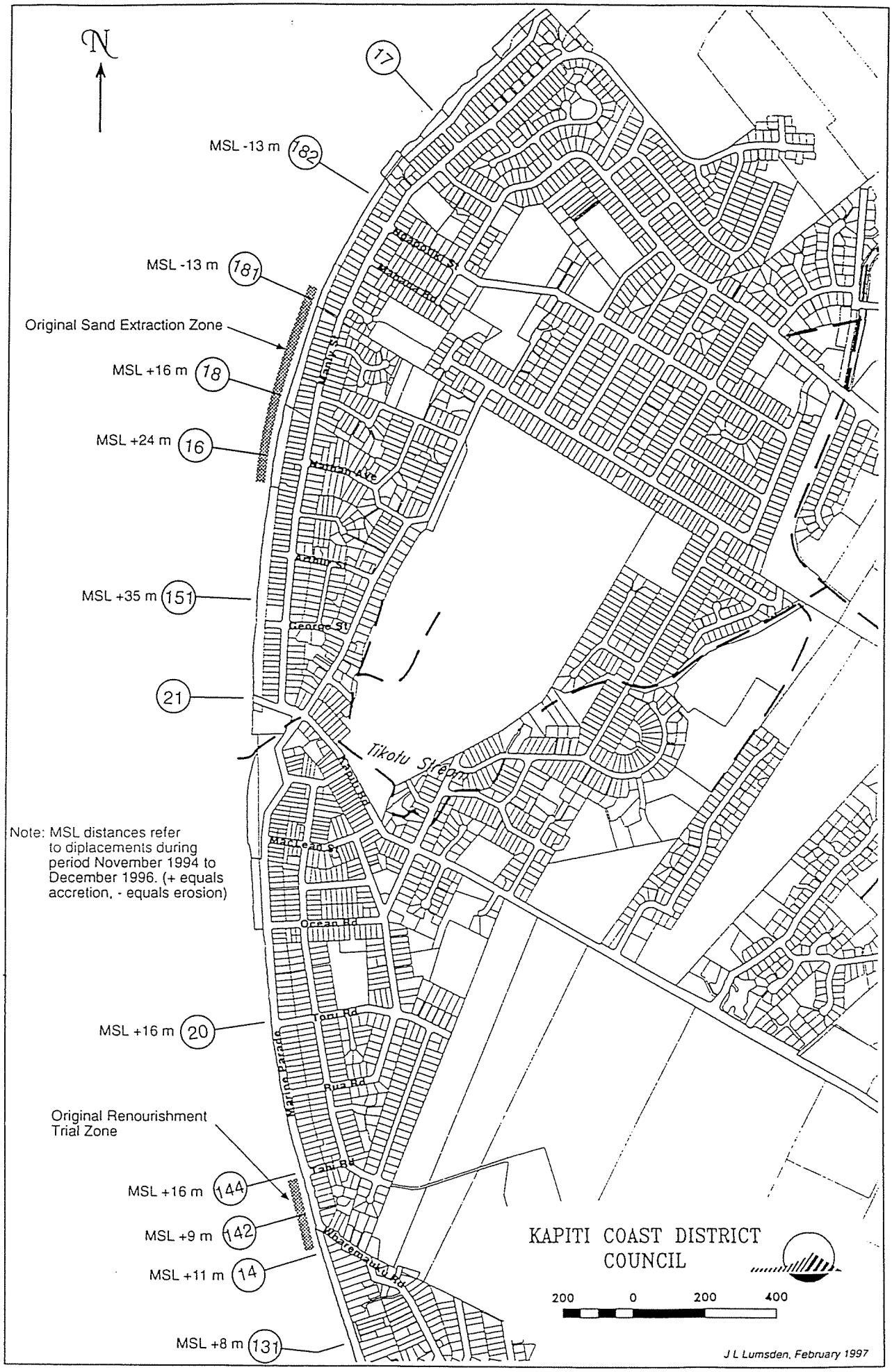

Figure 1: Paraparaumu Shoreline Showing Profile Locations Presently Being Monitored

Table 1: Changes in Beach Volume Following Renourishment Trial at Marine Parade, Paraparaumu

