BEFORE INDEPENDENT HEARING COMMISSIONER APPOINTED BY THE WESTLAND DISTRICT COUNCIL

IN THE MATTER OF	the Resource Management Act 1991
AND	
IN THE MATTER OF	resource consent applications 220120 & 230030 at 117 Arthurstown Road, Hokitika
BY	Forest Habitats Limited

MEMORANDUM FOR THE COMMISSIONER

McFADDEN McMEEKEN PHILLIPS
LAWYERS

Level 2, 241 Hardy Street
Nelson

P O Box: 656
DX: WC 70016
Phone: +64 3 548 2154

Solicitor: Nigel McFadden
(nm@mmp.co.nz)

42812 / 00026 /

May it please the Commissioner

1. By the Commissioner's Minutes dated variously 29 November 2024 and 17 December 2024 ("the Minutes") the Commissioner required the Applicant to provide further information as follows: -

   (a) ***A copy of the subdivision plan overlaid by the coastal hazard alert (variation) overlay proposed in Variation No. 2 to the Te Tai o Poutini Plan*** ("TTPP")

   Response: This plan as directed, is attached as "A".

   (b) ***A copy of the modelling report that informed the revised flood hazard layers in Variation 2 of the TTPP***

   Response: A full email response received from Doug Bray, Senior Policy Planner, West Coast Regional Council is annexed as "B". The response notes that the report is by Land River Sea and was prepared in 2020. Page 26 of the report outlines the different model runs that were generated - which include both RCP 6.0 and RCP 8.5.

   (c) ***A copy of the new provisions proposed as part of Variation 2 of the TTPP***

   Response: The Commissioner advised in the Minute of 17 December 2024 that no further response was necessary.

   (d) ***Confirmation as to whether the reference in Rule NH-R10 of the TTPP to the 1% AEP event includes the RCP 8.5 scenario***

   Response: This matter is addressed above as part of "B". The response provided by Doug Bray of West Coast Regional Council by reference to the email of Lois Easton of West Coast Regional Council records that the Land River Sea report: -

   > "*... outlines the different model runs that were generated - which include both RCP 6.0 and RCP 8.5*".

(e) ***A copy of the flood modelling report for the new Hokitika stop bank prepared by Land River Sea Consulting Ltd***

<u>Response:</u> This report is attached as "C". Matthew Gardner has commented on the effect of the stop bank raising at the top of page 17 in his attached modelling report, which confirms minimal impact on both flood extent and peak flood levels, except for some localised increases within the river channel itself. He refers specifically to raising the stop bank.

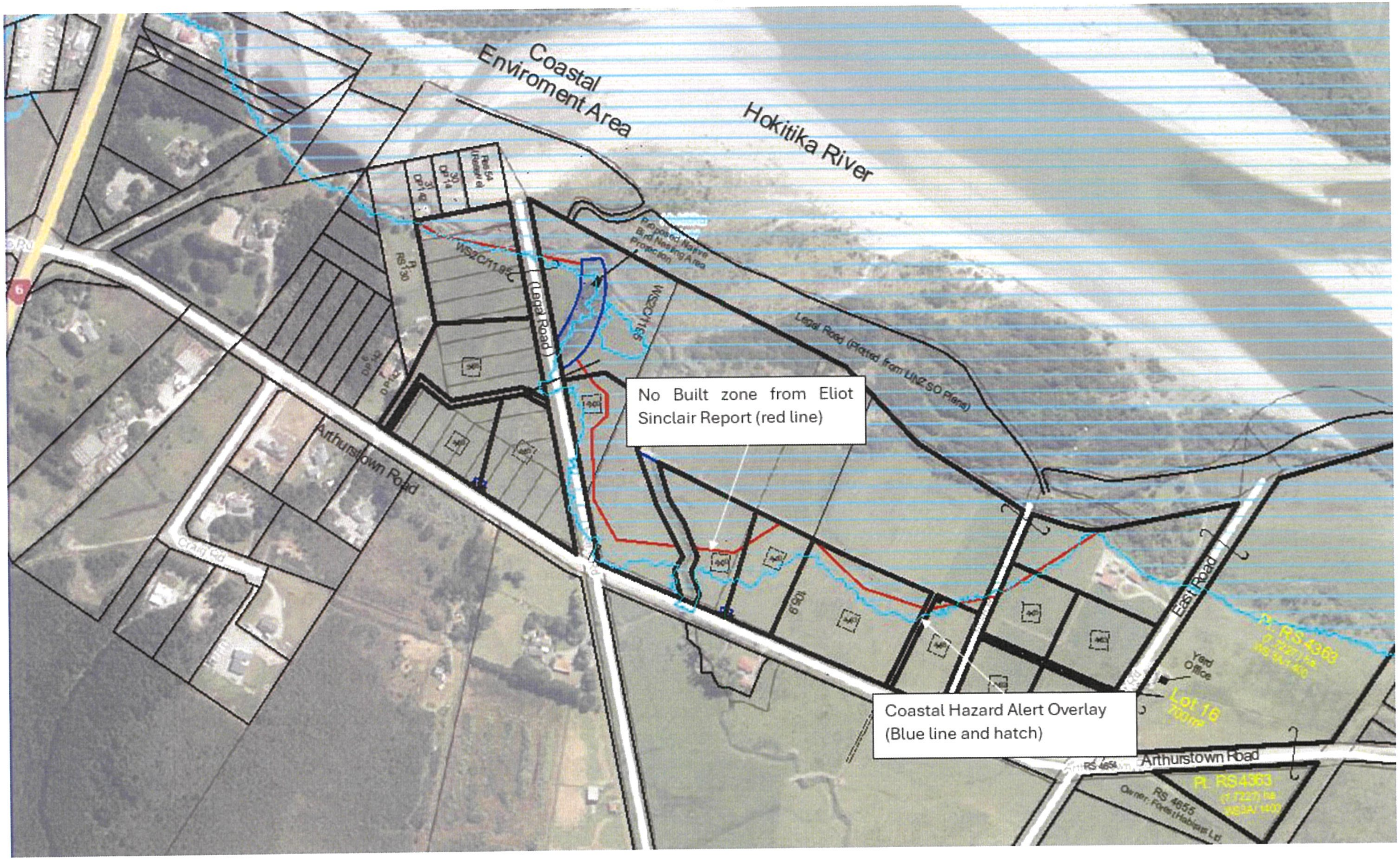
(f) ***A full explanation from Mr. Challenger regarding his estimations about the flood depths at the site resulting from the potential displacement of flood water from the Hokitika stop bank***

<u>Response:</u> The full explanation is contained in Mr Challenger's report annexed as "D".

NA McFadden
Counsel for Forest Habitats Limited

14 February 2025

"A"



Coastal Hazard Alert Overlay: New Buildings for Sensitive Activities NH-R43 Discretionary activity if located within the overlay

