

**Report on South Canterbury  
Coastal Flooding Event,  
19-22 July 2001.**

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## **1 BACKGROUND**

Canterbury has a long history of natural coastal hazards. These hazards are primarily the result of coastal erosion and seawater inundation during storm events. These events cause the complete loss of land or affect its production capacity. Damage to property is common, and there is always the potential for these events to threaten life. The issue for Environment Canterbury is how to avoid or mitigate the actual and potential cost of these hazards to the community, and how to ensure that the methods used to reduce costs are appropriate for the environment in which they operate. The aim of natural hazard management is to minimise the net cost of damage. In the coastal environment adopting the principal of avoidance rather than post-hoc protection is the most effective approach in terms of avoiding loss or damage to people, property, or other parts of the natural environment. Development in this manner also promotes sustainable management of the coastal zone.

To achieve these objectives a significant amount of information is required on coastal processes and extreme events that occur along the Canterbury coastline, as well as the effects that they have on adjacent land. Environment Canterbury's Proposed Regional Coastal Environment Plan addresses coastal hazards by defining Coastal Hazard Zones along the Region's coast which indicate land which is at risk from erosion. Also defined in the plan are those coastal margins that can be inundated with seawater during large storm events. A comprehensive coastal monitoring programme is currently in place, part of which is preparing reports on changes in the coastal environment and on significant coastal events. This information can be used for future coastal hazard management and policy formation. Monitoring, analysis and recording of large coastal storms is important for this process as their impacts can be forgotten.

## **2 INTRODUCTION TO REPORT**

The purpose of this report is to summarise and present information on the damage resulting from a severe coastal storm on 19-22 July 2001. The land affected is primarily within the coastal strip south of Timaru, between the Otaio River and Sinclairs Creek (approximately 4 km south of the Waihao Box). A large proportion of this area is productive cropping land and pasture. The coastal margins north of Timaru from Washdyke to the Orari River were also affected but to a lesser degree.

This storm resulted in approximately 1150 hectares of low-lying coastal land being inundated by seawater (south of Timaru). This inundation is a direct result of the gravel beach system being overtopped by a combination of very large waves and elevated sea levels, coinciding with exceptionally large tides. Seawater covered the land for several days in most places, but for up to two weeks in others. The areas that were flooded have been mapped and details of the storm event and its functions are discussed later in this report.

This report also details the significant alterations that occurred to the coastline as a result of the storm event, especially a section of the barrier beach fronting the Wainono Lagoon. Here the barrier has been lowered extensively as beach material has been pushed inland and into the Lagoon margin.

The last time that a storm and associated sea flooding of this magnitude occurred was 16 years ago in July of 1985. This storm caused a complete failure of a section of the barrier beach, but significantly less inundation. This report compares this latest storm to the 1985 event.

### **3 SUMMARY OF FLOOD LOG**

At 1.15 p.m. on Thursday 19 July 2001 (approximately high tide) the ECan Timaru office was informed by a Waihao farmer (one of our coastal storm observers) of heavy swells and some beach overtopping. A MetService heavy swell warning was received soon after this report indicating 3 m to 4.5 m Southeast swells forecast to continue for the following 12 - 24 hours. This swell warning was passed on to other ECan coastal observers on Thursday afternoon. During the early morning high tide (2 a.m.) on Friday 20 July 2001 considerable beach overtopping and lowering occurred between the Orari River and the Waihao River with serious coastal flooding reported around the Wainono/Waihao area.

The MetService continued to issue heavy swell warnings for the remainder of Friday with even higher seas expected for the following 2 days. Civil Defence warnings of possible continued coastal flooding were broadcast on South Canterbury radio but although some further overtopping of beaches was reported at high tides during Saturday 21 and Sunday 22 July, no further serious problems were reported. The complete Flood Log can be seen in Appendix 1.

## **4 DESCRIPTION OF STORM**

### **4.1 Meteorological Service Warnings**

As described in Section 3, Environment Canterbury staff were first made aware of storm activity from eyewitness reports of beach overtopping at Waihao during the early afternoon (45 min prior to high tide) of July 19 2001. The first swell warning from the Meteorological Service received at 2.30pm on July 19 for the Rangitata sea area predicted 3 to 4.5m south-east swells forecast to continue for the following 12 to 24 hrs. Air pressure was recorded as 988hPa. The Met Service updated their warning on Friday July 20 for east to south-east swells to continue to build from 4m to occasionally 6m on Friday and to rise to occasional 7m during Saturday July 21.

### **4.2 Atmospheric conditions contributing to the coastal storm**

A low pressure system (983hPa) with an associated slow moving front situated north-west of the Chatham Islands, produced large north to south-easterly swells the largest of which were recorded by the Canterbury wave buoy as 8.5 metres high with periods approaching 12 seconds. The depression was fairly stationary from about July 19 to July 22 before weakening and moving away from the country to the north-east. Onshore south-easterly winds of 30 to 40 knots were associated with the low pressure system. Figure 4.1a shows the mean sea level analysis chart for July 20 2001. Figure 4.1b is the mean sea level analysis chart for the last significant coastal storm to affect the South Canterbury coast in July 1985. Both storms are characterised by a slow moving depression situated off the Chatham Islands, creating a strong east to south-east flow onto the east coast of the South Island.

No sea level data is available for South Canterbury as Port of Timaru's tide gauge was non-operational during this period, however data is available from the Sumner sea level recorder. The predicted high tides during the main coastal flooding event were between 2.40m (19 July) and 2.50m (20 July), which corresponds to 0.98 m - 1.08 m above Mean Sea Level (MSL) at Timaru. Data from the Sumner Head Sea Level Recorder show maximum sea levels of 1.39m (19 July) to 1.41m (20 July) above MSL, which approximates to a water level of 0.41m above the predicted high tide on 19 July and 0.33m above the predicted high tide on 20 July. Storm surge (low air pressure causing elevated sea levels) accounts for most of this (perhaps up to 0.24m), with the exact amount yet to be investigated. Wave set up as a result of strong onshore winds will also have contributed to elevated water levels along the southern Canterbury coast.

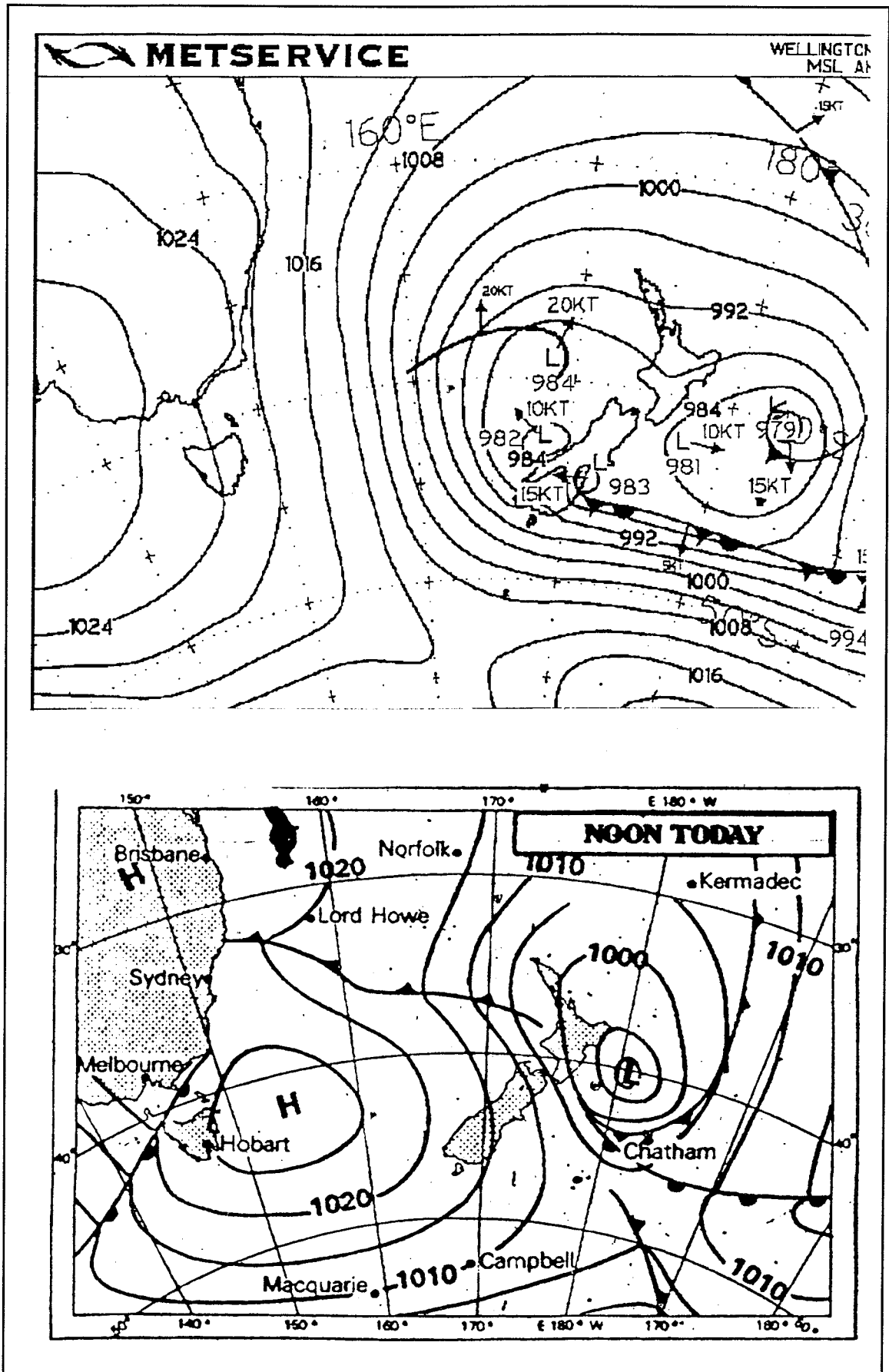


Figure 4.1a (top): Mean sea level analysis chart for 20 July 2001.

Figure 4.1b (bottom): Mean sea level analysis chart for 27 July 1985. Note the similarity of the location of the depression near the Chatham Islands causing southeast to easterly swells approaching the east coast of the South Island. Both storms caused damage to similar parts of the Canterbury coast.

### 4.3 Deepwater Wave Conditions

Data from the joint Ecan/NIWA directional wave rider buoy is presented in Figures 4.2 and 4.3. The wave buoy is located in deep water, 17 kilometres offshore of Le Bons Bay, Banks Peninsula. It is believed that deep water wave conditions between South Canterbury and east of Banks Peninsula will not have been significantly different during this storm event. From Figure 4.2 it can be seen that following several days of moderately high swell conditions on the 17 and 18 July, waves built steadily during the day on July 19 to reach a peak ( $H_{sig}^1$  of 4.8m with  $H_{max}^2$  of 7.7m) immediately after midnight on 20 July. This peak in wave activity corresponded with high tide on the south Canterbury coast (0200 hrs). Wave period also reached a peak during the early morning of July 20 (Figure 4.2). Eyewitness reports also indicate that this early morning period, where high tide and a peak in swell height and period combined, was the time in which the most severe beach overtopping and coastal hinterland flooding occurred. Heavy swells continued through until the evening of July 22 when they began to die away. Significant deepwater wave height generally remained between 4 and 5 metres for the duration of the storm event with maximum wave heights generally remaining above 7 metres. The highest waves recorded during the storm were 8.5 metres during the early morning of July 22.

Figure 4.3 shows the direction of swell during the storm event. The storm had a significant easterly component with 77% of the three hourly recorded directional averages arriving from 10 degrees either side of due east (80-100 degrees).

### 4.4 Nearshore Wave Conditions

The characteristics of deepwater waves change as they approach shallower water at the shore and break. Unfortunately no data, either physically measured or visually estimated, on wave conditions (breaker heights) at the shore were recorded for this storm.

Breaker heights can however be estimated theoretically from the deepwater wave data using mathematical formulae. From the deepwater wave conditions described in Section 4.3 and in figures 4.2 and 4.3 and using the methods described in the Coastal Engineering Manual (2001) the estimated breaker height based on wave

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<sup>1</sup>  $H_{sig}$  is the Significant Wave Height, which represents the average height of the largest 33% of waves.

<sup>2</sup>  $H_{max}$  is the Maximum Wave Height that was recorded during a particular period.

Figure 4.2: Deepwater Wave Conditions 17-24 July 2001 (3 hourly intervals)