Profile	Oct-94 to Nov-94	Nov-94 to Sep-95	Sep-95 to Mar-96	Mar-96 to Apr-96	Apr-96 to Nov-96	Nov-96 to Dec-96					Sep-95 to Dec-96	Nov-94 to Dec-96
131	2.950	-3.567	12.892	-6.315	10.435	29.423					46.435	42.868
132	3.038	6.975										
14	7.275	10.270	-3.155	9.523	15.939	1.187					23.494	33.764
141	25.488	-1.260										
142	27.016	-4.115	-5.984	8.425	13.462	5.921					21.824	17.709
143	30.940	3.441										
144	15.785	9.334	-7.634	1.116	2.162	23.147					18.791	28.125
20	2.684	23.558	11.145	3.234	3.928	0.105					18.412	41.970
21				-10.678	42.271	-4.817					26.776	26.776
151	30.067	91.867	21.118	8.258	19.922	-9.878					39.420	131.287
152	46.709	2.924										
16	-12.229	38.889	53.488	28.287	-29.245	9.803					62.333	101.222
18	-43.858	67.231	29.910	-21.579	15.799	-4.540					19.590	86.821
181	-58.141	9.502	-6.559	-39.390	66.119	-81.128					-60.958	-51.456
182	-69.581	-2.042	-4.644	0.123	-0.953	-32.846					-38.320	-40.362
17					5.948	-16.267						

Note: 1. Figures show volumetric changes in beach profile in cubic metres per metre along the beach.