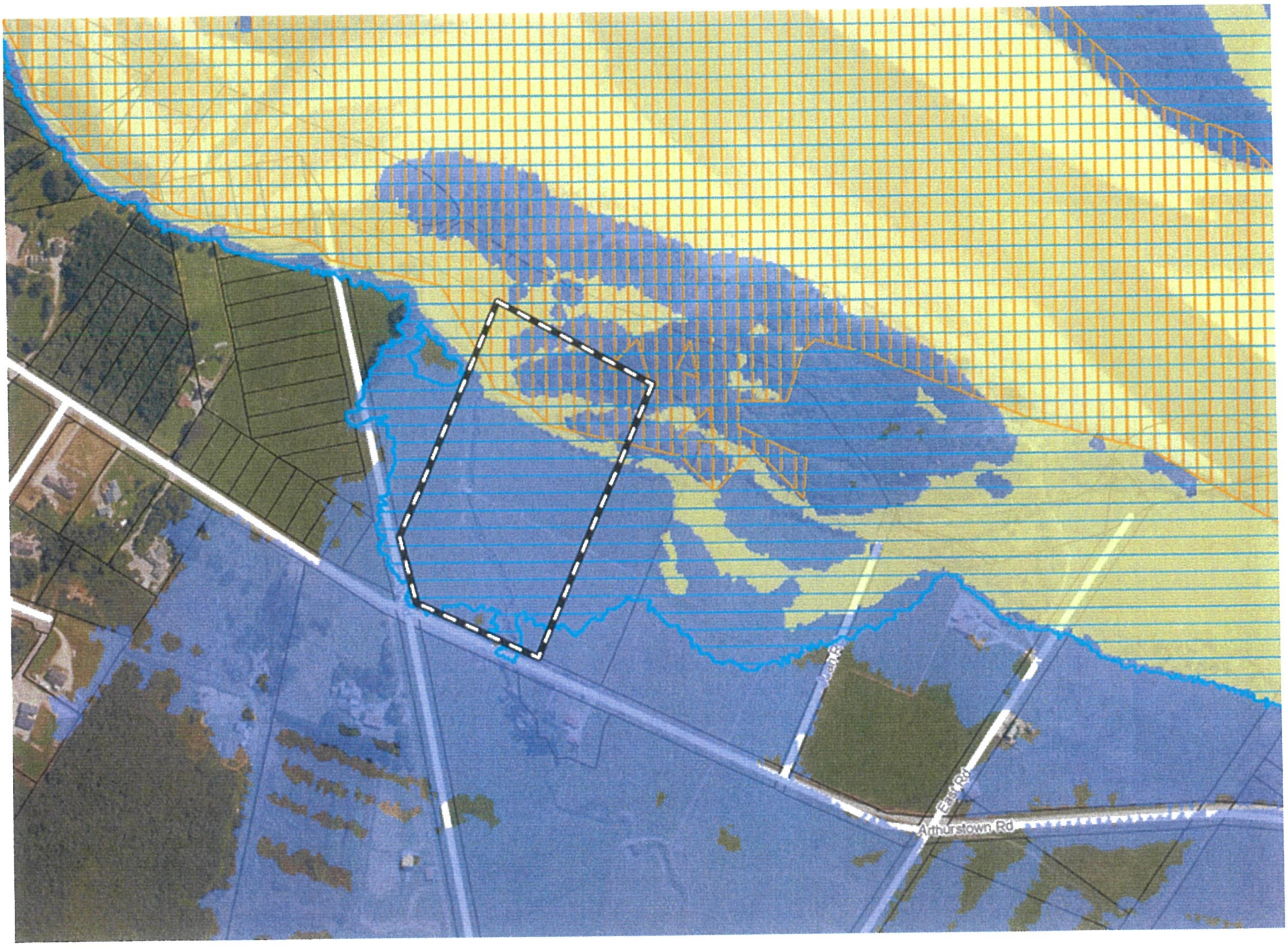
"B"

From: Doug Bray <doug.bray@wcrc.govt.nz>
Sent: Friday, 10 January 2025 2:28 pm
To: barry@macdonellconsulting.co.nz
Cc: Sharon Hornblow <sharon.hornblow@wcrc.govt.nz>; Reg Kemper <reg.kemper@wcrc.govt.nz>; Jo Armstrong <jo.armstrong@wcrc.govt.nz>; Chu Zhao <chu.zhao@wcrc.govt.nz>; Lillian Crozier <lillian.crozier@wcrc.govt.nz>
Subject: Fw: Flood Hazard: 117 ARTHURSTOWN ROAD, HOKITIKA

Kia ora Barry

Thanks for your email - confirming that the property concerned is at 117 Arthurstown Road, Hokitika. As this will assist somewhat in narrowing down the search for information of relevance.

In terms of the Proposed te Tai o Poutini Plan itself, there are in fact a number of Natural Hazard Overlays applied by the Proposed Te Tai o Poutini Plan to this particular property - as shown on the Map below.



These include:

- Coastal Tsunami Hazard - orange hatch;
- Flood Hazard Susceptibility - blue shading;
- Flood Hazard Severe - yellow shading
- Coastal Hazard Alert (as imposed/determined by Variation 2) - light blue shading; and
- Flood Plain - dark blue shading.

I have shown the Flood Plain Overlay separately. That is an Overlay for which no modelling has been undertaken, and to which no specific Rules are intended to apply. It was initially included as a "precautionary approach", but while formal decisions are yet to be made, present indications are that it may well be removed from the Plan.

Indications are from the attached Subdivision Scheme Plan that building will take place principally in the south of the area concerned - meaning the Flood Hazard Susceptibility and Coastal Hazard - Alert Overlays are of principal relevance (with the Coastal Tsunami Overlay and Flood Hazard Severe Overlay affecting the north of the area, which will include balance-type allotments to be amalgamated.

As mentioned, Dr Sharon Hornblow (Natural Hazards Analyst with the Catchment Management Team) is back on 23 January 2025, and will be able to confirm things. But essentially:

- In terms of the Flood Hazard Susceptibility Overlay, of relevance is the publication *Hokitika River Hydraulic Modelling and Flood Hazard Mapping* (Land River Sea Consulting, June 2020). What is itself quite a large document is available for download at https://ttpp.nz/wp-content/uploads/2022/01/2020_LRS_Hokitika-River-Hydraulic-modelling-and-flood-hazard-mapping_v2-10-12-2020.pdf. Different design runs were generated, as highlighted on page 26 of the report. These included applications of both RCPs 6.0 and 8.5, and relative to both 50 and 100 year return periods, plus one for each return period based on current climatic conditions. Sharon would confirm it 100%, but it is understood that Scenario 5 (i.e. 100 year return period and relative to the current climate) was applied. So essentially climate change was *not* factored in, and the decision was somewhat of a "political" one; while
- In terms of the Coastal Hazard-Alert Overlay, RCP 6.0 is understood to have been used. In relation to the property concerned, the Overlay has been added as a result of Variation 2: Coastal Hazards (i.e. Essentially the application of superior LiDAR (light detection and ranging) data, in preference to less accurate space shuttle-type data).

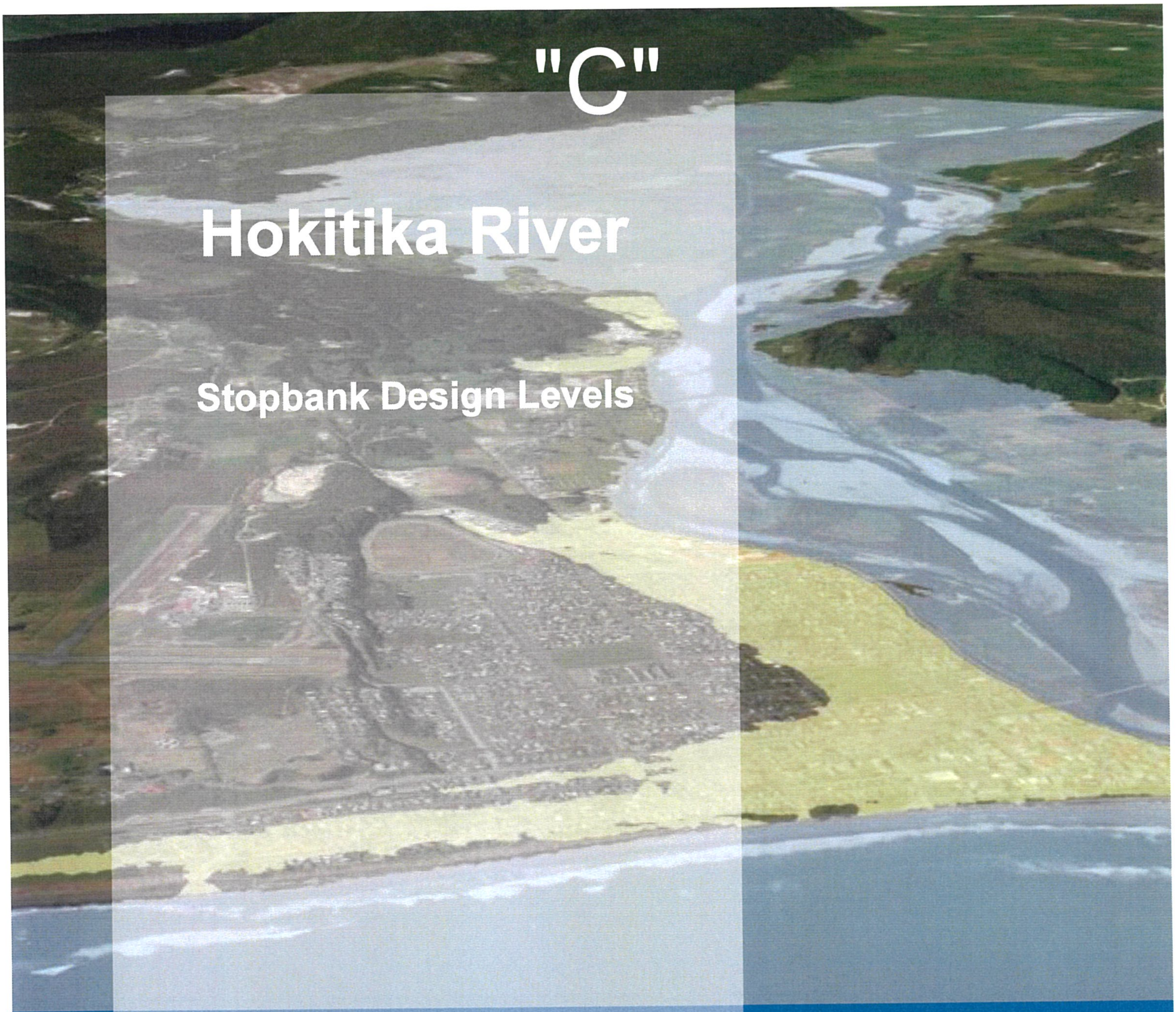
Hopefully the above provides some degree of guidance for now.