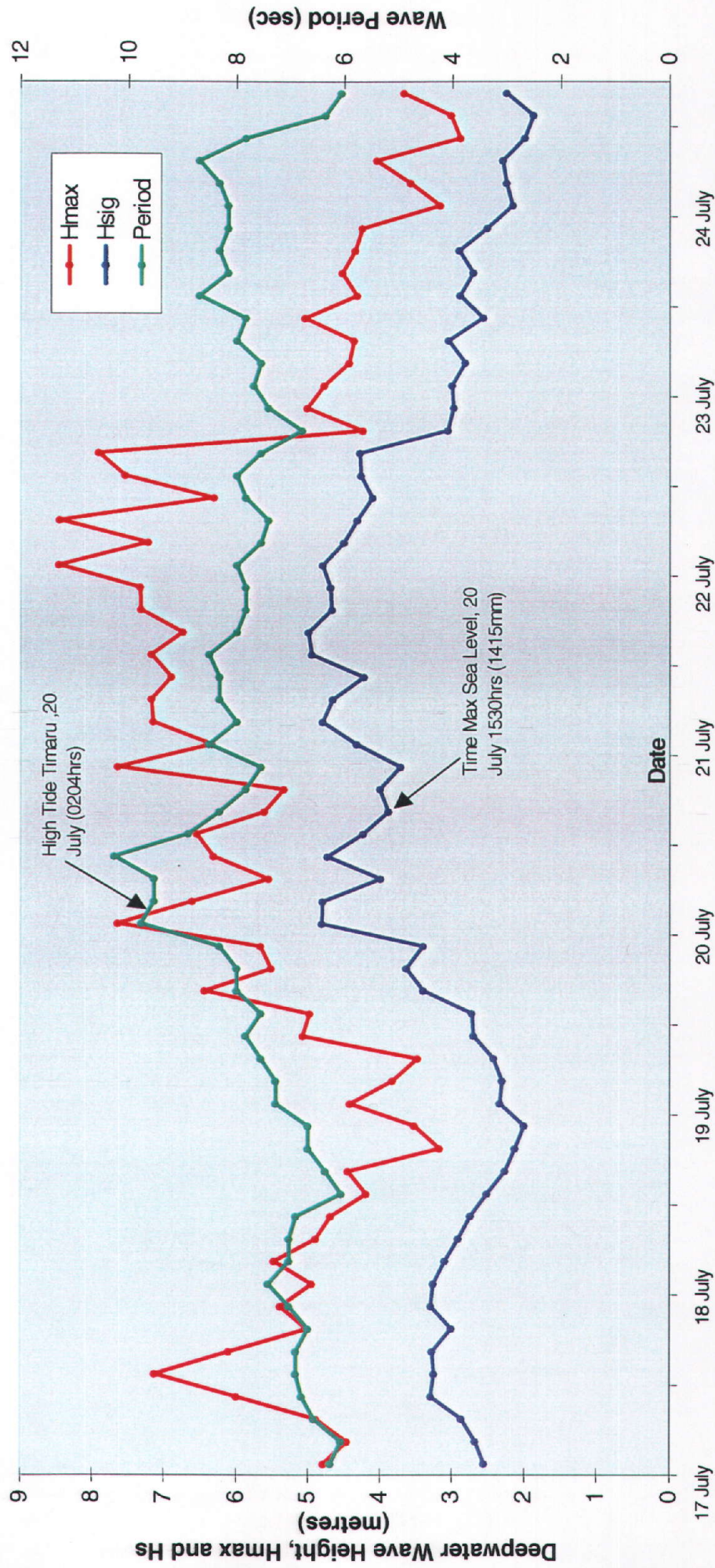
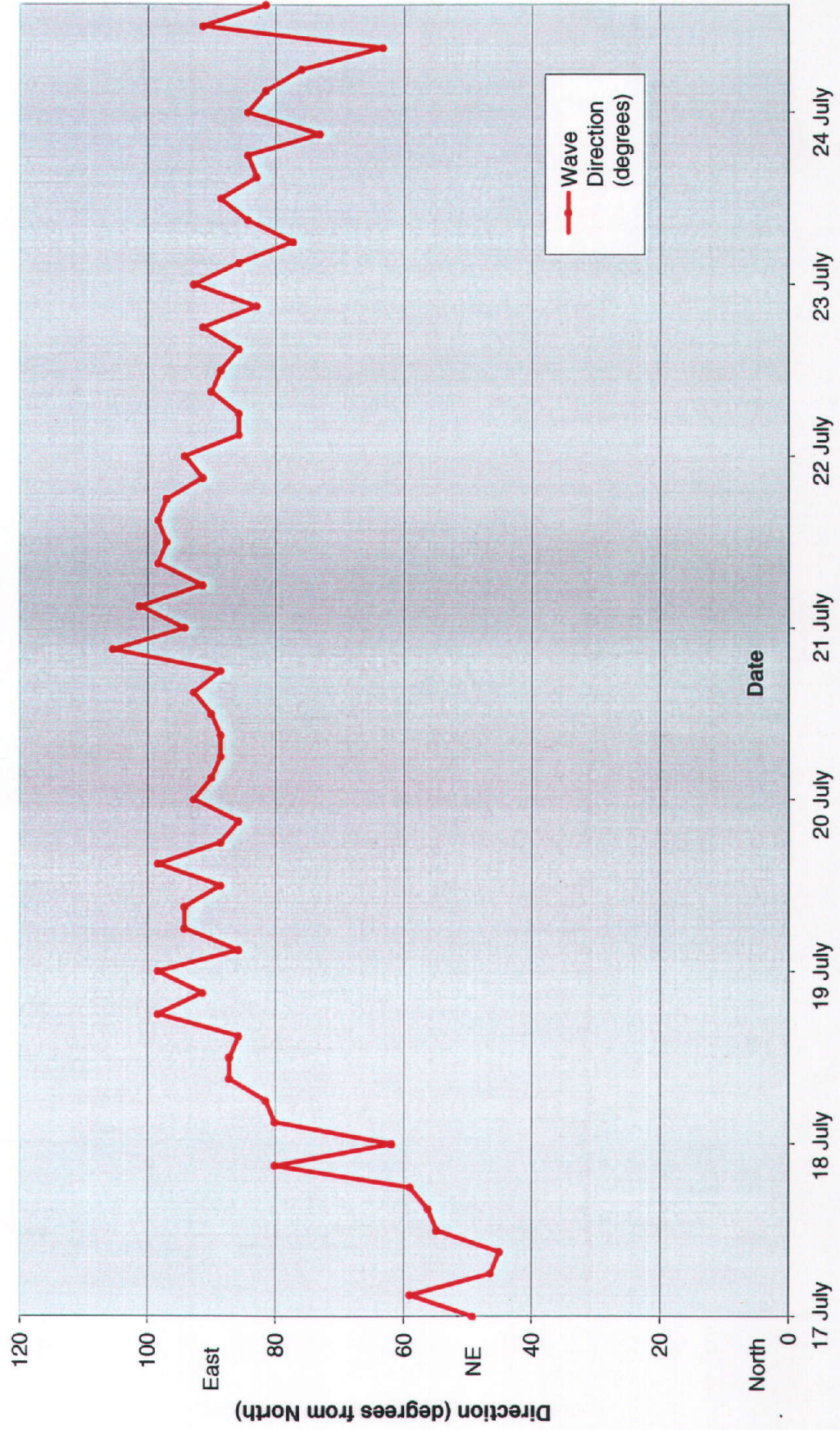




Figure 4.3: Deepwater Wave Direction 17-24 July 2001 (3 hourly intervals)



conditions during the initial storm peak on the early morning of July 20 was 5.3 metres. The Coastal Engineering Manual (2001) also indicates that the water depth at the point of this wave breaking would be 6.2 metres.

Water depth of 6.2 metres is found well offshore, hence the largest breakers will break a significant distance from the beach and will dissipate their energy before arriving at the shore. The most damaging waves therefore, are the ones that break nearest to the shore. They produce the highest runup and are likely to cause most of the beach crest overtopping.

The maximum height of wave breaking at the shore is dependent on water depth at the toe of the beach. On the mixed sand and gravel beaches of South Canterbury, the beach toe is the bottom of the nearshore step. Survey data is limited for this part of the beach profile, however the bottom of this step has been measured at Washdyke beach, north of Timaru. Assuming a similar nearshore profile on beaches south of Timaru we can place the reduced level (RL) of the base of the step at around -3.0 metres below Mean Sea Level (MSL). On 19 July, high tide at Timaru was around 0.98m above MSL and storm surge has been estimated at around 0.41m (Section 4.2). These extra components added to the depth of the nearshore step gives an estimated water depth of approximately 4.4 metres.

As a general rule of thumb, based on the ratio of breaker height to water depth (Pethick 1984, Komar 1998), water depth can be multiplied by an average critical value of 0.78 to get an estimate of the maximum breaking wave at this water depth. Therefore at 4.4m water depth the height of the maximum breaking wave will theoretically be 3.4m. A previous report on the 1985 coastal storm along the south Canterbury coast (Connell and Todd 1985) in which offshore wave conditions were similar, describes visual estimates of breakers at the shore of 3.0 metres. Breakers of greater than 3.0m have been shown to generate runup of over 7.0m above MSL on south Canterbury beaches (Connell and Todd 1985). Average height of the beach crest before the storm was approximately RL 5.5 metres. Therefore breakers of 3.4 metres would produce significant beach overtopping which, evidenced by the significant amount of coastal flooding, did in fact occur.

## **5 POST STORM MONITORING AND ANALYSIS**

Immediately after the event the focus was on finding out the exact extent of the inundation that had occurred. As soon as weather permitted, aerial photographs and video was taken of the whole coastal area from the Orari River to the Waihao River on Monday 23 July (four days after the onset of the flooding event). This has provided an indication of coastal erosion and an excellent record of the extent of land inundated by seawater. The photographs have been catalogued and along with the video have been stored in the ECan records system.

A small team of ECan staff then spent several days in the Washdyke/Opihi and Waihao/Wainono areas during the following week (Tuesday 31 July – Thursday 2 August). Numerous farmers in the area were interviewed to gain a better understanding of the storm and its impacts, as well as to discuss the functioning of the storm warning and coastal observers' network. A number of coastal cross-sections were surveyed and a large topographic survey was undertaken of an area of the Wainono Barrier. This information on the coastal erosion resulting from the storm has since been analysed and compared against the pre-storm state of the coastline. The results from this work are presented in Section 6.

With respect to the sea flooding, a ground truthing survey was conducted to determine the accuracy of the flooding shown in the aerial photographs. In some areas the extent of flooding was expanded where debris lines indicated that the landward extent of inundation had been greater than that shown by the photographs. In these locations, seawater had obviously receded in the three to four days following the initial event, although the majority of ground truthing indicated that the photographs accurately recorded maximum flood extents. The extent of inundation was then transferred to 1:20 000 scale vertical aerial photographs. Co-ordinates of the flooded areas were then entered into the ECan Geographic Information System for analysis. From these investigations flood extent maps for the area south of the Otaio River to Sinclairs Creek have been created. Approximately 1150 hectares of land was inundated during this coastal storm. This figure is exclusive of the area normally covered by the margins of Wainono Lagoon. A detailed discussion of the sea flooding is contained in Section 7. Similar maps were also created for the coastline north of Timaru to the Orari River, however the inundation was significantly less for this section of the coastline.

## 6 COASTAL EROSION RESULTING FROM THE STORM

Following the storm, a number of coastal profile surveys were carried out both north and south of Timaru (See Appendix 2 for cross-section locations). A longitudinal section along part of the beach at Wainono Lagoon was also surveyed. These sections have been compared with pre-storm surveys and a summary of results is presented;

### 6.1 North of Timaru

As can be seen in Table 6.1 the beach sections north of Timaru all experienced a landward retreat of the beach crest position. All but one section had significant volume losses, with the beach at the southern end of Washdyke lagoon (section S1175) undergoing significant loss of beach sediment (48.9 m<sup>3</sup>/m) as well as 13 metres of erosion at the beach crest. At Connolly's Rd (S0081) there was significant erosion of the old stopbank that had previously contained the beach (see Figure 6.1). The top of the old stopbank was eroded back over 5 metres and was reduced in height by 2 metres. The toe of the beach is now at the base of the new stopbank that was nearly overtopped by floodwater (Figure 6.2). Water reached a RL of 6.05m MSL, only 0.5m from the top of the stopbank. Beach gravel was deposited on the carpark area up to a depth of 0.5m. Much of the beach gravel was stripped from the beach leaving only basement material exposed (Figure 6.3).

*Table 6.1 Summary of post-storm erosion surveys. Sections north of Timaru. Negative numbers indicate erosion.*

<b>Section Code (see Appendix 2 for location)</b>	<b>Beach Movement at Crest (metres)</b>	<b>Beach Elevation Change at Crest (metres)</b>	<b>Beach Volume Change (m<sup>3</sup>/m)</b>
S0081 <sup>a</sup>	-5.1	-2.02	-36.6
S0329 <sup>a</sup>	-0.5	-0.03	-10.8
S0966 <sup>a</sup>	-13.5	-0.08	-6.6
S1005 <sup>b</sup>	-4.4	0.0	-1.4
S1075 <sup>b</sup>	-3.0	-0.31	+13.3
S1135 <sup>b</sup>	-1.0	-0.16	-25.0
S1175 <sup>b</sup>	-13.1	-0.39	-48.9

Note: Sections surveyed 11 days after the storm and compared to surveys carried out 4 months before the storm.

- a. Seadown cross sections
- b. Washdyke lagoon sections



Figure 6.1 Significant Erosion of Old Coastal Stopbank at Connolly's Rd.

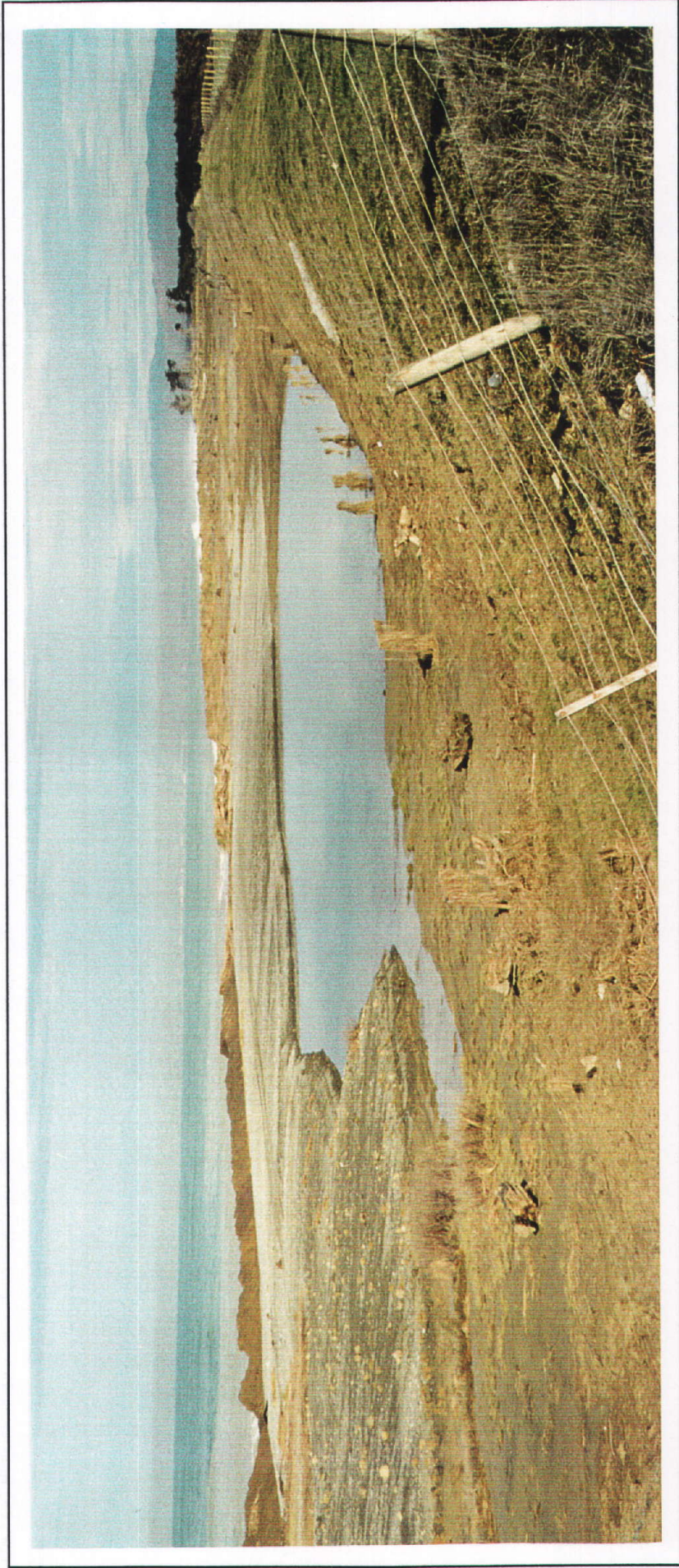


Figure 6.2 Beach Toe position now at the base of the New Stopbank at Connolly's Rd. Note also the flood debris line near the top of the bank.

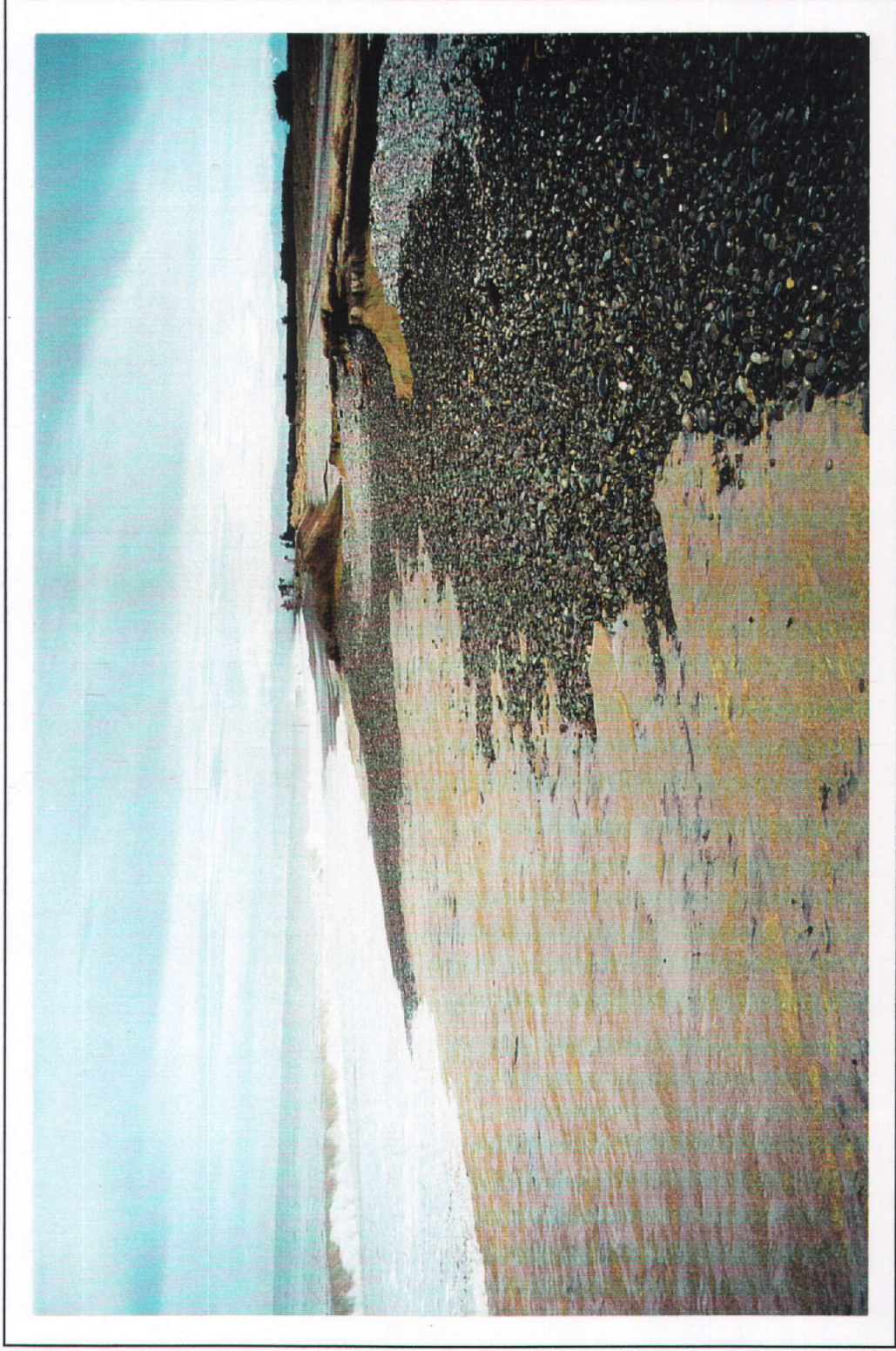


Figure 6.3 Beach gravel stripped to expose basement material at Connolly's Rd.