2. The shaded zones represent the cut (lower) and fill (upper) zones.

3. Negative values represent loss of sand. Positive values represent accretion.

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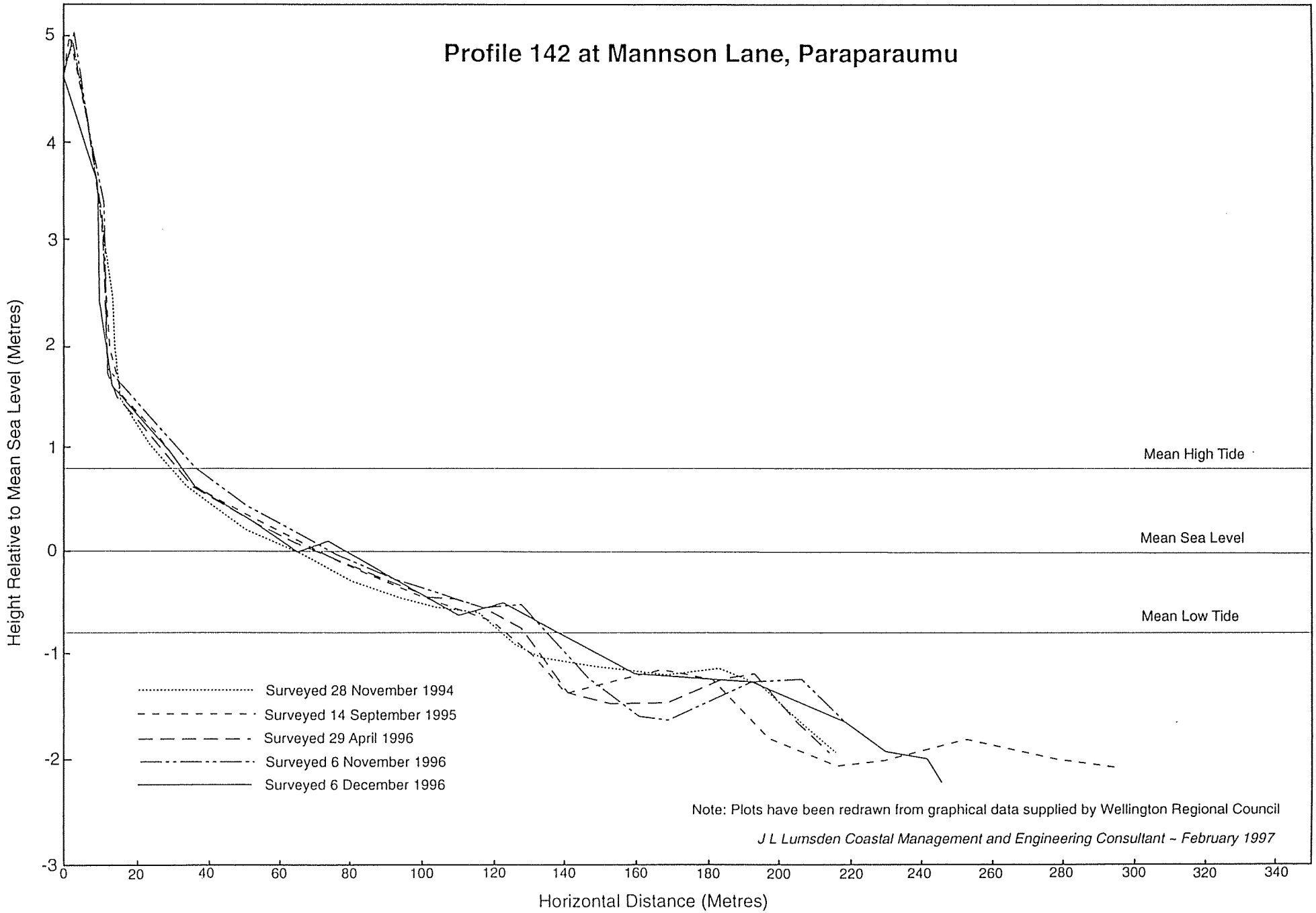
Profile 142 at Mannson Lane, Paraparaumu
Height Relative to Mean Sea Level (Metres)
5
4
3
2
1
0
-1
-2
-3
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
Horizontal Distance (Metres)
Mean High Tide
Mean Sea Level
Mean Low Tide
Surveyed 28 November 1994
Surveyed 14 September 1995
Surveyed 29 April 1996
Surveyed 6 November 1996
Surveyed 6 December 1996
Note: Plots have been redrawn from graphical data supplied by Wellington Regional Council
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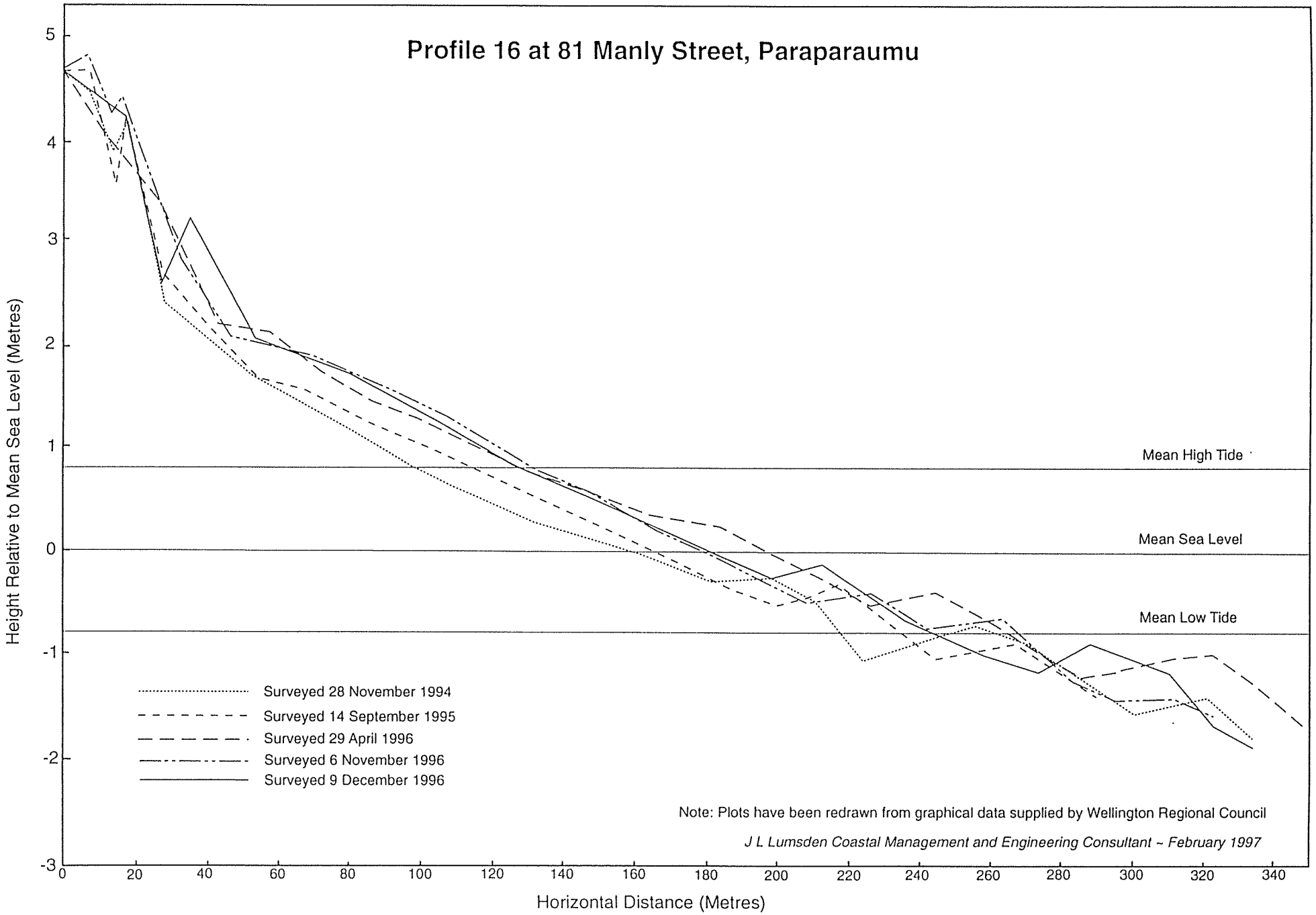
Profile 16 at 81 Manly Street, Paraparaumu
Height Relative to Mean Sea Level (Metres)
5
4
3
2
1
0
-1
-2
-3
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
Horizontal Distance (Metres)