Cheers

Doug Bray
Senior Policy Planner | West Coast Regional Council

doug.bray@wcrc.govt.nz | +64 3 768 0466 ext. 9109 | +64272416771

"C"



Hokitika River

Stopbank Design Levels

SEPTEMBER 09, 2020

Client: West Coast Regional Council
Report by: Matthew Gardner
Land River Sea Consulting Ltd
www.landriversea.com

LANDRIVERSEA CONSULTING

THE WEST COAST REGIONAL COUNCIL

HOKITIKA RIVER – STOPBANK DESIGN LEVELS

REVISION HISTORY

Author:	Matthew Gardner Water Resources Engineer, CMEngNZ, CPEng
Signature:	
Date:	9/09/2020
Revision:	01
Authorised by:	Brendon Russ
Signature:	
Organisation:	West Coast Regional Council
Date:	

Land River Sea Consulting Limited
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Christchurch

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E: matthew@landriversea.com
W: landriversea.com

TABLE OF CONTENTS

LANDRIVERSEA CONSULTING

1. INTRODUCTION

1.1 SCOPE

Land River Sea Consulting built a 2-dimensional hydraulic model of the Hokitika River in June 2020. Full details on the original model build can be found in the model build report (Gardner, 2020).

The WCRC has now asked us to provide design stopbank heights for three areas as shown in Figure 1-1 below.

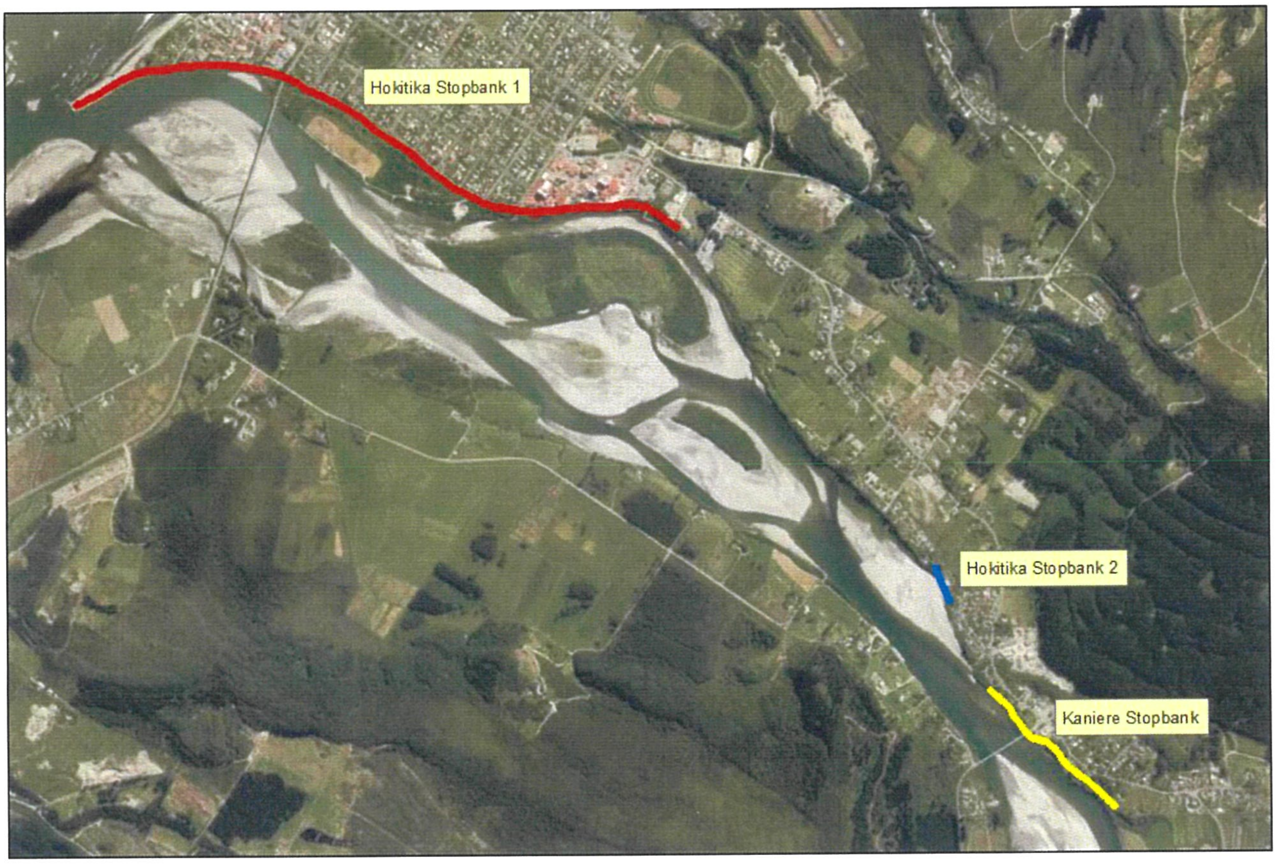

Figure 1-1 – Location of modelled stopbanks

Rather than simply adding 0.9m of freeboard to the base model results, as is often done for major stopbank design, we have used a detailed sensitivity analysis approach, in order to fully understand the likely impacts of a range of potential aggradation, bridge blockage scenarios as well as investigating the impact of a change in the location of the existing river mouth. The advantage of this approach is that the model is used to assess realistic changes in peak water level due to likely physical scenarios and doesn't apply a blanket freeboard to the entire river.

The design storm chosen for the stopbank design is the 1 in 100-year event with an allowance for climate change. We have chosen the RCP 6.0 scenario and have simulated 1m of sea level rise in conjunction with a 0.4m storm surge component for the tidal boundary.

2. MODELLED SENSITIVITY SCENARIOS

10 sensitivity scenarios have been simulated as part of our investigations which are detailed below:

SCENARIO 01 – LONGMOUTH SCENARIO

This scenario simulates the mouth migrating south as has occurred historically. The modelled channel alignment has been based on the analysis of historical satellite imagery. Figure 2-1 shows the modelled alignment. Bed levels in the modelled channel have been kept as similar to the existing channel, however the increased channel length has caused bed slopes to decrease.