## 6.2 South of Timaru

The most significant impact of the storm on the beaches south of Timaru was the overtopping and lowering of over 1km of gravel beach along Wainono lagoon. The location and extent of the beach lowering can be seen in Figure 7.9. It is believed that sea water pouring in over this breached section of coast contributed extensively to the hinterland flooding described in Section 7. Figure 6.4 is a longitudinal survey of the beach crest along the area where the beach was lowered. On average the elevation of the beach was reduced by 1.0 metres from its original height (as surveyed in October 2000) with a maximum height reduction of 1.90 metres. Beach gravel was washed over the crest and deposited on the landward side of the barrier beach, burying the access track to a depth of 0.5 metres in some places (see Figure 7.1). During the storm of July 1985 a 1.5 km section of beach was lowered to a similar degree along Wainono Lagoon, however, this took place further south of the present breach (Figure 7.9)

Table 6.2 shows a summary of beach movement as a result of the July 2001 storm for coastal cross sections south of Timaru. All sections, except at one location along the Wainono lagoon barrier, experienced erosion of the beach crest. Erosion of the beach crest varied between  $-1.1$  metres and  $-8.2$  metres. The majority of sections lost sediment volume and elevation. A typical example of storm induced beach erosion can be seen in Figure 6.5 This example is section S5214, one of the sites along the Wainono lagoon that experienced considerable overtopping by storm waves. Note the landward retreat and reduction in elevation of the beach crest and the increase in sediment volume on the landward side of the beach as sediment was washed over the crest by waves during the periods of overtopping.

Because there is a deficiency in the supply of sediment to South Canterbury beaches, the landward retreat of the beach crest is an irreversible process, without some sort of human intervention such as beach reconstruction (Single 1992). The recovery of beach crest elevation does occur naturally however.



Figure 6.4: Comparison of Longitudinal Cross Section Surveys, Pre and Post July 2001 Storm, Wainono Lagoon

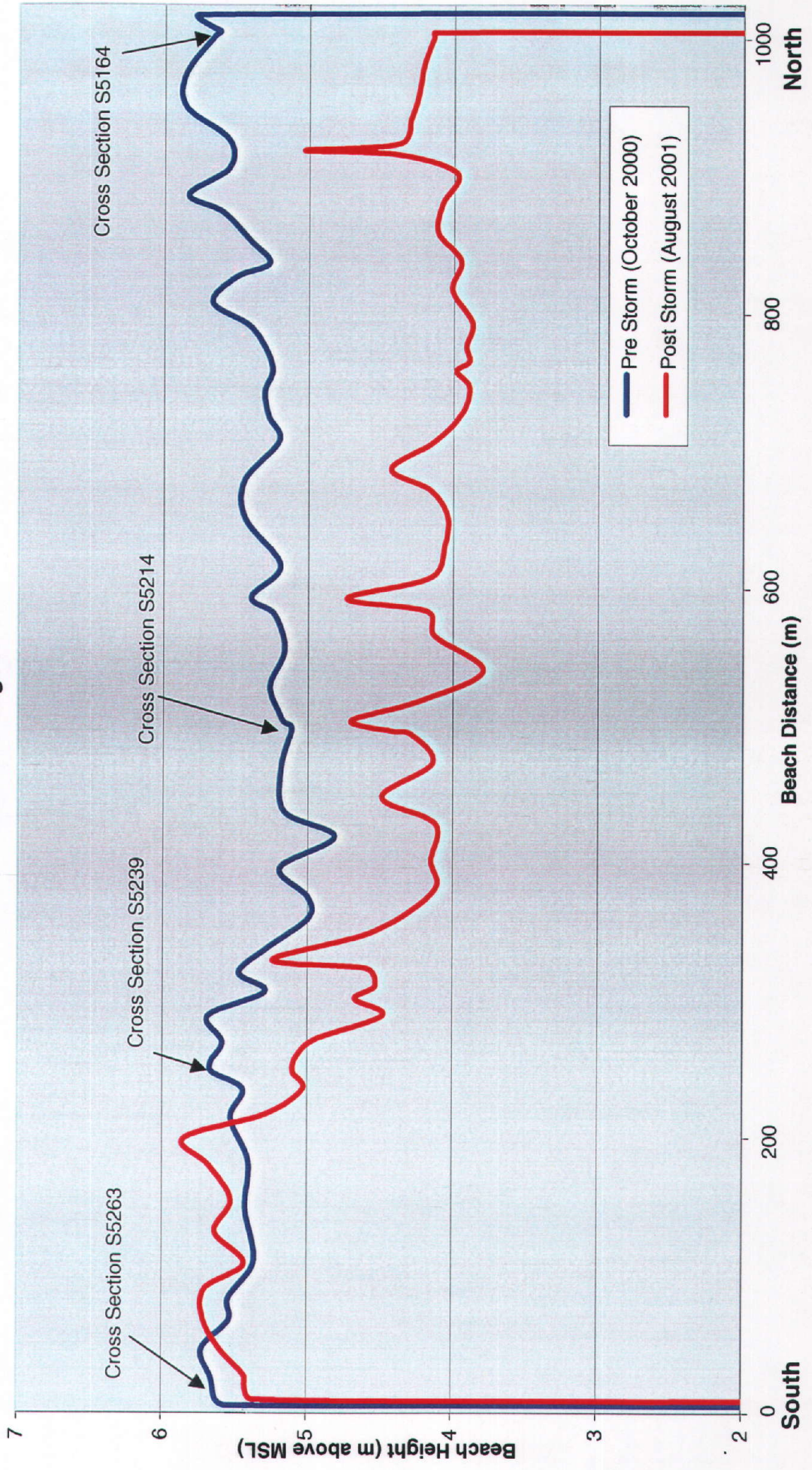
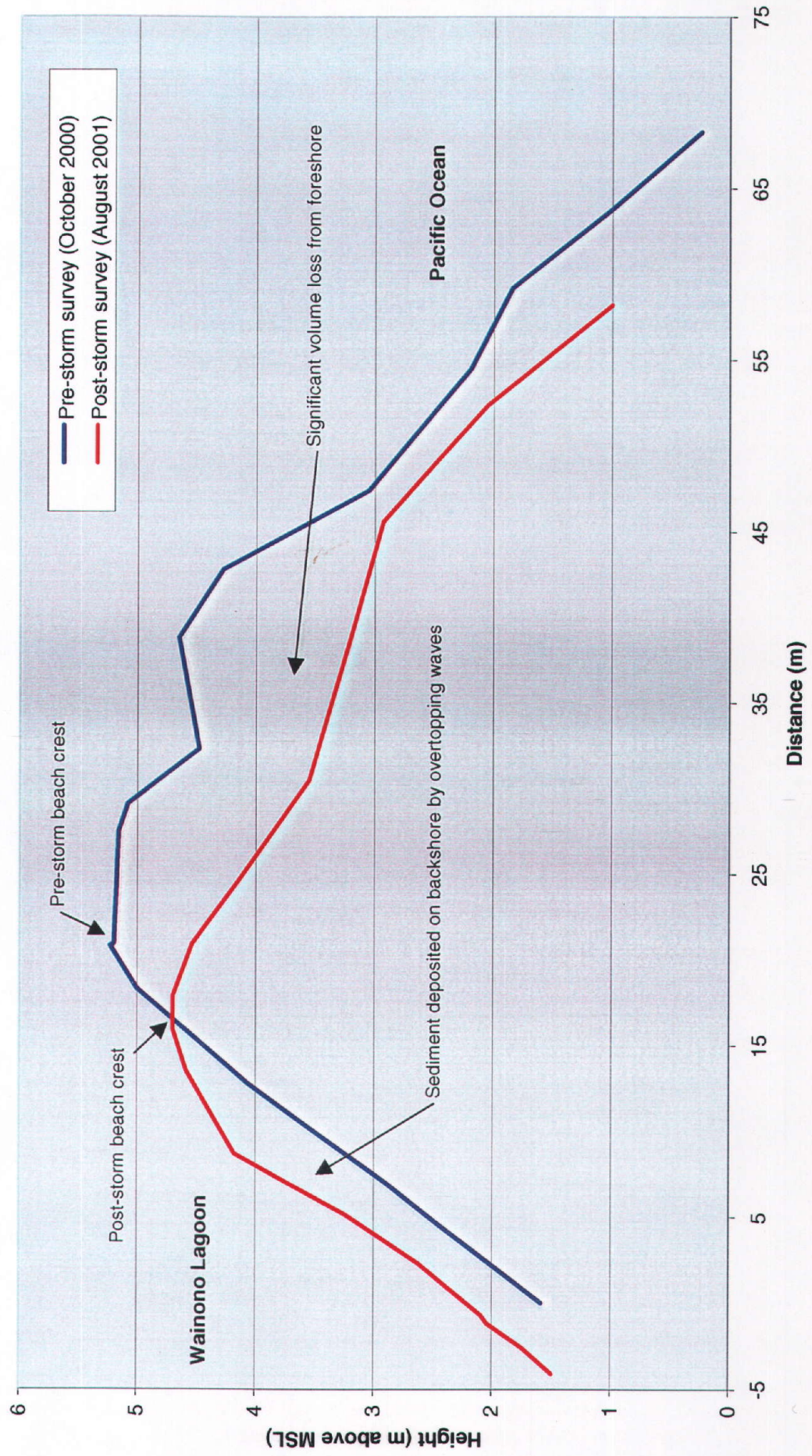


Figure 6.5: Cross section S5214, Wainono Lagoon. Pre and post storm surveys



**Table 6.2 Summary of post-storm erosion surveys. Sections south of Timaru. Negative numbers indicate erosion.**

<i>Section Code (see Appendix 2 for location)</i>	<i>Beach Movement at Crest (metres)</i>	<i>Beach Elevation Change at Crest (metres)</i>	<i>Beach Volume Change (m<sup>3</sup>/m)</i>
S3764	-1.1	-0.22	-17.7
S4361	N/A	N/A	-19.6
S4550	-4.2	-0.24	-18.1
S4737	-7.7	+0.11	-6.6
S5214 <sup>a</sup>	-3.0	-0.5	-39.3
S5239 <sup>a</sup>	-3.4	-0.55	-31.9
S5320 <sup>a</sup>	+3.7	+0.09	-20.1
S5370 <sup>a</sup>	-2.1	-0.06	-16.8
S5513 <sup>a</sup>	-3.3	-0.07	-25.7
S5800 <sup>b</sup>	-8.2	-1.84	-2.9
S5954	-3.0	-0.33	+20.6
S6158	-6.6	-0.56	+10

Note: Sections surveyed 12 days after the storm and compared to surveys carried out 9 months before the storm.

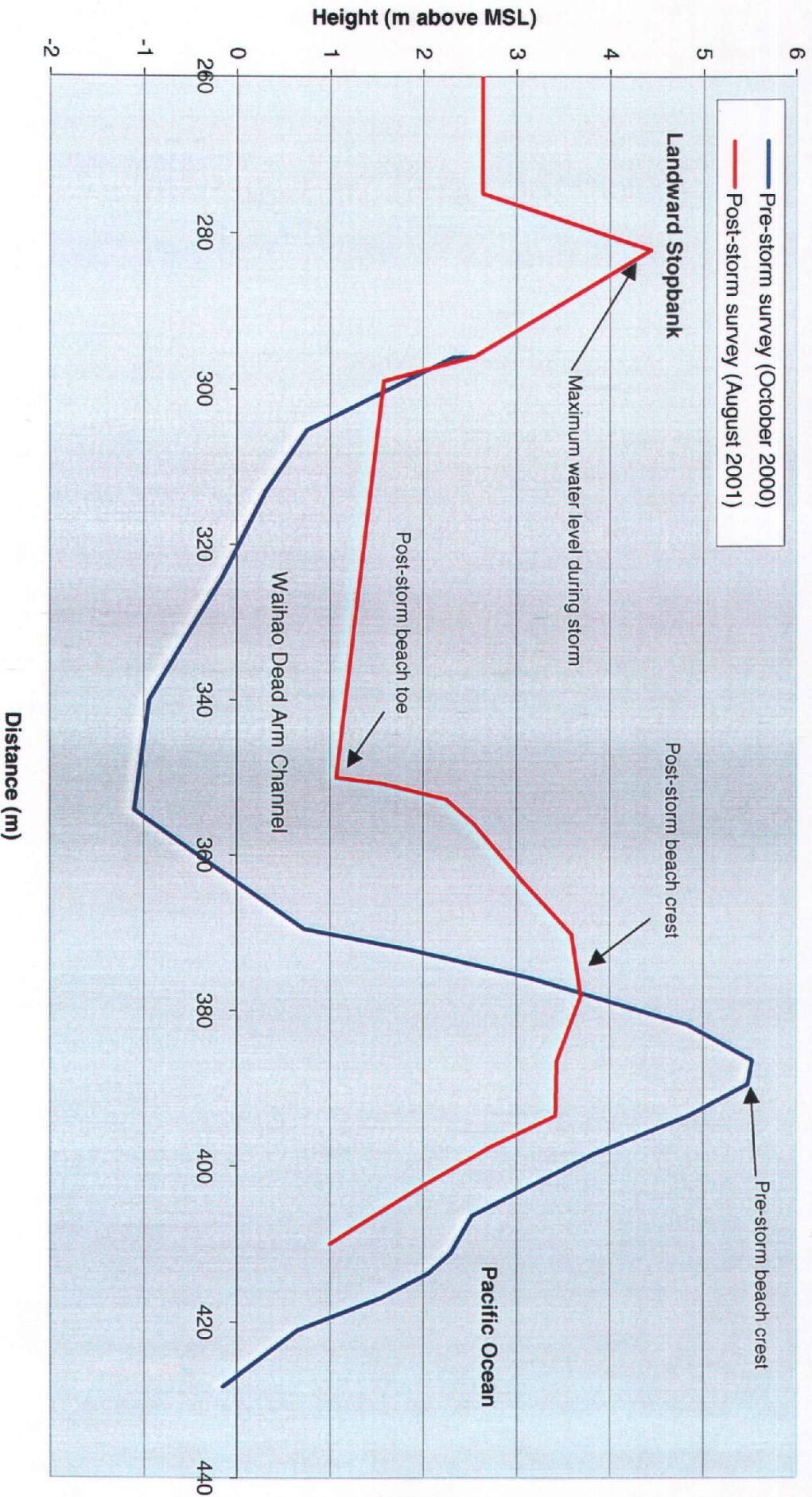
a. Wainono Lagoon sections

b. Waihao Dead Arm section

N/A: No beach crest at this section

Beaches fronting the Waihao dead arm were also significantly affected by the storm. Figure 6.6 is cross section S5800 (see Appendix 2 and Table 6.2) adjacent to Lows Road and provides a good example of the changes to the beach along the dead arm. The beach crest was significantly lowered and sediment was pushed back into the dead arm, significantly reducing the capacity of the channel and in some places blocking the channel altogether. Figure 6.6 shows the landward toe of the beach has moved nearly 20 metres into the dead arm channel behind the barrier as a result of overtopping. A debris line only centimetres from the top of the stopbank (RL 4.4 metres above MSL) landward of the dead arm indicates the height to which flood waters reached during the storm (Figure 6.7). Flooding may well have been worse in this area if the water levels had exceeded the capacity of this stopbank.