Mean High Tide
Mean Sea Level
Mean Low Tide
Surveyed 28 November 1994
Surveyed 14 September 1995
Surveyed 29 April 1996
Surveyed 6 November 1996
Surveyed 9 December 1996
Note: Plots have been redrawn from graphical data supplied by Wellington Regional Council
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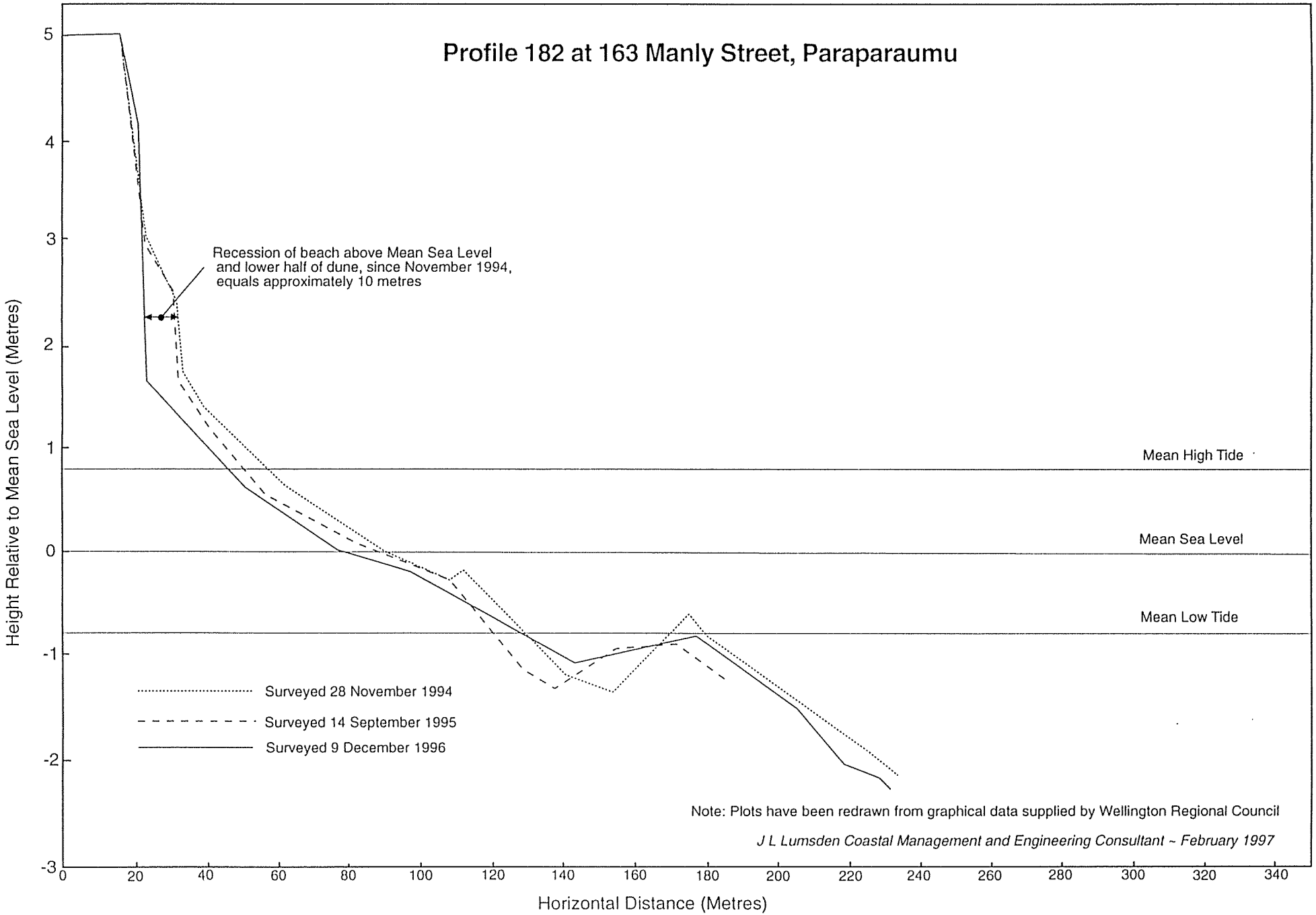
Profile 182 at 163 Manly Street, Paraparaumu
Recession of beach above Mean Sea Level and lower half of dune, since November 1994, equals approximately 10 metres
Mean High Tide
Mean Sea Level
Mean Low Tide
Surveyed 28 November 1994
Surveyed 14 September 1995
Surveyed 9 December 1996
Note: Plots have been redrawn from graphical data supplied by Wellington Regional Council
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Height Relative to Mean Sea Level (Metres)
Horizontal Distance (Metres)
5
4
3
2
1
0
-1
-2
-3
0
20
40
60
80
100
120
140
160
180
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