Figure 2-1 – Simulated Long Mouth Scenario

SCENARIO 02 – INCREASE IN CHANNEL ROUGHNESS (25%)

This scenario has simulated an increase in channel roughness by 25% by increasing the Manning's 'n' value within the entire river channel. Channel roughness during a flood event is a very complex phenomena and it is very difficult to determine with precision what the impact on channel roughness will be. Scientific opinion is mixed within the NZ river science community; however studies have been undertaken showing that channel roughness can increase significantly with an increase in flow.

It is also important to realise that over time significant changes in channel vegetation etc can take place which will have an influence on the overall roughness factor.

SCENARIO 03 TO 07 – LOCALISED AGGRADATION SCENARIOS 1 TO 5

In order to simulate the impact of localised gravel build up, we have simulated 5 separate scenarios with significant gravel islands building up over time in locations that we have judged to likely to cause.

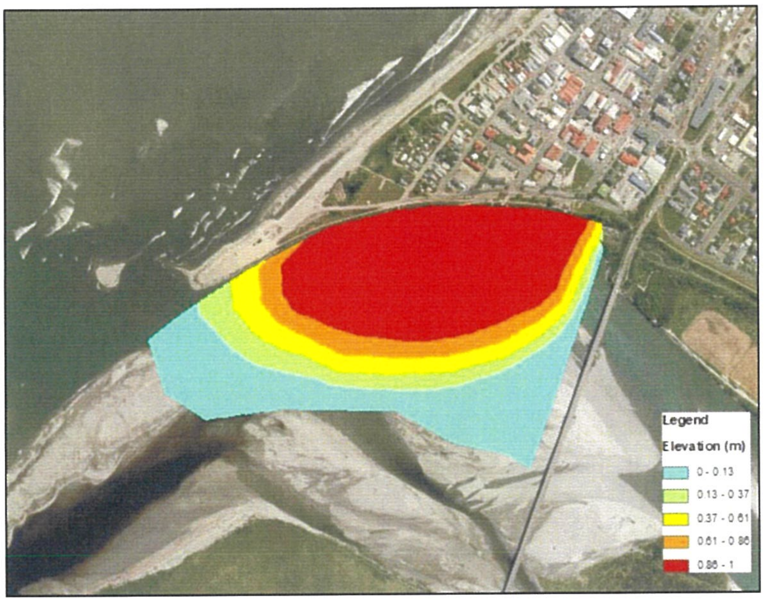

Figure 2-2 – Aggradation Scenario 1

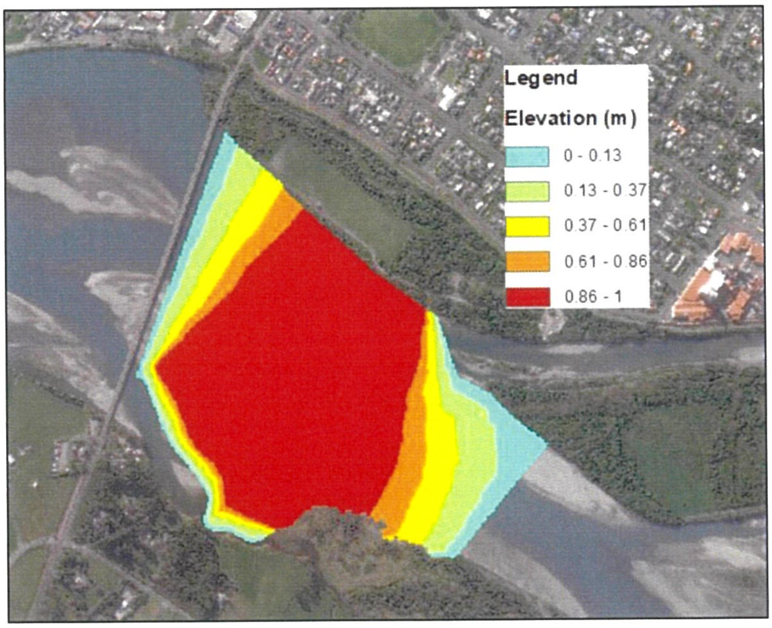

Figure 2-3 – Aggradation Scenario 2

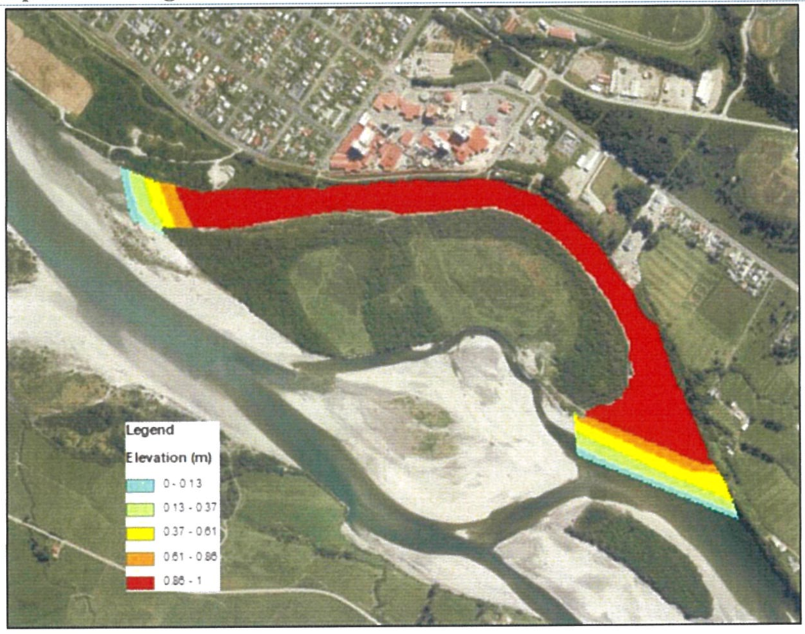

Figure 2-4 – Aggradation Scenario 3

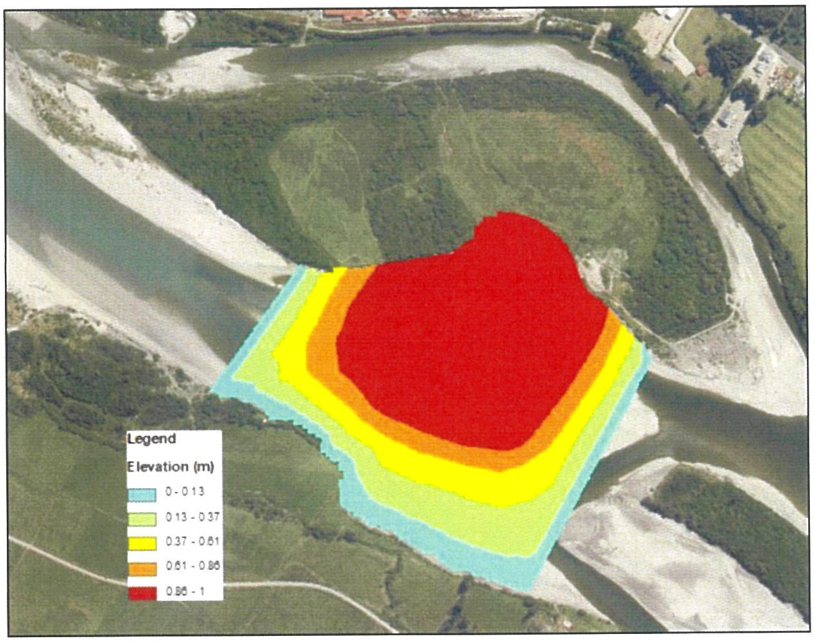

Figure 2-5 – Aggradation Scenario 4

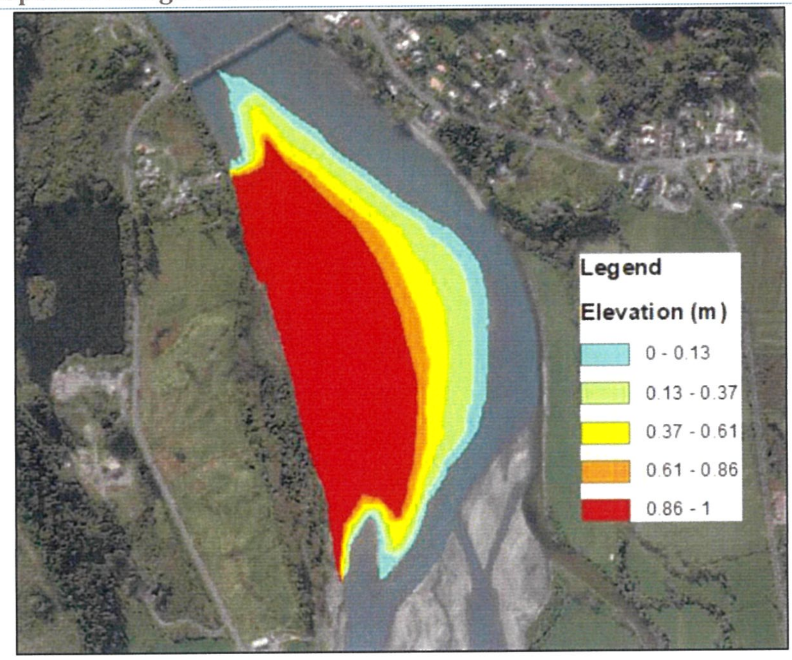

Figure 2-6 – Aggradation Scenario 5

SCENARIO 08 – STATE HIGHWAY BRIDGE PIER BLOCKAGE

This scenario has simulated the impact of significant build up of debris on the bridge piers of the State Highway Bridge. In total there are 35 piers in the waterway and for this simulation we have doubled the width of 18 of these piers on the righthand side of the channel (ie closest to the stopbank). This has increased the percentage of the channel blocked from 6.5% to 10%. Considering the significant width of the channel and spacing between the piers, we consider that this is a realistic scenario.

SCENARIO 09 – KANIERE BRIDGE PIER BLOCKAGE

This scenario has simulated the impact of significant build up of debris on the bridge piers of the Kaniere Bridge. In total there are 12 piers in the waterway and for this simulation we have doubled the width of these piers. This has increased the percentage of the channel blocked from 8.5% to 17%.

It should be noted that we do not have any survey information for this bridge on file, therefore the bridge dimensions have been assumed. It is recommended that this bridge is surveyed before any stopbank is constructed in the vicinity and the model us rerun with actual dimensions prior to detailed design.