**Figure 6.6: Cross Section S5800, Lows Road. Pre and post storm surveys**



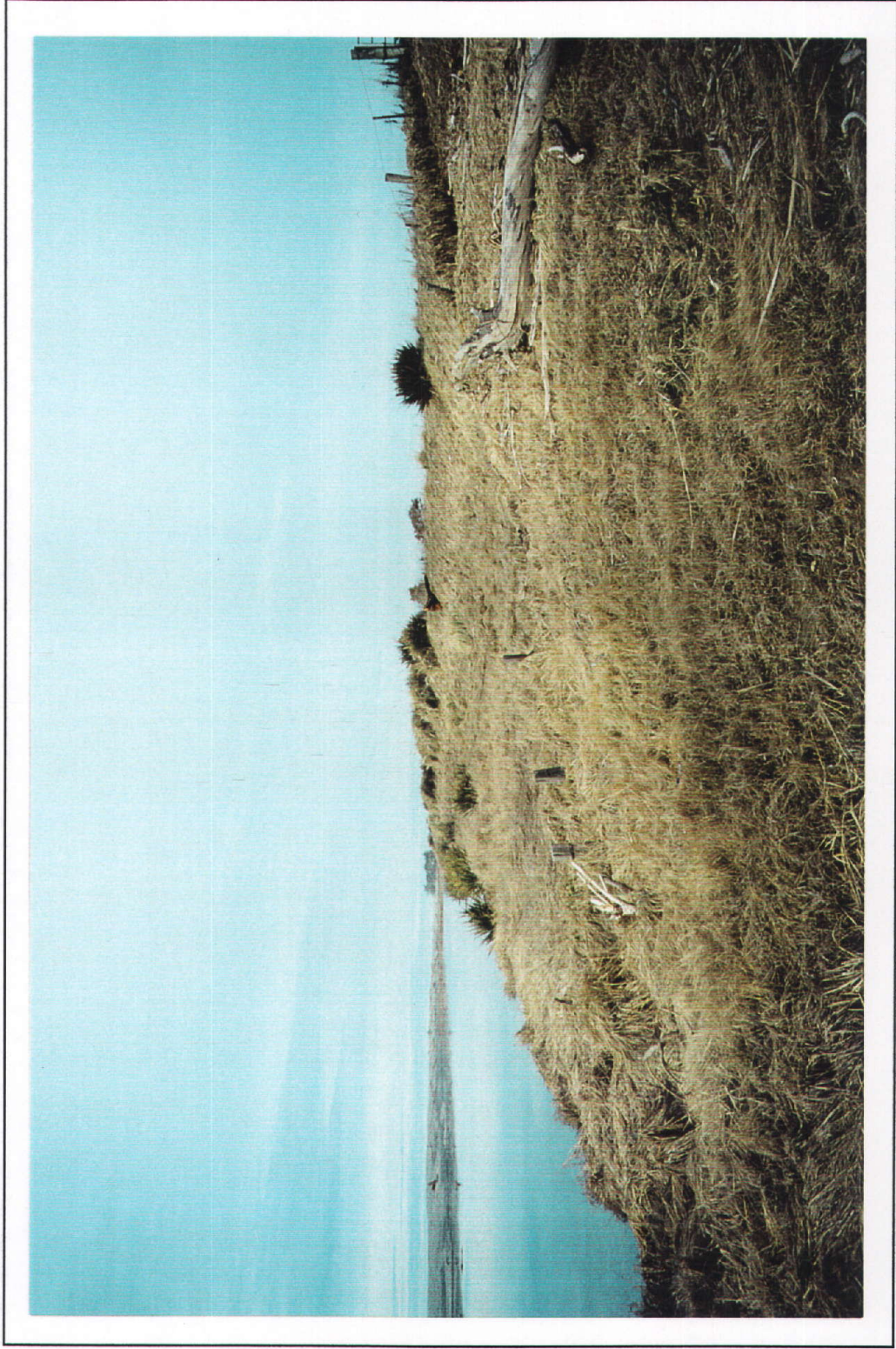


Figure 6.7 Debris line very close to the top of the stopbank along the Waihao Dead Arm.



Figure 6.8 Significant damage to unconsolidated stopbanks south of Otaio River.

A series of small stopbanks built along drainage channels immediately south of the Otaio River (Figure 7.6) suffered significant damage during the storm event. These largely unconsolidated stopbanks were built primarily to assist with the control of drainage, however, waves overtopping the beach crest blew many holes in them and scattered the remnants throughout the adjoining paddocks as the land behind became flooded (Figure 6.8)

## **7 SEAWATER INUNDATION RESULTING FROM THE STORM**

As discussed in Section 6.2 above, adjacent to the Wainono Lagoon the storm reduced the elevation of the barrier beach by an average of 1.0 metres from its original height, with a maximum height reduction of 1.90 metres. It is considered that the majority of the seawater that flooded the margins of the Lagoon came through this breach. Figure 7.1 shows the lowered part of the barrier after the storm. The following Figures 7.2 – 7.10 are the results of the mapping exercise discussed in Section 5. Below is a brief description of each of these figures:

### **7.1 North of Timaru**

As mentioned previously the extent of the inundation that occurred north of Timaru was quite limited. The coastal stopbank system worked satisfactorily and there was only reasonably minor flooding caused by seawater entering drainage channels. For a time however there was considerable concern about the level of the Milford Lagoon (Opihi River mouth), although again the flood protection system held. Inundation plans for the coastal area north of Timaru have been included for the sake of completeness (Figures 7.2 – 7.5)

### **7.2 South of Timaru**

Table 7.1 shows the area of land (divided into four coastal segments) that was inundated during the storm. Also shown is the inundation that occurred in the last significant storm in 1985. It is obvious from this comparison that the latest storm resulted in significantly more inundation in all areas, and particularly south of the Wainono Lagoon. The maps showing the flooding resulting from the 1985 event are not quite as detailed as those drawn for the 2001 storm, however generally they show that the inundation occurred in the same places, just not to the same extent.

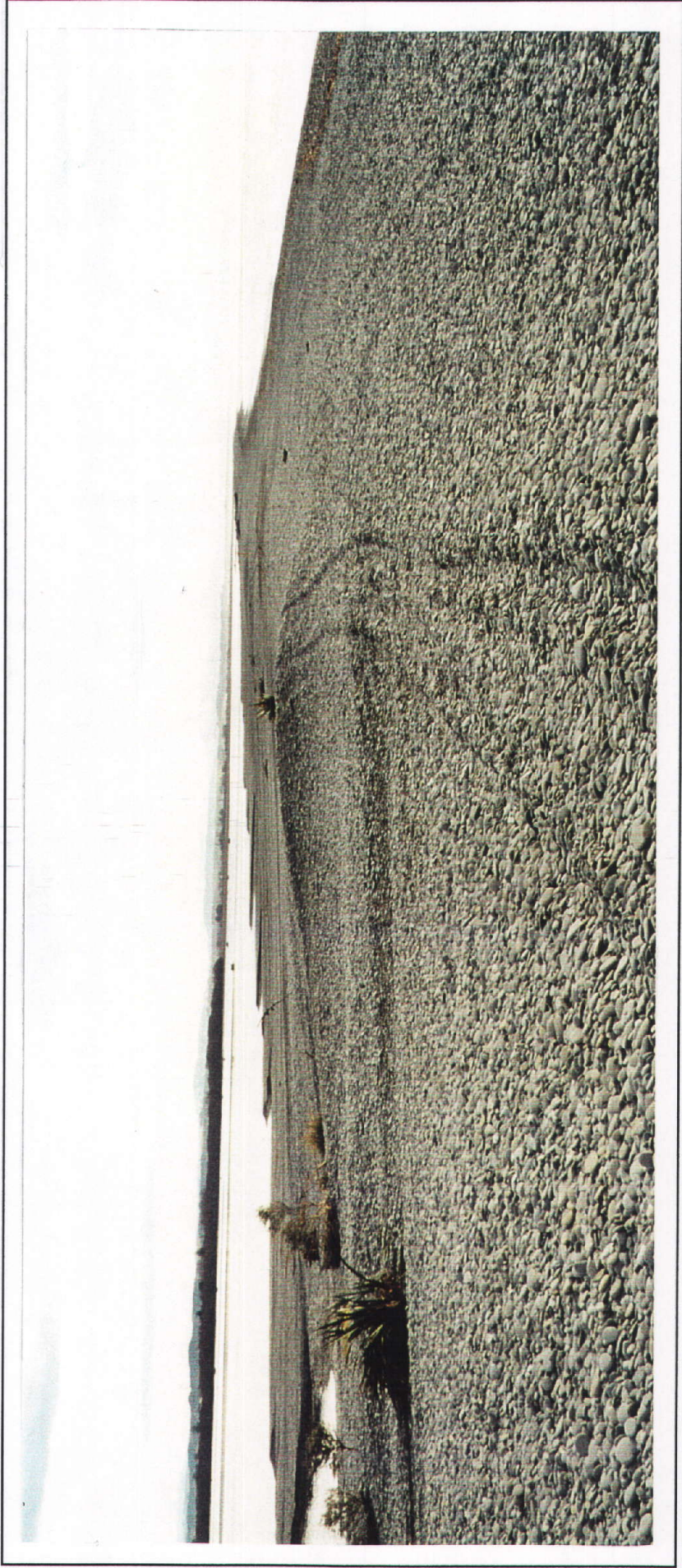
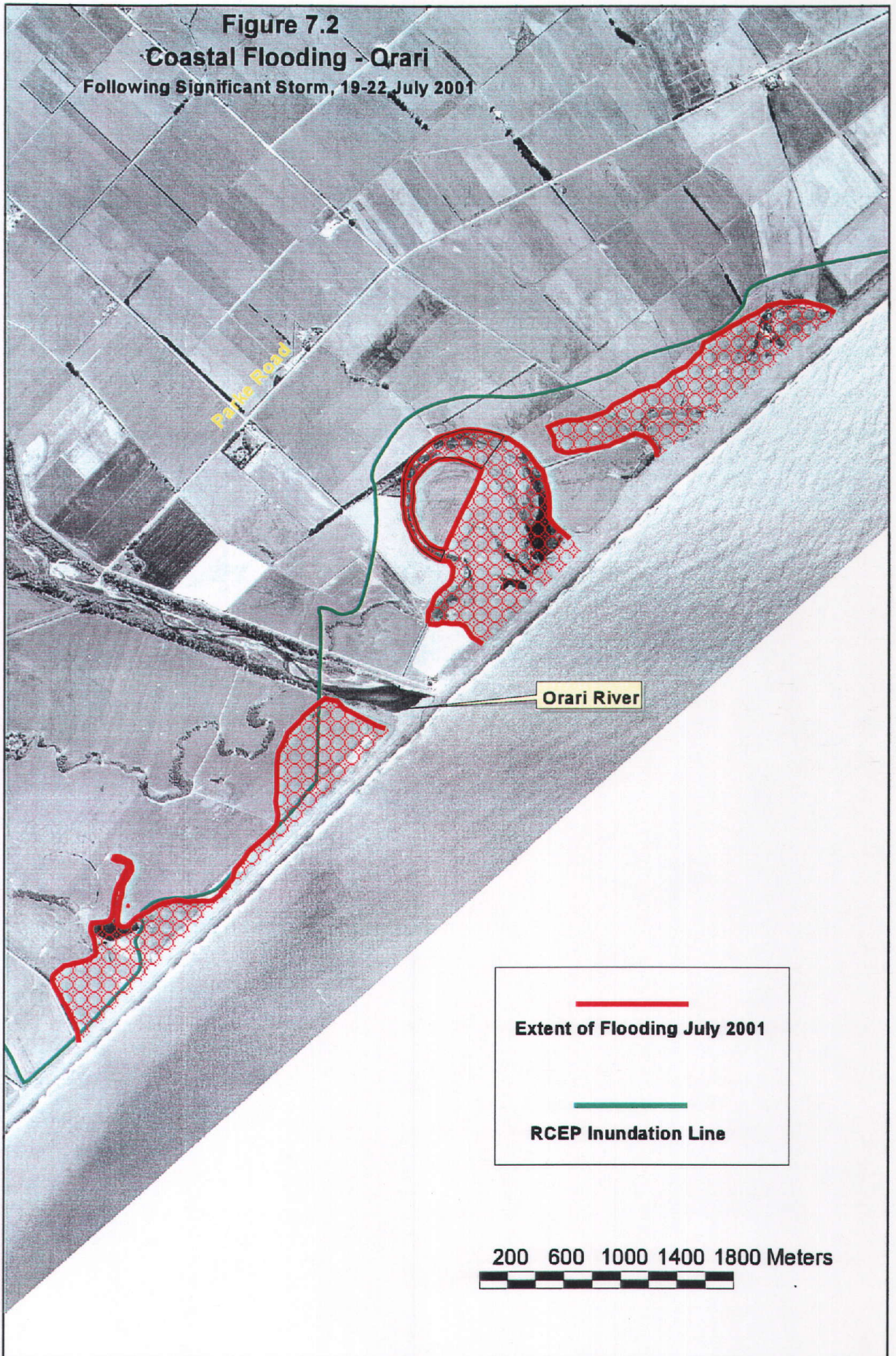


Figure 7.1 Significant beach lowering along the Wainono Barrier.