SCENARIO 10 – UNIFORM CHANNEL AGGRADATION (0.5M)

This scenario investigates the impact of long term gravel aggradation over the entire river channel which could potentially occur if there was in increase of gravel supply into the river due to increase erosion in the upper catchments for any reason (such as earthquake, or increased storm intensities).

This scenario has increased the entire main river channel by a uniform amount of 0.5m.

3. MODEL RESULTS

Model results have been presented in a range of formats.

1) Longsection profiles for each stopbank
2) Combined flood depth maps
3) Difference in peak flood depth maps

Longsection profiles have been produced for each stopbank showing the peak water level for each scenario as well as a combined scenario showing the maximum water level from each of the 10 sensitivity scenarios.

To allow an understanding of the sensitivity of the peak water level to of the scenarios, we have also plotted the peak water levels for each individual scenario and these are presented in Appendix A

Figure 3-1, Figure 3-2 and Figure 3-3 below show the location of each stopbank in relation to the peak water level plots.

Figure 3-1 – Hokitika Stopbank 1

Figure 3-2 – Stopbank 2

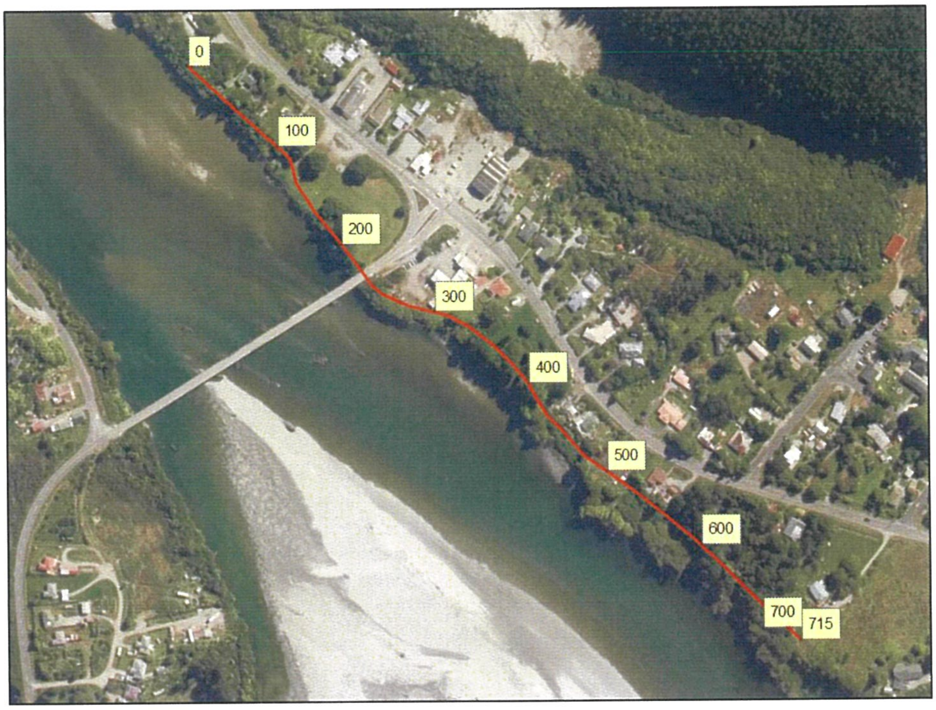

Figure 3-3 – Kaniere Stopbank

4. DESIGN STOPBANK LEVELS

Based on an analysis of the sensitivity results, I recommend that an additional 300 mm of freeboard is added to the combined peak water level results.

For Hokitika Stopbank 1, this results in an overall freeboard range of between 2.37 and 0.66 metres with an average freeboard amount of 1.25 m.

For Stopbank 2 this results in an overall range of 0.83m

For the Kaniere Stopbank this results in an overall freeboard range of between 0.72 and 0.82 metres for the with and average freeboard amount of 0.75 m.

Please note that all design levels presented in this report are in terms of the New Zealand Vertical Datum 2016 (NZVD2016).

HOKITIKA STOPBANK 1

Sensitivity results show that peak water levels are very sensitive to the location of the river mouth, with peak water levels increasing by more than 1.5m near the mouth.

Full results of each sensitivity run is presented in Appendix A. Design crest levels have been provided in electronic shapefile format at 20 metre intervals.

Final design profiles are presented in Figure 4-1, Figure 4-2, and Figure 4-3 below.

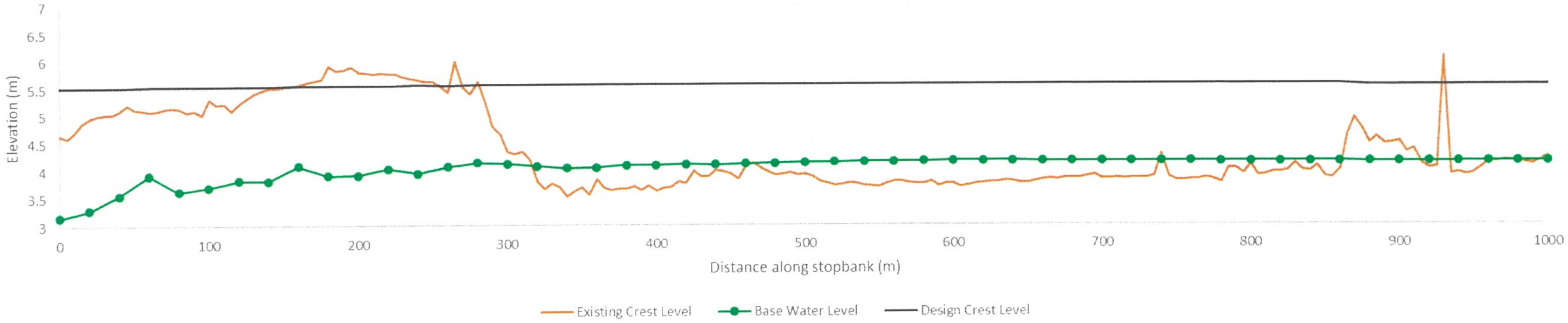

Figure 4-1 – Design Crest Levels Hokitika Stopbank 1 (0 to 1000m)

Figure 4-2 – Design Crest Levels Hokitika Stopbank 1 (1000m to 2000m)

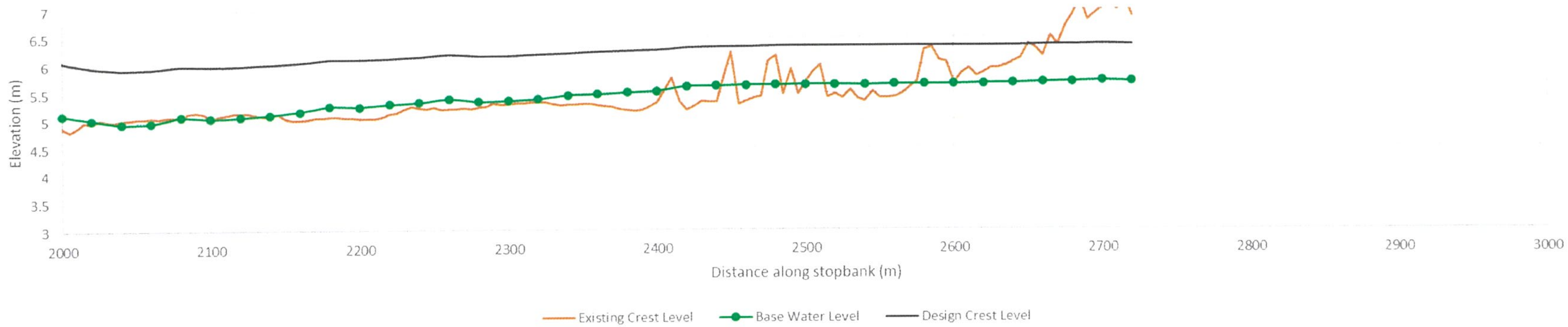

Figure 4-3 – Design Crest Levels Hokitika Stopbank 1 (2000m to 3000m)

HOKITIKA STOPBANK 2

There is no existing stopbank in this location, and the existing road level has been selected as the base level. One possible solution to prevent this flooding would be to raise the existing road to the design crest levels.

Sensitivity results show that peak water levels are most sensitive to the to the increased channel roughness and bed levels in this location, but show limited sensitivity to the mouth migration or bridge blockage scenarios.

Full results of each sensitivity run are presented in Appendix A and design crest levels are presented in tabular format in Appendix B.

Final design profile are presented in the Figure 4-4 below.

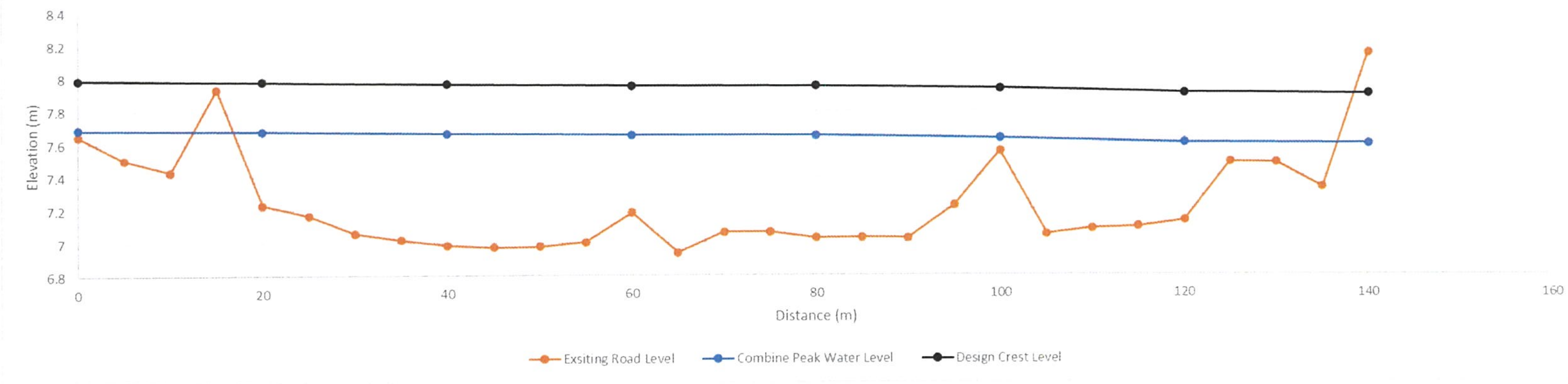

Figure 4-4 – Design Crest Levels Hokitika Stopbank 2

KANIERE STOPBANK

There is no existing stopbank in this location, and the existing ground level has been selected as the base level.

Sensitivity results show that peak water levels are most sensitive to the to the increased channel roughness and bed levels in this location, but show limited sensitivity to the mouth migration, localised aggradation, and bridge blockage scenarios.

Full results of each sensitivity run are presented in Appendix A.

Final design profiles are presented in Figure 4-5 below.

It should be highlighted that the bridge soffit is not currently included in this model due to a lack of survey information. If the bridge capacity is actually exceeded, then peak levels upstream of the bridge may be greater than this.

More detailed investigation into the existing bridge structure is recommended before finalising any design crest levels.

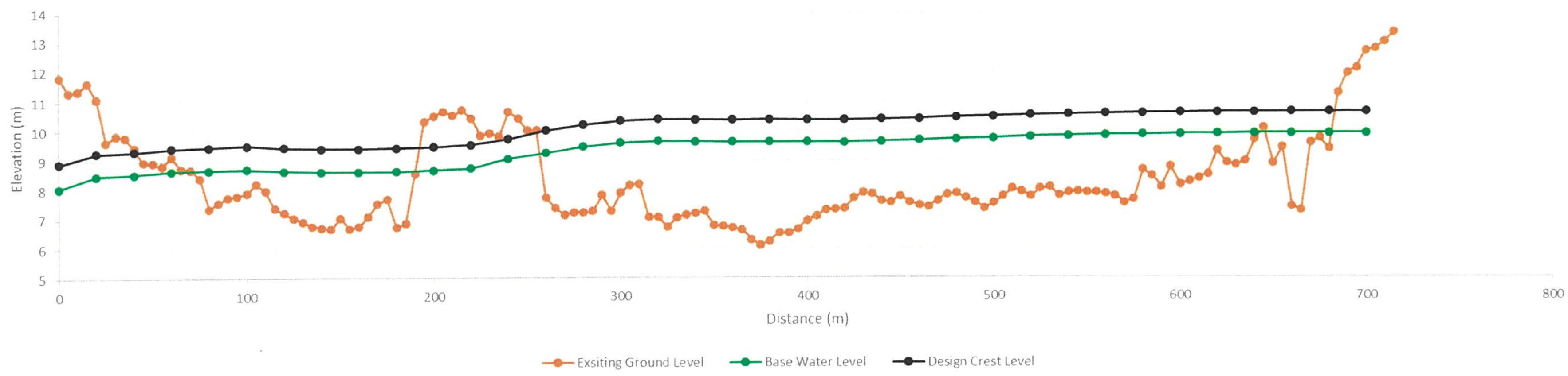

Figure 4-5 – Design Crest level for Kaniere Stopbank

5. FLOOD EXTENT MAPS

Raising the height of the existing banks has the potential to have unforeseen impacts on the flood extent. In order to compare the impact of the flood extent, the model has been run with and without the design stopbanks for each of the 10 sensitivity scenarios with the results being combined into a single map of flood maximum flood depth/extent.

It should be noted that this flood extent has a greater extent than the base flood map – due to the fact it is made up of a combination of all of the sensitivity runs which were not allowed for in the base model.

The two layers have then been subtracted from each other to present a difference in peak depth flood map – as well as a peak flood extent map.