**Figure 7.2**  
**Coastal Flooding - Qrari**  
Following Significant Storm, 19-22 July 2001

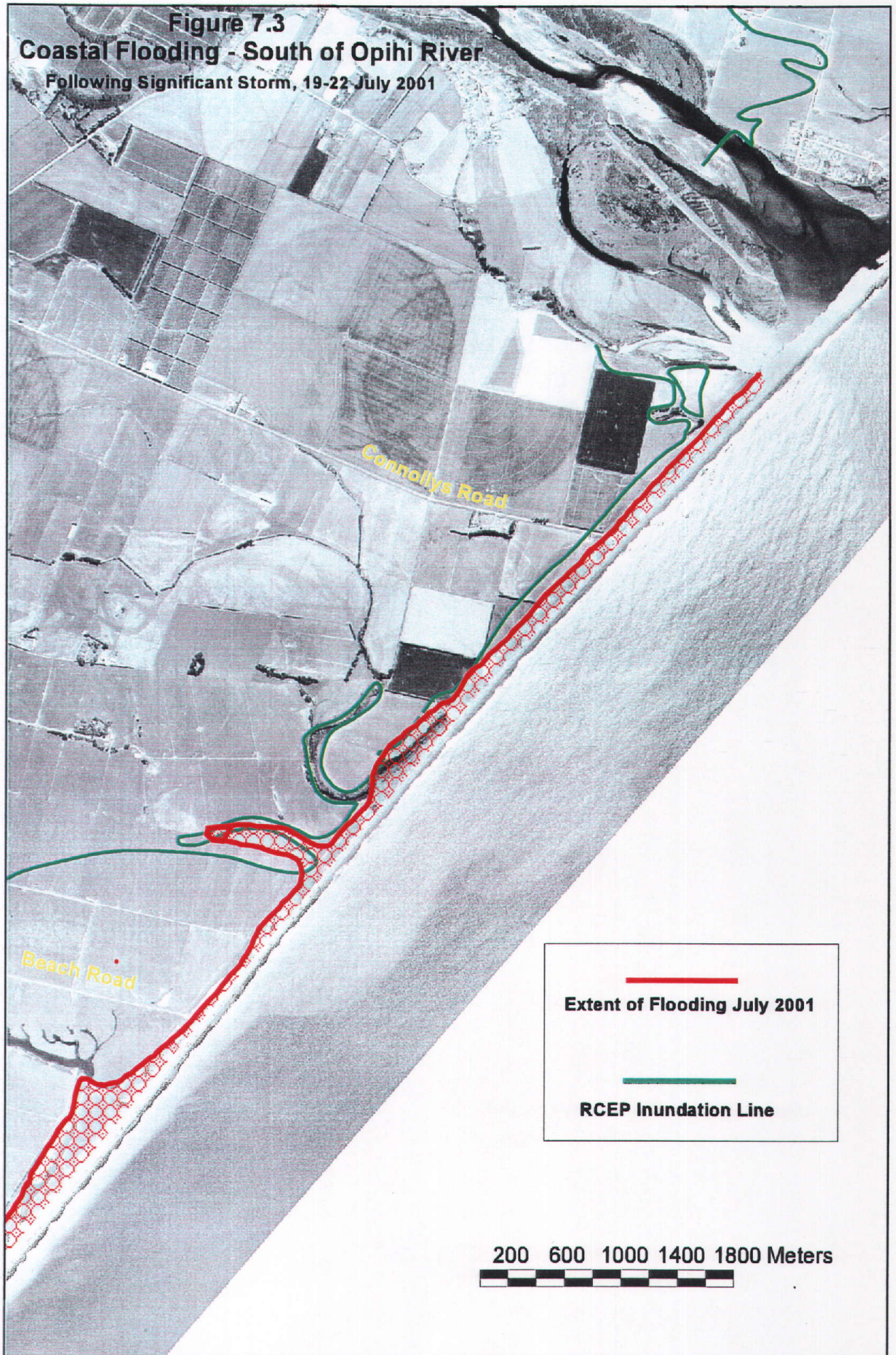


Extent of Flooding July 2001

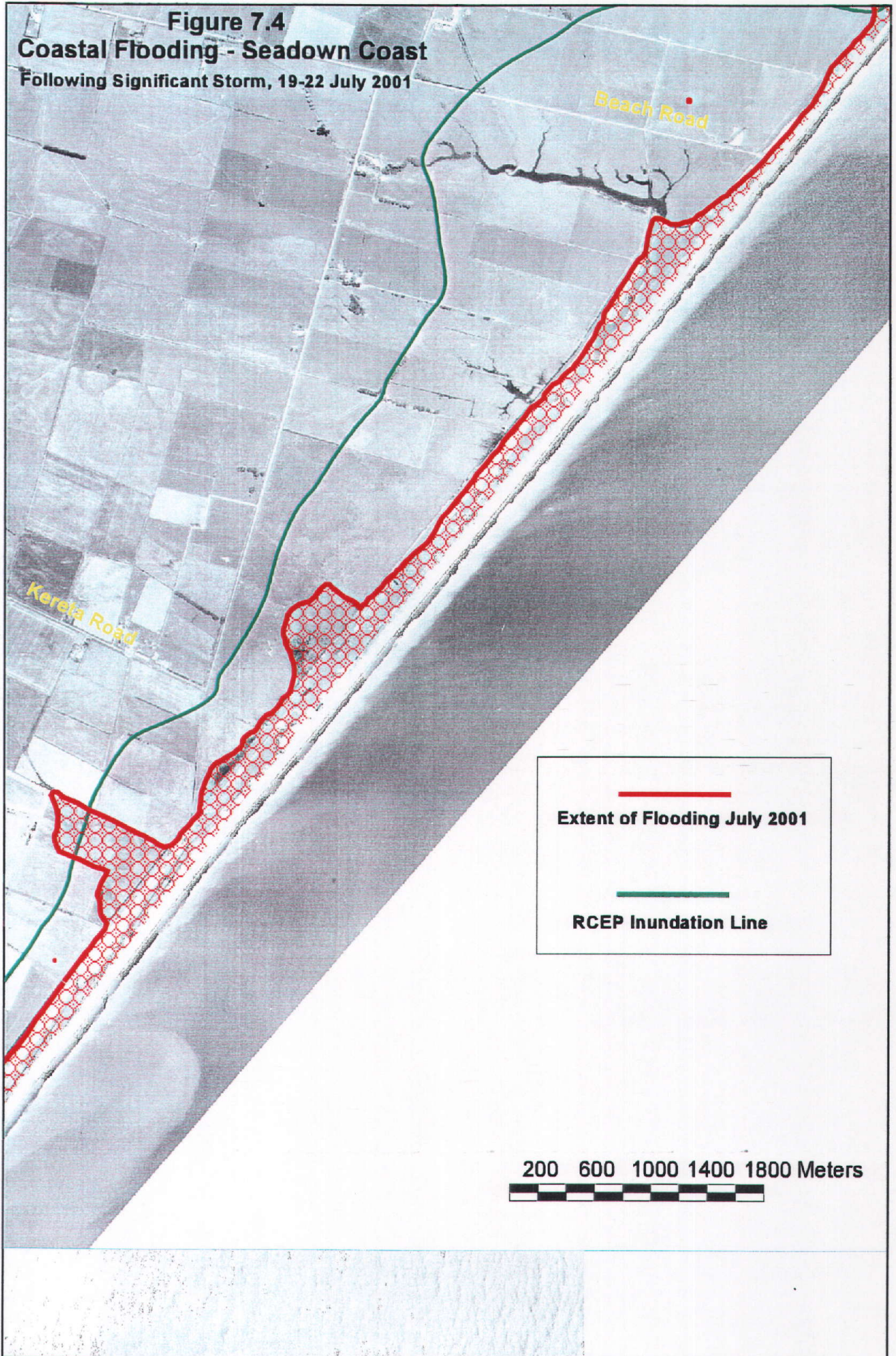
RCEP Inundation Line

200 600 1000 1400 1800 Meters

**Figure 7.3**  
**Coastal Flooding - South of Opihi River**  
Following Significant Storm, 19-22 July 2001



**Figure 7.4**  
**Coastal Flooding - Seadown Coast**  
Following Significant Storm, 19-22 July 2001

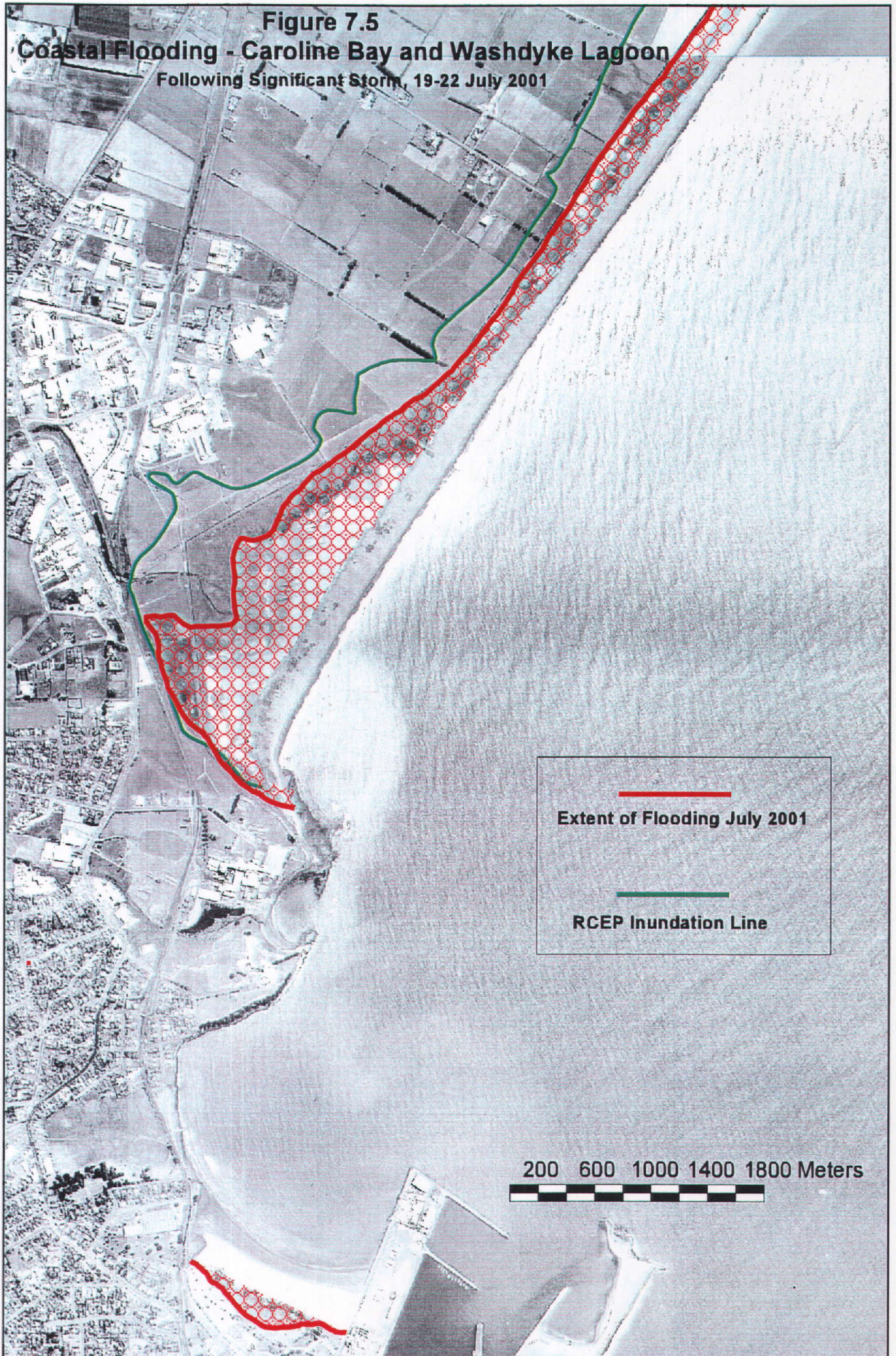


Extent of Flooding July 2001

RCEP Inundation Line

200 600 1000 1400 1800 Meters

**Figure 7.5**  
**Coastal Flooding - Caroline Bay and Washdyke Lagoon**  
Following Significant Storm, 19-22 July 2001



Extent of Flooding July 2001

RCEP Inundation Line

200 600 1000 1400 1800 Meters

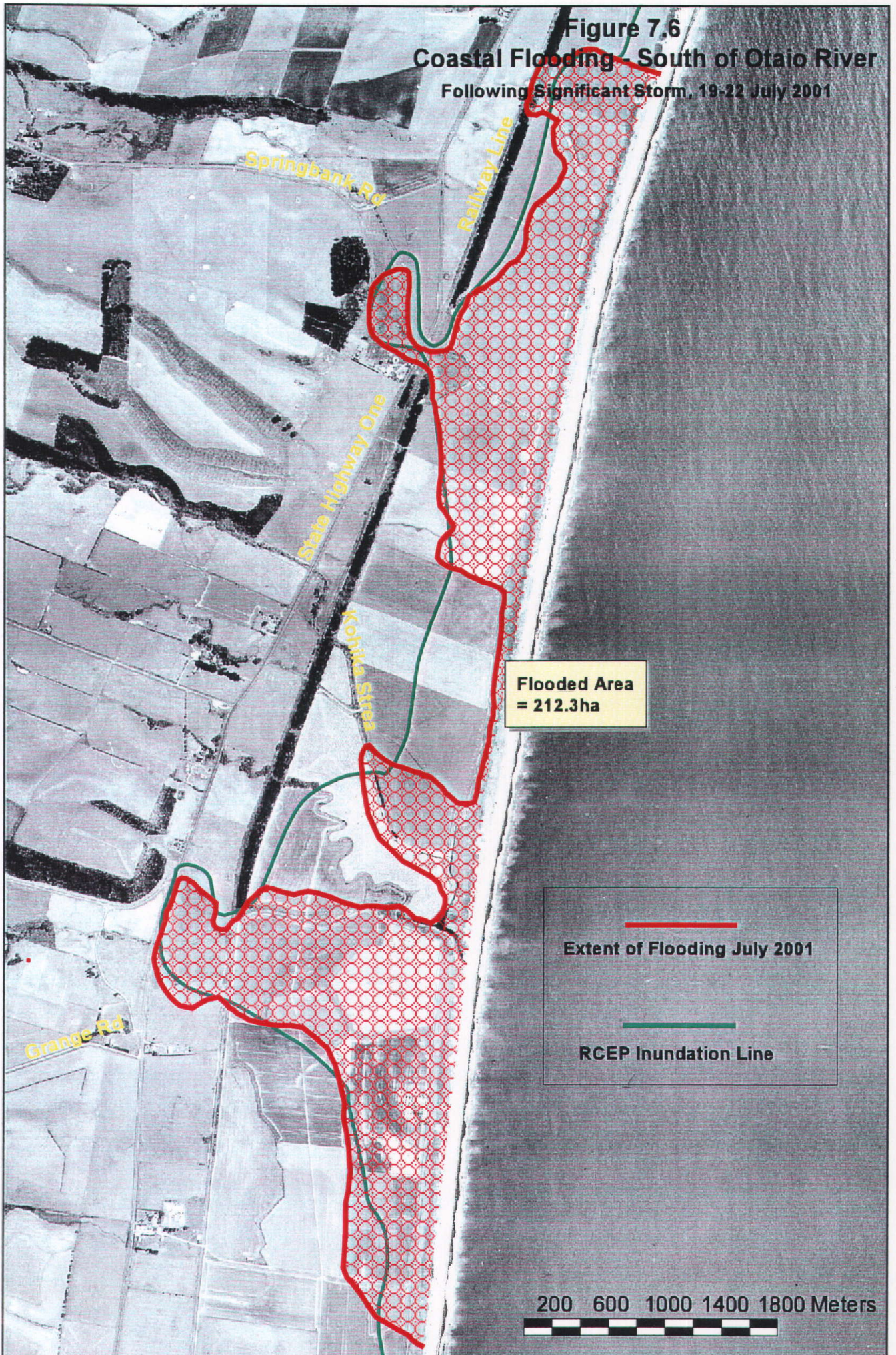
**Table 7.1 Land areas inundated by seawater**

<b>Coastal Segments (North to South)</b>	<b>Land Area Inundated by Seawater (ha)</b>	
	<i>Storm on 27-28 July 1985</i>	<i>Storm on 19-22 July 2001</i>
South of Otaio River to Makikihi River (Figure 7.6)	158	215
Makikihi River to Hook Swamp and North of Wainono Lagoon (Figures 7.7 and 7.8)	156	322
South of Wainono Lagoon to the Waihao Box (Figure 7.9)	128	432
The Waihao Box to South of Sinclairs Creek (Figure 7.10)	64	179
<b>Totals</b>	<b>506</b>	<b>1148</b>