Figure 5-1 presents the difference in peak flood depth map (difference in peak depth with and without the stopbanks in place), and Figure 5-2 presents the difference in peak flood extent map (difference in flood extent with and without the stopbanks in place.

Legend

Change in peak depth (m) (With Stopbanks)

- <-0.5
- -0.5 to -0.1
- -0.1 to -0.05
- -0.05 to 0.05
- 0.05 to 0.1
- 0.1 to 0.5
- >0.5

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FIGURE 5-1

0 0.3 0.6 1.2 Kilometers

PROJECT	MAP TITLE	REVISION	DATE
Hokitika River Flood Modelling	**CHANGE IN PEAK DEPTH MAP** 1 in 100 year event including climate change (2100) RCP Scenario 6, 1m Sea Level Rise,0.4m Storm Surge	01	07 September 2020
		A3 SCALE 1:20,000	AUTHOR Matthew Gardner

N

Legend

Flood Extent

- With StopBank
- Without StopBank

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FIGURE 5-2

0 0.3 0.6 1.2 Kilometers

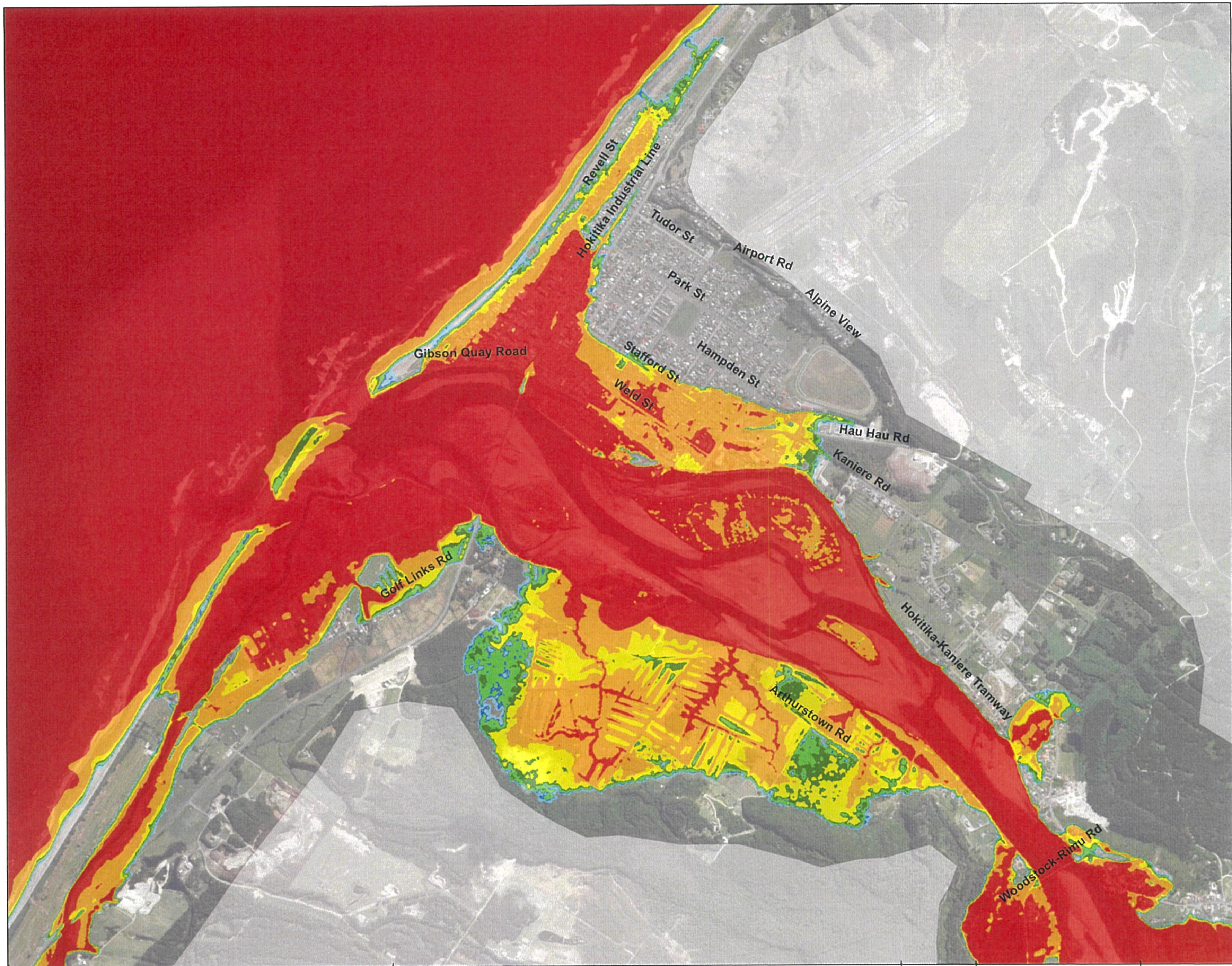
PROJECT **Hokitika River Flood Modelling**	MAP TITLE **CHANGE IN FLOOD EXTENT MAP** **1 in 100 year event including climate change (2100)** **RCP Scenario 6, 1m Sea Level Rise,0.4m Storm Surge**	REVISION **01** A3 SCALE **1:20,000**	DATE **07 September 2020** AUTHOR **Matthew Gardner**

N

Hokitika River – Stopbank Design Levels

It can be seen in Figure 5-1 and Figure 5-2 that raising the stopbanks will have minimal impact on both flood extent and peak flood levels, except for some localised increases in flood level within the river channel itself. This is likely due to the wide nature of the river channel, giving the river the ability to 'absorb' some of the increase in volume being held within the channel itself.

In addition to the change in depth / extent maps presented above in relation to the stopbanks, we considered it worthwhile to present the peak depth maps for the combined sensitivity run, as well as a change in extent map for this combined scenario. The increase in flood extent has been labelled as flood sensitive area in this map. This terminology is used by Greater Wellington Regional Council in some of their maps to separate the base flood extent from the model sensitivity scenarios and can aid in the public understanding how the flood extent in derived.



Legend

Max Peak Depth (m)

- 0
- 0 - 0.05
- 0.05 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- 1 - 2
- 2+

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FIGURE 5-3

0 0.3 0.6 1.2
Kilometers

PROJECT	MAP TITLE	REVISION	DATE
Hokitika River Flood Modelling	**COMBINED SENSITIVITY RUN (SCEN 01 to 10) 1 in 100 year event including climate change (2100) RCP Scenario 6, 1m Sea Level Rise,0.4m Storm Surge**	01	**07 September 2020**
		A3 SCALE 1:20,000	AUTHOR **Matthew Gardner**

N

Legend

Flood Extent

Base Extent

Flood Sensitive Area

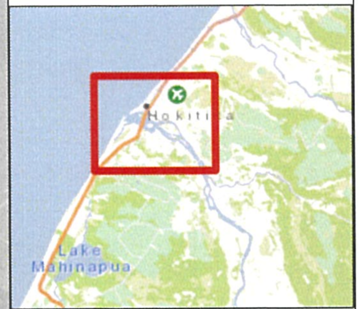

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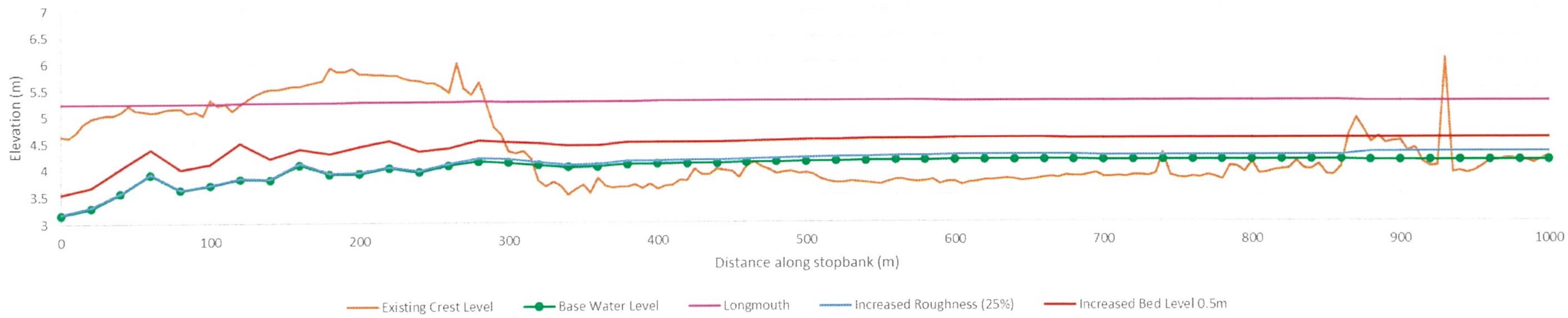
FIGURE 5-4