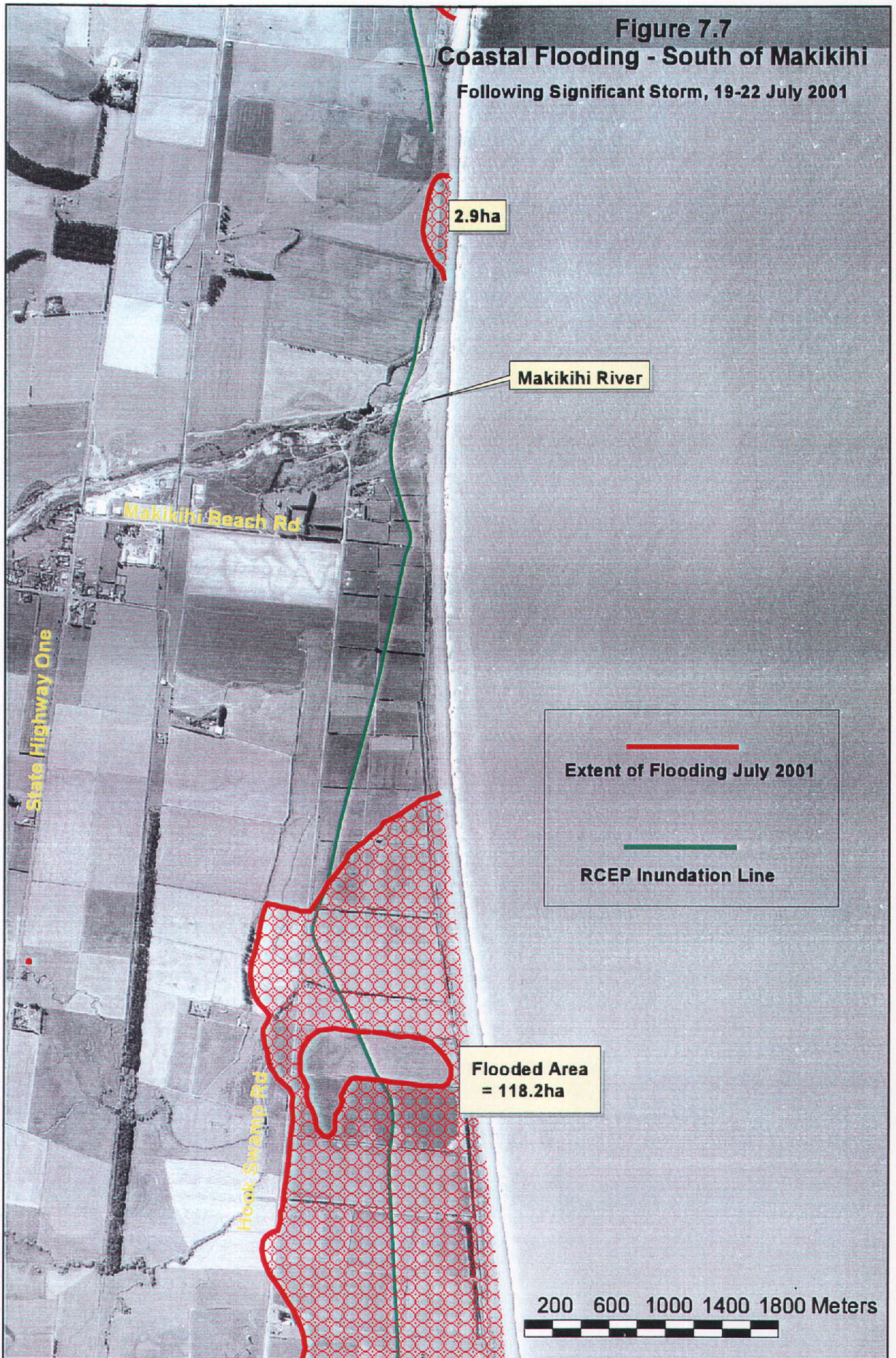
Figure 7.6 shows the extent of the seawater inundation between the Otaio and Makikihi Rivers (red shaded areas) and the position of the Inundation Line in the Regional Coastal Environment Plan (green line). Here the line from the Plan agrees very well with the extent of flooding that occurred. Both the Inundation Line and the recent flooding extend inland of the Main Trunk Railway and State Highway One. Figure 7.7 shows that immediately adjacent to the Makikihi River mouth there was no coastal flooding but further south it was significant, covering an area nearly twice as much as indicated by the Coastal Plan Line. Inundation occurred to a similar extent along the rest of the Hook Swamp Road area (see Figure 7.8) mainly from seawater entering the drainage system.

Flooding also occurred right around the margins of the Wainono Lagoon itself, but was most prevalent to the South of the Lagoon around the Poingdestres Road area (see Figure 7.9). Here the inundation extended significantly more inland than the position of the Inundation Line from the Coastal Plan. Also shown in Figure 7.9 is the location of the main barrier beach failure that occurred in this latest event, the centre of which is approximately 1.2 km North of the significant beach failure that occurred as a result of the 1985 storm. A similar pattern of inundation can be seen in Figure 7.10. Around the Waihao Box the flooding was significantly greater than that indicated on the Coastal Plan Line.

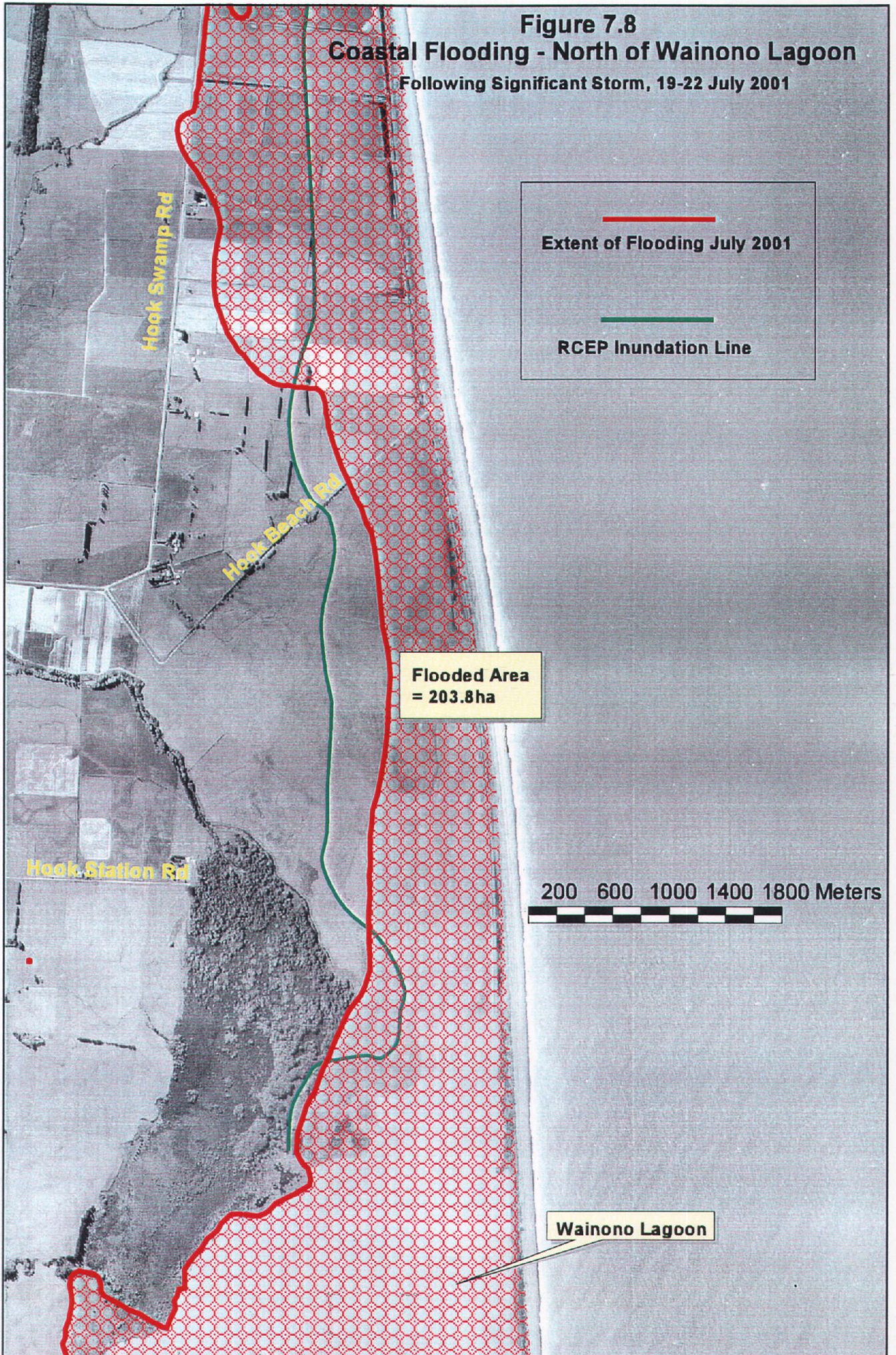
**Figure 7.6**  
**Coastal Flooding - South of Otaio River**  
Following Significant Storm, 19-22 July 2001



**Figure 7.7**  
**Coastal Flooding - South of Makikihi**  
Following Significant Storm, 19-22 July 2001

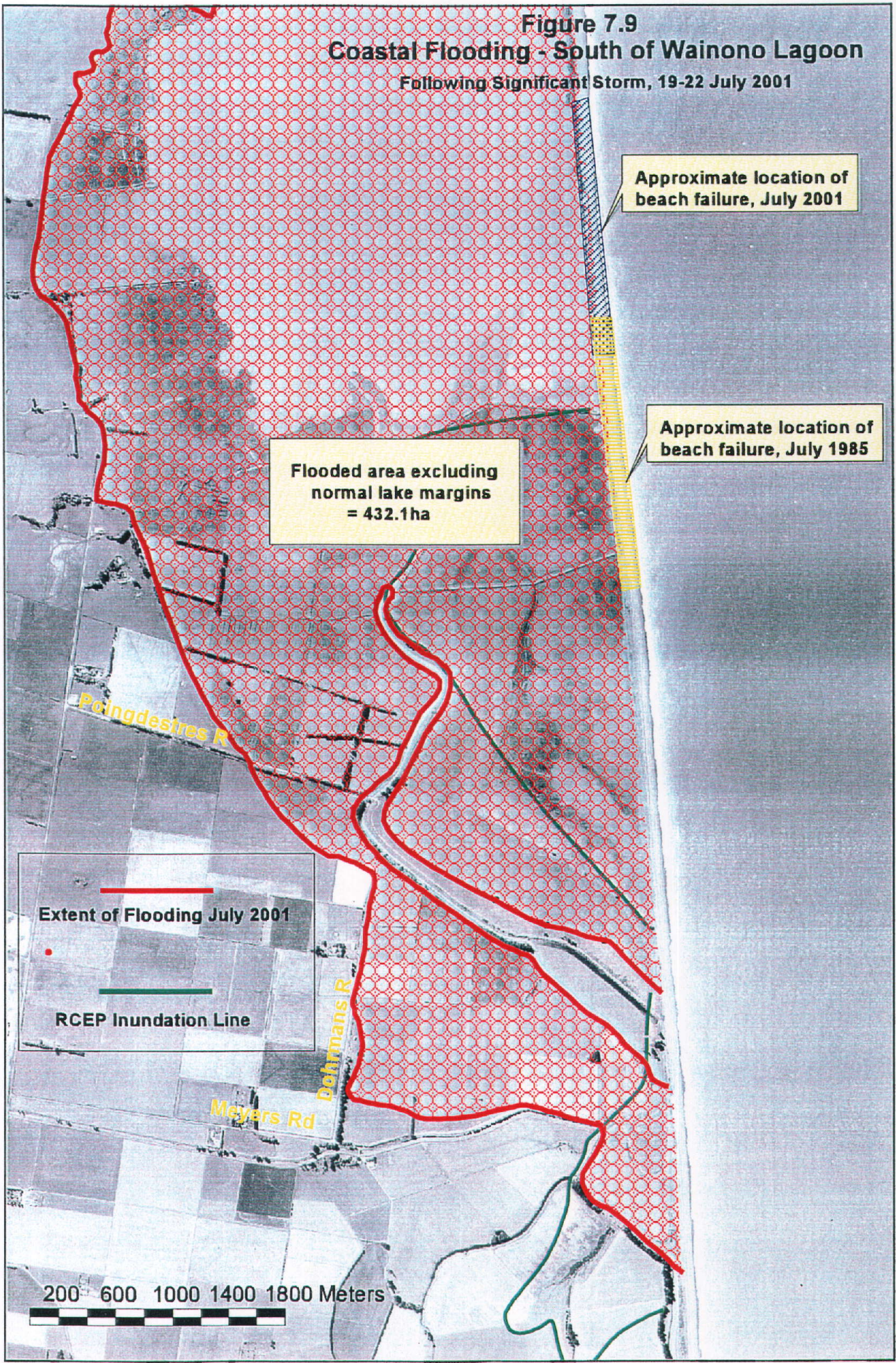


**Figure 7.8**  
**Coastal Flooding - North of Wainono Lagoon**  
Following Significant Storm, 19-22 July 2001

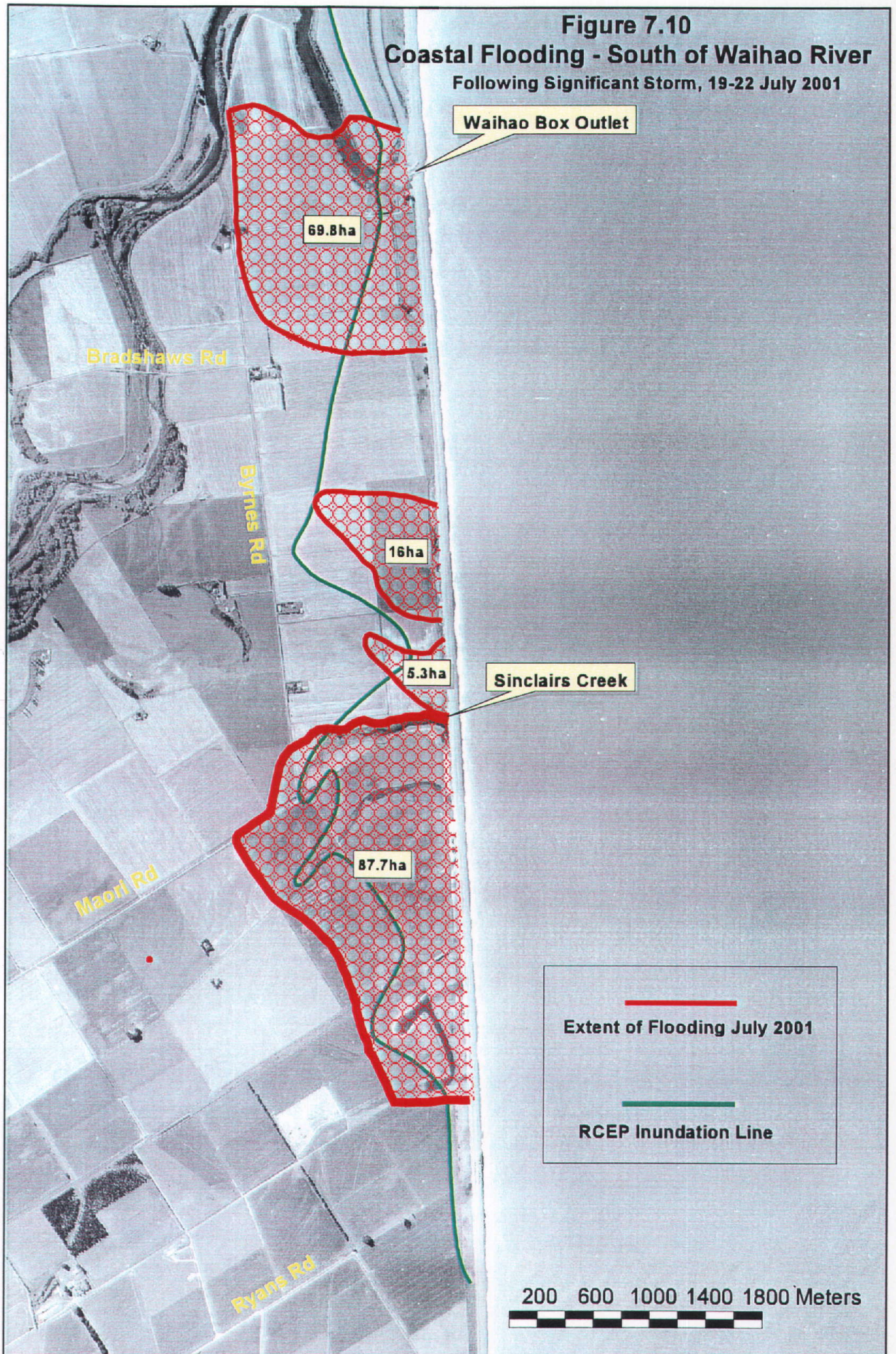




**Figure 7.9**  
**Coastal Flooding - South of Wainono Lagoon**  
Following Significant Storm, 19-22 July 2001



**Figure 7.10**  
**Coastal Flooding - South of Waihao River**  
Following Significant Storm, 19-22 July 2001



## **8 CONCLUSIONS**

- A coastal storm during the 19 to the 22 July 2001 caused significant overtopping and erosion of beaches south of Timaru, primarily between the Otaio River and Sinclairs Creek. As a result, approximately 1150 hectares of low-lying coastal land was inundated by seawater. This is over twice as much flooding as that recorded after the last significant storm to affect the area in July 1985.
- North of Timaru, significant beach overtopping occurred during the same storm, however floodwaters were generally held back by coastal stopbanks.
- The extent of flooding during the July 2001 event was compared with inundation lines presented in the Regional Coastal Environment Plan. Between the Otaio River and the Makikihi River the inundation lines in the Coastal Plan generally agree with the extent of flooding which occurred during this event. South of the Makikihi River, especially around the margins and immediately south of the Wainono lagoon the extent of flooding inland during this event far exceeded the lines drawn in the Plan.
- The storm was generated by a slow moving depression situated near the Chatham Islands. This low pressure system created a strong easterly flow that resulted in maximum offshore deepwater waves measured by wave buoy of up to 8.5 metres high and with average wave periods of up to 10.5 seconds. Three quarters of all waves recorded during the storm came from the east.
- The last swell event that resulted in widespread coastal flooding of the South Canterbury coast was in July 1985. This storm was also originated from a similar weather system to the east the South Island. It seems that antecedent weather patterns involving a stationary or slow moving depression at or just to the north of the Chatham Islands may be conducive to the production of large swell events with a significant easterly component that may result in damage to the beaches of South Canterbury.
- Wave conditions at the shore were not directly measured during the storm, however mathematical modelling suggests that breakers may have reached a height of approximately 3.4 metres. Breakers of this height have been

demonstrated to run up the beach face to a height of 7 metres above MSL. The average height of the beach is 5.5 metres. This suggests that a very large volume of seawater was able to run over the top of the beach during the July 2001 storm event.

- Significant erosion of South Canterbury beaches resulted from the storm. Of most significance was the overtopping and lowering of a 1km stretch of beach along the Wainono lagoon. Here, the beach was lowered by an average of 1 metre. It is believed that this lowering contributed significantly to the amount of seawater able to enter the lagoon and inundate surrounding farmland.
- The majority of seawater inundation occurred during high tide in the early morning of July 20. This high tide coincided with an initial peak in offshore wave conditions and it is likely that this is when the main breach of the section of beach at Wainono occurred. Eyewitness accounts of the advancement and peak time of the floodwaters support this notion.
- North of Timaru, storm damage to beaches resulted in erosion of up to 13.5 metres of the beach crest in some locations on the Washdyke/Seadown coast.
- South of Timaru, beach crest erosion of up to 8.2 metres was recorded with most of the surveyed cross section experiencing significant losses in sediment volume.
- This landward erosion of the beach crest is an irreversible process.

## **9 RECOMMENDATIONS**

The storm of July 19-22 July 2001 has been the most significant event to affect the South Canterbury coast in 16 years. Based on the severity of the storm and the extent of seawater inundation and beach erosion, three recommendations are made;

### **9.1 Increased vigilance during storm activity, as beaches will be more susceptible to overtopping for some time to come.**

Because of the significant erosion that took place during the storm, particularly sediment volume loss and reduction in height of the beach crest the beaches will be

susceptible to overtopping by storm waves on a more regular basis until they rebuild themselves naturally. This will take some time, especially at the point of breaching at Wainono and along the Waihao Dead Arm beach where over a metre of beach height was lost.

It is unknown exactly how long this beach recovery will take, as it is dependent on swell conditions being conducive to “beach building”. Some recovery has taken place already, however it may be more than a year before the breach at Wainono has recovered to its pre-storm height. Until the beach has recovered, it will be overtopped more often and by smaller waves. It is therefore recommended that any swell warnings received by the Meteorological Service be considered in light of the above information and that landowners in susceptible areas be notified accordingly.

It should be noted that Environment Canterbury’s coastal flood warning system has been streamlined recently to provide improved notification of any potential problems to a greater number of landowners in a shorter amount of time.

## **9.2 Continued monitoring of areas susceptible to coastal flooding and erosion.**

A continued monitoring of beach conditions through coastal cross section surveys is important to track and understand the recovery processes of these South Canterbury beaches. It is recommended that the long-section survey of the beach crest be repeated on an annual basis for several years to monitor the recovery of the severely lowered length of beach along Wainono lagoon.

The continued collection of wave data is vital. This information now plays a large part in the Meteorological Services swell warning programme for the South Canterbury coast. Real time wave data helps us track the progress of a storm system and will aid the Timaru Flood Controller in decision-making.

To better understand all the forcing functions that combine to produce increased sea levels along the South Canterbury coast it is also recommended that an approach be made to the Timaru Port Company to investigate the possibility of upgrading their tide gauge/sea-level recorder. At present, due to the unreliable nature of the existing recorder an estimate of storm surge must be taken using data from the Sumner sea-level recorder. The application of sea-level data from such a long distance away in

analysing the components of storm surge for the South Canterbury coast is problematic.

### **9.3 Update of Inundation Lines in the Regional Coastal Environment Plan.**

Methods used or to be used by Environment Canterbury to deal with coastal hazards are outlined in Chapter 9.3 of the Regional Coastal Environment Plan. One of the methods to be employed by Environment Canterbury (Method 9.1(a)(vi)) is to update hazard maps at 10 yearly intervals. Section 7 of this report has identified areas where inundation lines in the Coastal Plan were exceeded by floodwaters during the July 2001 storm. It is recommended that in the next update of hazard maps for the Regional Coastal Environment Plan that inundation lines for South Canterbury be extended to include those areas flooded by the significant coastal storm of July 2001.

## **10 REFERENCES**

- Coastal Engineering Manual (2001); United States Army Corps of Engineers, Department of the Army. Publication EC 1110-2-110
- Connell, R.J and Todd, D.J (1985); Sea Flooding – Ruddenklau's Frontage 27-28 July 1985. Unpublished South Canterbury Catchment Board Report.
- Komar, P.D. (1998); Beach processes and sedimentation. Prentice Hall, 2<sup>nd</sup> Edition. 544pp
- Pethick, J.P. (1984); An introduction to coastal geomorphology. Edward Arnold. 260pp.
- Single, M.B. (1992); High energy coastal processes on mixed sand and gravel beaches. Unpublished Ph.D. thesis, Geography Department, University of Canterbury. 220pp.

## **Appendix 1**



**CANTERBURY REGIONAL COUNCIL FLOOD LOG SOUTHERN AREA****Event: 19-23 JULY 2001 FLOOD EVENT****Logged By: FIONA WILLIX****Call No: 2 Date Of Call: 19/07/01 Time Of Call: 1315 Location: Waihao**

Caller: John Hughes

Received By Telephone By Philip Lees

**Message:**

Quite a bit of overtopping at Waihao Box.

*Issued (Received 1430 hrs)***Call No: 1 Date Of Call: 19/07/01 Time Of Call: 1324 Location: N/A**

Caller: Metservice

Received By Fax By Philip Lees

**Message:**

Situation - A low pressure centre to the east of the South Island has a strong easterly flow on its southern side. Forecast - The strong east or southeast flow is expected to generate an east to southeast swell of 3 occasional 4.5 m about the South Canterbury coast from Banks Peninsula to the Waitaki River both this evening and overnight and is expected to ease to below 3 m by Friday evening. Air pressure - 986 hPa about Banks Peninsula to 988 hPa near Timaru gradually rising to 992 hPa over the whole area by midday Friday.

**Call No: 3 Date Of Call: 19/07/01 Time Of Call: 1400 Location: Aorangi Road**

Caller: Philip Lees

Received By Verbal By Philip Lees

**Message:**

P Lees checked Aorangi Road. Quite a bit of overtopping. Every third-fourth wave is just reaching the channel at the back of the beach. Timaru high tides - 19 July 2001, 1400 hours, 2.4, 20 July 2001, 0200 hours, 2.3 m and 1450 hours, 2.5 m.

**Call No: 4 Date Of Call: 19/07/01 Time Of Call: 1430 Location: N/A**

Caller: Metservice

Received By Telephone By Philip Lees

**Message:**

(Also received by fax). Received heavy swell warning.

**Call No: 5 Date Of Call: 19/07/01 Time Of Call: 1430 Location: N/A**

Caller: Philip Lees

Received By Telephone By Various

**Message:**

(Time between 1430-1500 hours). Rang first order coastal observers: Gavin Ladbrook, Carol Cusdin - mouth is wide open (it opened last night), - she reckons there will not be any problem, she will pass message on), Bill Penno (Mrs Penno will pass message on), John Hughes, Mark Oldfield ( cell phone message), Mick Laming and Bruce Scarlett.

## CANTERBURY REGIONAL COUNCIL FLOOD LOG SOUTHERN AREA

**Event:** 19-23 JULY 2001 FLOOD EVENT

**Logged By:** FIONA WILLIX

**Call No:** 6    **Date Of Call:** 19/07/01    **Time Of Call:** 1600    **Location:** Waimataitai

**Caller:** Noel Woolfe

**Received By Telephone By** Philip Lees

**Message:**

Informing us of heavy swells. I checked it out, does not appear to be anything unusual at this stage.

**Call No:** 7    **Date Of Call:** 19/07/01    **Time Of Call:** 1605    **Location:** N/A

**Caller:** Philip Lees

**Received By Telephone By** Mark Bang, Timaru CD

**Message:**

Informed him of swell warning and rain warning.

**Call No:** 8    **Date Of Call:** 20/07/01    **Time Of Call:** 0700    **Location:** N/A

**Caller:** ~~Philip Lees~~ Paul Eddy,

**Received By Verbal By** Philip Lees

**Message:**

River works staff out and about checking situation - Seadown, Milford and Waihao. Reporting back damage to P Eddy and B Scarlett.

**Call No:** 9    **Date Of Call:** 20/07/01    **Time Of Call:** 0800    **Location:** Aorangi Road

**Caller:** Philip Lees

**Received By Verbal By** Philip Lees

**Message:**

P Lees observed considerable overtopping at Aorangi Road (150-200 mm around buildings now). Dropped from overnight. *W/L rose to 600mm.*

**Call No:** 10    **Date Of Call:** 20/07/01    **Time Of Call:** 0815    **Location:** Connollys Road

**Caller:** Phil Crotty

**Received By Radio By** Philip Lees

**Message:**

Gravel washed over beach and lying against stopbank.

**Call No:** 11    **Date Of Call:** 20/07/01    **Time Of Call:** 0900    **Location:** Waimataitai

**Caller:** Noel Woolfe

**Received By Telephone By** Philip Lees

**Message:**

Contact numbers for Noel Woolfe, phone 688 8985, fax 688 9856. He has suffered quite a bit. I advised him to contact Timaru District Council. I advised yesterday's swell forecast was for swells to ease today. I will fax today's swell forecast when it arrives.

# CANTERBURY REGIONAL COUNCIL FLOOD LOG SOUTHERN AREA

**Event: 19-23 JULY 2001 FLOOD EVENT**

**Logged By: FIONA WILLIX**

**Call No: 12 Date Of Call: 20/07/01 Time Of Call: 0930 Location: Waihao**

Caller: Philip Lees

Received By Telephone By John Hughes

**Message:**

More than 100 acres under water. Still big swells. Beach flattened. No holes. No waves going over at 2300 hours last night. By 0130 hours, water to Middlemiss' yard. *(corner of Maori and Byrnes Roads)*

**Call No: 13 Date Of Call: 20/07/01 Time Of Call: 0945 Location: N/A**

Caller: Philip Lees

Received By Fax By Noel Woolf

**Message:**

As requested, please find enclosed swell forecast for today.

*(4m on-shore swells)*

**No: 16 Date Of Call: 20/07/01 Time Of Call: 0945 Location: N/A**

Caller: Paul Eddy

Received By Telephone By Philip Lees

**Message:**

Milford Lagoon: blew out at 2030 hours last night, water level rose to 4 m (stopbank top), odd wave going over the top, good mouth at the moment, about opposite toilets, 40 m wide with good flat batters on both sides and no breaches of stopbank. Orari-Opihi: overtopped stopbank in a few places (roads etc.) for short periods and no ponding on landward side. Connollys Road: beach shingle has pushed back against stopbank. Aorangi Road: 600 mm overnight.

*of water here at peak*

**Call No: 17 Date Of Call: 20/07/01 Time Of Call: 1000 Location: N/A**

Caller: Philip Lees

Received By Telephone By Maura (Waimate DC)

**Message:**

Passed on information: high tide yesterday 2.4 m, this morning 2.3 m, 3.00 pm today 2.5 m. Quite a bit of overtopping, they are aware of it. 4 m swells forecast for today. Beaches will be lower. Maura will pass onto M<sup>rs</sup> Johnson.

*Met Service swell by warning received about 1030hrs*

**Call No: 14 Date Of Call: 20/07/01 Time Of Call: 1011 Location: N/A**

Caller: Sue Seymour

Received By Fax By Ashley Harper

**Message:**

Metservice fax: Situation - A strengthening east to southeast flow affects the east coast of the South Island, generated by a deep low pressure centre located just north of the Chatham Islands. The strong onshore southern flow is expected to be maintained through the rest of today and Saturday and should gradually ease by late Sunday as the low centre moves northeast. Forecast - East to southeast swell rising to 4 m occasional 6 m this afternoon between Banks Peninsula and north of the Waitaki River, gradually spreading from Pegasus Bay north the Clarence River by late this evening. The swell is expected to rise to 4.5 m occasional 7 m throughout the region during Saturday. Air Pressure - 988 hPa in the south to 990 hPa in the north today gradually becoming 1001 hPa in the south and 988 hPa in the north by midday Saturday.

# CANTERBURY REGIONAL COUNCIL FLOOD LOG SOUTHERN AREA

**Event:** 19-23 JULY 2001 FLOOD EVENT

**Logged By:** FIONA WILLIX

**Call No:** 15 **Date Of Call:** 20/07/01 **Time Of Call:** *about 1045h* 1011 **Location:** N/A

**Caller:** Sue Seymour

**Received By Fax By** Murray Johnston and Alister McGaughran

**Message:**

Metservice fax: Situation - A strengthening east to southeast flow affects the east coast of the South Island, generated by a deep low pressure centre located just north of the Chatham Islands. The strong onshore southe flow is expected to be maintained through the rest of today and Saturday and should gradually ease by late Sunday as the low centre moves northeast. Forecast - East to southeast swell rising to 4 m occasional 6 m this afternoon between Banks Peninsula and north of the Waitaki River, gradually spreading from Pegasus Bay north the Clarence River by late this evening. The swell is expected to rise to 4.5 m occasional 7 m throughout the region during Saturday. Air Pressure - 988 hPa in the south to 990 hPa in the north today gradually becoming 1001 hPa in the south and 988 hPa in the north by midday Saturday.

**Call No:** 18 **Date Of Call:** 20/07/01 **Time Of Call:** 1020 **Location:** N/A

**Caller:** Philip Lees

**Received By Telephone By** Mark Bang in Christchurch

**message:**

Contact phone number - 025 365 367. Passed on information regarding Milford. He will monitor the situation closely this afternoon, high tide (today 1500 hours) 2.5 m, tomorrow 0300 hours 2.3 m, water level reached top of stopbank, Rangitata? and ECan will contact the radio stations.

**Call No:** 19 **Date Of Call:** 20/07/01 **Time Of Call:** 1105 **Location:** N/A

**Caller:** Sue Seymour

**Received By Telephone By** Justin Cope

**Message:**

Asked for updated swell forecast. We have the latest available forecast - issued at 1011 hours. Justin feels overtopping will probably continue until Sunday when the low pressure system moves on. Asked Justin to keep us informed if he receives any further information.

**Call No:** 21 **Date Of Call:** 20/07/01 **Time Of Call:** 1108 **Location:** N/A

**Caller:** Philip Lees

**Received By Fax By** Whitestone

**Message:**

*(classic Ltr)* *Whitestone FM*  
Also faxed to Radio Caroline<sup>^</sup>, Port FM, Radio Waitaki<sup>^</sup>, Timaru Police, Bob Reid and Bill Simpson. The Metservice has issued the following forecast at 10 am this morning - East to south east swell rising to 4 m occasional 6 m this afternoon for the Waitaki River to Banks Peninsula. On Saturday the swell is expected to rise to 4.5 m occasional 7 m throughout the region. High tide is approximately 3 pm today. Considerable overtopping of the beach system can be expected as high tide approaches this afternoon. Considerable flooding of land adjacent to coastal areas may result. Farmers in coastal areas are advised to move stock to higher ground. Residents in coastal areas are advised to monitor the situation carefully and take appropriate action.

# CANTERBURY REGIONAL COUNCIL FLOOD LOG SOUTHERN AREA

Event: 19-23 JULY 2001 FLOOD EVENT

Logged By: FIONA WILLIX

Call No: 20 Date Of Call: 20/07/01 Time Of Call: 1110 Location: N/A

Caller: Philip Lees

Received By Telephone By Radio Caroline - Receptionist  
*and Whitstone 877*

**Message:**

Also contacted Port FM, White FM and Radio Waitaki. ^ Fax coming through - hourly plus 12.30 pm please. Everyone will broadcast it.

Call No: 24 Date Of Call: 20/07/01 Time Of Call: 1115 Location: Waihao

Caller: Mick Laming (689 9832)

Received By Telephone By Sue Seymour

**Message:**

Breach in shingle bar at Skeltons Ford. Waihao Box 2 boards sprung. Will ring Bruce back at midday or could Bruce contact him. Rang Mick 11.15 am (Paul Eddy) - Skeltons Ford overtopping and rods.

Call No: 26 Date Of Call: 20/07/01 Time Of Call: 1120 Location: N/A

Caller: Sue Seymour

Received By Telephone By See message below

**Message:**

Warnings to: Colin Ladbroke - 688 2377 (knee high through workshop, same as years ago), Carol - 615 9143 (overtopped on stopbank, blew out on ongoing tide, lagoon now empty, swell screwing around so lessening, goin on train trip to West Coast anyway), John Hughes (cell phone message), Neville Hall - 612 6645 (wife), Mick Laming - 689 9832 (wife), Bill Penno - 025 343 056, Mark Oldfield - Beach Road, Tom Lister - 688 2191 (wife), Mark Houston - 615 6322 (Phillipa, back paddocks under water now), and Alister Rooney - 615 9003. "East to south east swell rising to 4 m occasional 6 m this afternoon between Banks Peninsula and north of the Waitaki River. Swell is expected to rise to 4.5 m occasional 7 m tomorrow Saturday. Could continue until Sunday until low pressure system moves on."

Call No: 22 Date Of Call: 20/07/01 Time Of Call: 1130 Location: N/A

Caller: Philip Lees

Received By Telephone By Mark Bang, Timaru DC

**Message:**

Passed on Metservice forecast from 1101 hours.

Call No: 23 Date Of Call: 20/07/01 Time Of Call: 1145 Location: N/A

Caller: Philip Lees

Received By Fax By Noel Woolf

**Message:**

Latest Metservice swell forecast for your information.

*(1011g forecast)*

## CANTERBURY REGIONAL COUNCIL FLOOD LOG SOUTHERN AREA

**Event: 19-23 JULY 2001 FLOOD EVENT**

**Logged By: FIONA WILLIX**

**Call No: 25 Date Of Call: 20/07/01 Time Of Call: 1150 Location: Rangitata Huts South**

Caller: Philip Lees

Received By Telephone By Colin Tipper (South Rangitata Huts)

**Message:**

No problems last night. He will pass the message on. Passed Metservice forecast on.

**Call No: 27 Date Of Call: 20/07/01 Time Of Call: 1150 Location: Temuka**

Caller: Philip Lees

Received By Telephone By Paul Eddy

**Message:**

(From Paul). Passed on Metservice update. South of Timaru: considerable flooding has occurred and will do so again at high tide - river mouths/lagoons, all farmers have been contacted. Milford Lagoon: critical spot, they will erect a debris fence on top of stopbank opposite the mouth. They will keep us informed. Opihi-Orari: overtopping of the gravel beach along full length, some water over stopbank at low points. North of Orari: old Orari Lagoon - some flooding.

**Call No: 28 Date Of Call: 20/07/01 Time Of Call: 1235 Location: Christchurch**

Caller: Philip Lees

Received By Telephone By Bob Reid and Bill Simpson

**Message:**

Informed them of situation (messages on answer phone). 1300 hours - Bill rang back and I gave him a full update. 1330 hours - Bob rang, updated him fully.

**Call No: 29 Date Of Call: 20/07/01 Time Of Call: 1305 Location: N/A**

Caller: Colin Tipper - South Rangitata Huts

Received By Telephone By Philip Lees

**Message:**

Gorse beside lagoon near huts <sup>is</sup> are covered with shingle. Water in depressions at south end. First time Colin seen water over beach. Everyone at the huts knows the situation.

**Call No: 30 Date Of Call: 20/07/01 Time Of Call: 1340 Location: N/A**

Caller: Philip Lees

Received By Telephone By Paul Eddy, 025 352 959

**Message:**

Set up at Milford: lagoon low (1.7 m) - starting to rise. Sea reasonably high, odd wave going over. Sandbagging low spot at road. Building barrier on top of stopbank. Paul said the overtopping last night occurred shortly before the mouth blew out at 10.30 pm. He is concerned with the possibility of waves on the lagoon overtopping the stopbank near high tide.

## CANTERBURY REGIONAL COUNCIL FLOOD LOG SOUTHERN AREA

**Event: 19-23 JULY 2001 FLOOD EVENT**

**Logged By: FIONA WILLIX**

**Call No: 40 Date Of Call: 20/07/01 Time Of Call: 1345 Location: Waihao**

Caller: Sue Seymour

Received By Telephone By John Hughes

**Message:**

Left cell phone message. Current situation 5 m swells for next 24-48 hours. Winds expected to pick up from south east, noon Saturday.

**Call No: 31 Date Of Call: 20/07/01 Time Of Call: 1345 Location: N/A**

Caller: Krista Hunter, Timaru Herald

Received By Telephone By Philip Lees

**Message:**

Update on situation, south of Timaru, Washdyke north and Milford Huts. Suggested she talk to Timaru District Council regarding Benveneue area. High tide at 3 pm. Milford Huts area of concern at high tide.

**Call No: 32 Date Of Call: 20/07/01 Time Of Call: 1430 Location: Waihao**

Caller: Philip Lees

Received By Telephone By John Hughes

**Message:**

Pouring into the river. Odd big wave, water overtopping for 200 mm of beach. Richardson's complaining they were not warned. John agreed there is nothing more ECan can do for warnings. Passed on Metservice forecast We will NOT RECONTACT them unless the forecast is different.

**Call No: 33 Date Of Call: 20/07/01 Time Of Call: 1440 Location: N/A**

Caller: Philip Lees

Received By Telephone By Paul Eddy

**Message:**

2 m and still rising. Sea is not as rough as last night. Two thirds of beach being overtopped at any one time - filling up rapidly. Does not appear to be pushing to the north, towards Mark Houston's. Houston is just south of Orari. Situation does not appear to be as bad as last night. Paul predicts the situation may ease.

**Call No: 36 Date Of Call: 20/07/01 Time Of Call: 1450 Location: Wellington**

Caller: Philip Lees

Received By Telephone By Metservice, Marine Forecaster

**Message:**

Do not expect swells to drop maintain at 5 m for 24-48 hours then a slow reduction. Winds will pick up from south east by Saturday noon.

## CANTERBURY REGIONAL COUNCIL FLOOD LOG SOUTHERN AREA

**Event: 19-23 JULY 2001 FLOOD EVENT**

**Logged By: FIONA WILLIX**

**Call No: 48 Date Of Call: 20/07/01 Time Of Call: 1500 Location: N/A**

Caller: Metservice (internet site) Received By Fax By Philip Lees

**Message:**

Marine Forecast - expect present situation to continue for 24-48 hours, south east 5 m swells. Winds expected to pick up from south east noon Saturday.

**Call No: 34 Date Of Call: 20/07/01 Time Of Call: 1500 Location: Aorangi Road**

Caller: Gavin Ladbrook Received By Telephone By Philip Lees

**Message:**

600 mm over floor of workshop at 0200 hours this morning. 150-200 mm below floor now (high tide). Every wave is going over the beach. Passed on Metservice update - situation that we have now is expected to continue. They have raised everything and are not concerned at this stage.

**Call No: 37 Date Of Call: 20/07/01 Time Of Call: 1510 Location: Washdyke/Aorangi Road**

Caller: Graham Sullivan Received By Telephone By Philip Lees

**Message:**

Overtopping of beach at Washdyke from Freezing Works and north as far as he could see.

**Call No: 35 Date Of Call: 20/07/01 Time Of Call: 1512 Location: N/A**

Caller: Justin Cope Received By Telephone By Sue Seymour

**Message:**

Been onto NIWA - wave buoy. Maximum wave height 8 m deep water wave last night at high tide. Today's ones at high tide 5-6 m estimated.

**Call No: 39 Date Of Call: 20/07/01 Time Of Call: 1540 Location: Waimate**

Caller: Philip Lees Received By Telephone By Murray Johnston, Waimate DC

**Message:**

Passed on 1500 hour Marine forecast. Hook Swamp Road, had water over it. Waihao - two mouths, Box - lake. Murray said that water levels are much lower now (high tide) than at 0200 hours this morning.

**Call No: 38 Date Of Call: 20/07/01 Time Of Call: 1540 Location: N/A**

Caller: Sue Seymour Received By Telephone By Peter Hall, Opus

**Message:**

Springbank culvert north of Otaio (south end of passing lanes). Water backed up both sides of road due to overtopping of sea wall. If situation worsens overnight, please ring their 24 hour office number 684 8539.



# CANTERBURY REGIONAL COUNCIL FLOOD LOG SOUTHERN AREA

**Event: 19-23 JULY 2001 FLOOD EVENT**

**Logged By: FIONA WILLIX**

**Call No: 43 Date Of Call: 20/07/01 Time Of Call: 1545 Location: Milford**

Caller: Paul Eddy

Received By Telephone By Bruce Scarlett

**Message:**

Approximately 120 sandbags now on top of stopbank ramp. 100 m of wash fence erected on seaward side of stopbank adjacent to ramp. Paul Eddy will check site at 10 pm tonight.

**Call No: 44 Date Of Call: 20/07/01 Time Of Call: 1600 Location: N/A**

Caller: Philip Lees

Received By Fax By Various - Radio stations etc.

**Message:**

Swell warnings - all radio stations contacted by phone. They will broadcast hourly. 1700-2000 tonight and 0600-1000 hours tomorrow (warnings monitored).

*The Metservice have predicted 5m South East swells to continue for the next 24-48 hrs. N of the Waitaki River. Overtopping of the beach system can be expected at high tide. Some flooding of land adjacent to coastal areas will continue. Farmers and residents are advised to monitor the situation carefully and take appropriate action.*

**Call No: 46 Date Of Call: 20/07/01 Time Of Call: 1605 Location: N/A**

Caller: Bruce Scarlett

Received By Telephone By P L Smith

**Message:**

Okay to open Saltwater Creek mouth, is sending <sup>ton</sup> digger on side about 5 pm. Swell/sea water not filling up creek too much, but runoff from rain likely to bring creek up overnight.

**Call No: 45 Date Of Call: 20/07/01 Time Of Call: 1606 Location: Saltwater Creek, SH 1**

Caller: Bruce Scarlett

Received By Telephone By B Mulcahy

**Message:**

Paul L Smith opening mouth 5 pm.

**Call No: 41 Date Of Call: 20/07/01 Time Of Call: 1609 Location: N/A**

Caller: Philip Lees

Received By Fax By Whitestone

**Message:**

Also faxed to Radio Waitaki, Port FM, Radio Caroline and Timaru Police. All stations will broadcast hourly 5-8 pm tonight. Tomorrow 6-10 am. The Metservice have predicted 5 m south east swells to continue for the next 24-48 hours north of the Waitaki River. Overtopping of the beach system can be expected at high tides. Some flooding of land adjacent to coastal areas will continue. Farmers and residents in coastal areas are advised to monitor the situation carefully and take appropriate action.

## CANTERBURY REGIONAL COUNCIL FLOOD LOG SOUTHERN AREA

**Event: 19-23 JULY 2001 FLOOD EVENT**

**Logged By: FIONA WILLIX**

**Call No: 42 Date Of Call: 20/07/01 Time Of Call: 1612 Location: Seadown**

Caller: Phil Crotty

Received By Radio By Bruce Scarlett

**Message:**

Beach Road - no overtopping here or south. Some to the north. Water level around 1-1.5 m lower than previous.

**Call No: 52 Date Of Call: 21/07/01 Time Of Call: 0900 Location: N/A**

Caller: Philip Lees

Received By Telephone By Paul Eddy

**Message:** (last night)

2300 hours ^ lagoon dry. Sea not as rough as yesterday. Paul does not perceive any problems. He will check Milford at 1100 hours and then 1500 hours.

**Call No: 51 Date Of Call: 21/07/01 Time Of Call: 0930 Location: N/A**

Caller: Philip Lees

Received By Telephone By Metservice - Marine

**Message:**

Still on shore south-south easterlies, 5 m swell, 35 knt. Dunedin (head) Tairoha 3-4 m swell. No change in wind or direction.

**Call No: 50 Date Of Call: 21/07/01 Time Of Call: 0940 Location: N/A**

Caller: Philip Lees

Received By Telephone By Peter (Hughes) (John Hughes cell phone)

**Message:**

I passed n Metservice forecast - same as yesterday. Water level on land has dropped. Sea is much flatter. Peter said all stock has been moved. Nothing more they can do.

**Call No: 49 Date Of Call: 21/07/01 Time Of Call: 1000 Location: Saltwater Creek**

Caller: Bruce Scarlett

Received By Telephone By Philip Lees

**Message:**

Saltwater Creek is open, no problems there, should be okay.

**Call No: 47 Date Of Call: 21/07/01 Time Of Call: 1230 Location: Milford**

Caller: Paul Eddy

Received By Telephone By Philip Lees

**Message:**

No problems at Milford. The mouth is open and the lagoon is empty. No need to check tonight. A Civil Defence Warden is living at the Huts. I passed on Metservice swell forecast. They are being cautious.

## CANTERBURY REGIONAL COUNCIL FLOOD LOG SOUTHERN AREA

Event: 19-23 JULY 2001 FLOOD EVENT

Logged By: FIONA WILLIX

Call No: 53 Date Of Call: 23/07/01 Time Of Call: 0900 Location: Waihao

Caller: Philip Lees

Received By Telephone By John Hughes

**Message:**

A lot of water gone, quite a bit still around Lake Wainono. A beach has built up a bit already, beach has shifted 30' (10 m) west wards, no waves over beach Saturday/Sunday, all overtopping was from one tide and only a short time, no water coming over at Waihao at 2315 hours on 19 July 2001, but at 0145 hours 20 July 2001 cattle near sheep yards at Maori Road/Byrnes Road Corner had water up to their bellies, at 0300 hours water started to recede (high tide Timaru 0200 hours), 3' (1 m) of water in car park at Waihao Box, mouth is running to the north east from the box, John doesn't know of any stock losses, Bleekers may have lost 15 sheep, large numbers of cows made miraculous escapes (chased out by sea water), none of the farmers John ran on Thursday shifted stock, and John shifted 1400 sheep from flood prone areas on Wednesday when he was concerned at the size of the sea swells.

## **Appendix 2**