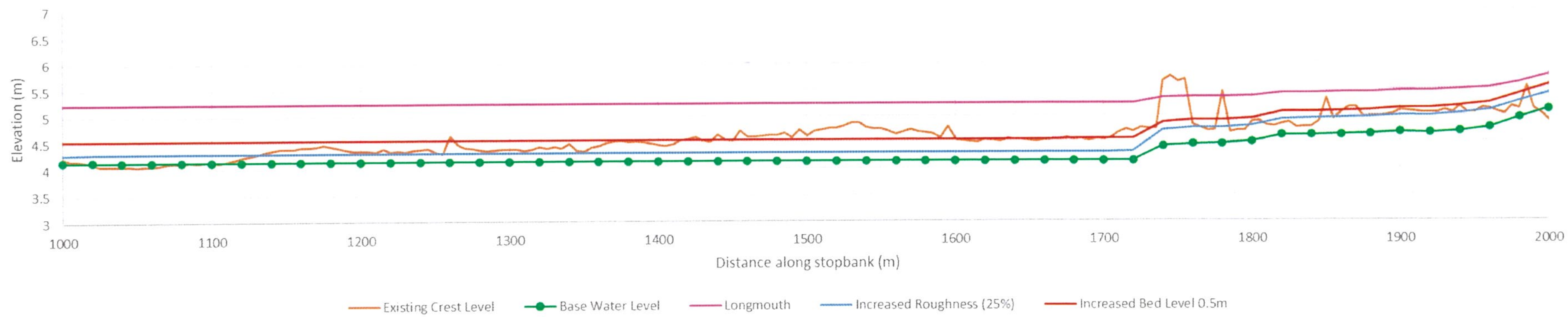
0 0.3 0.6 1.2
Kilometers

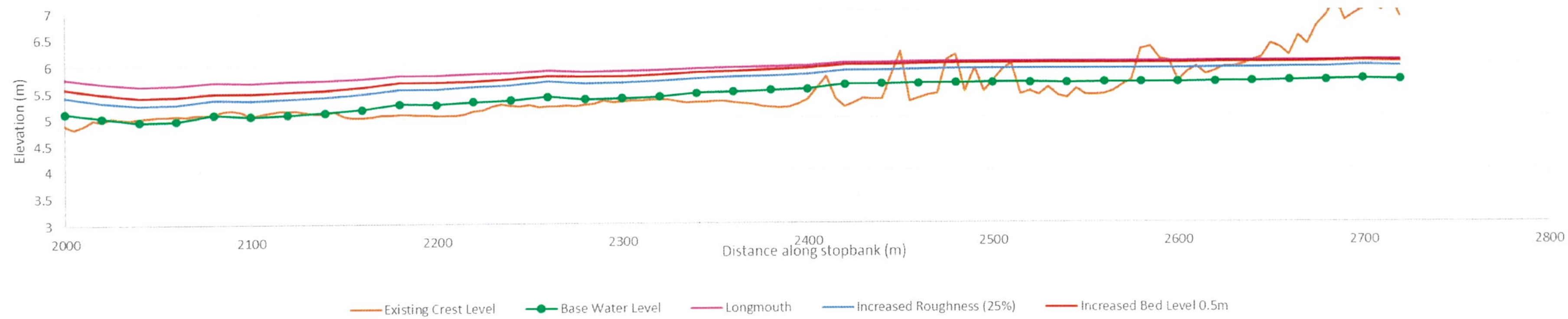
PROJECT	MAP TITLE	REVISION	DATE	
Hokitika River Flood Modelling	CHANGE IN FLOOD EXTENT MAP 1 in 100 year event including climate change (2100) RCP Scenario 6, 1m Sea Level Rise,0.4m Storm Surge	01	07 September 2020	N
		A3 SCALE 1:20,000	AUTHOR Matthew Gardner	

APPENDIX A

Hokitika Stopbank 1 – Sensitivity Scenario Results (Scenarios 11, 12, 20)







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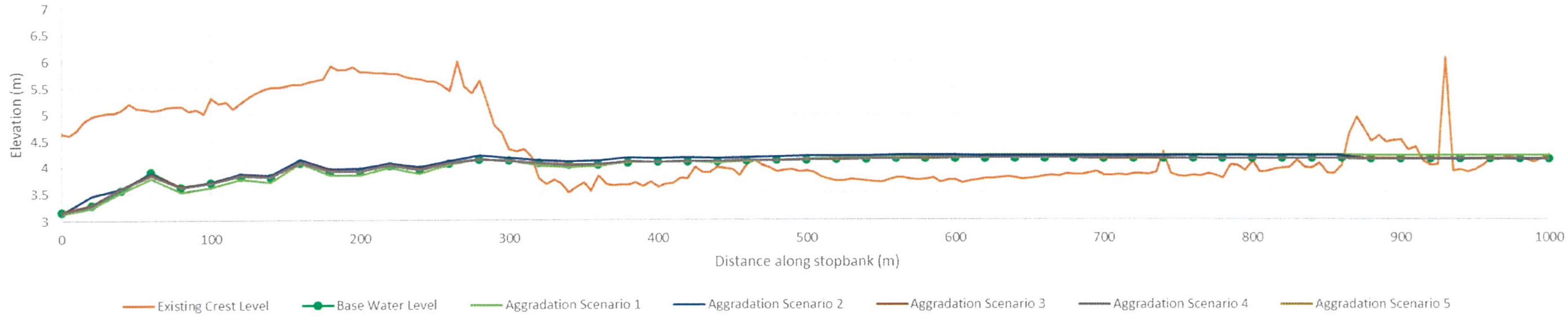
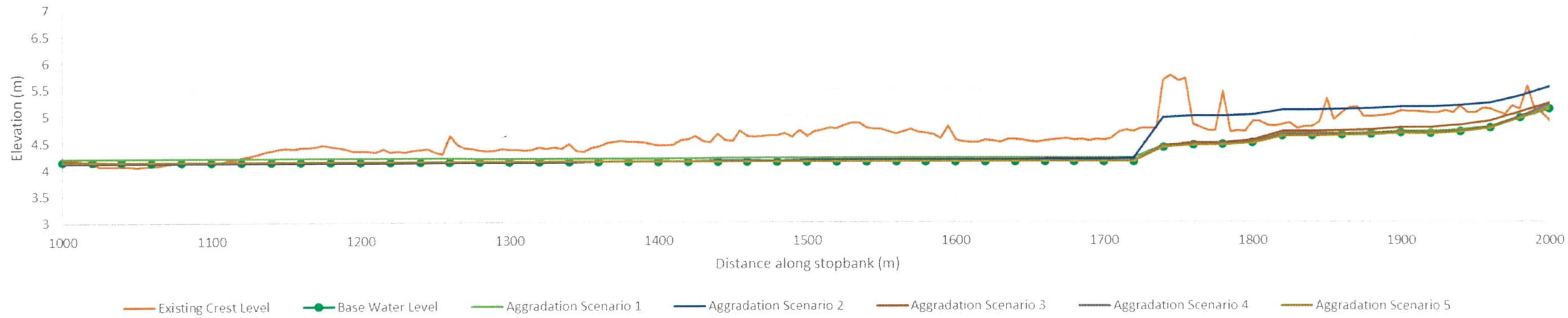
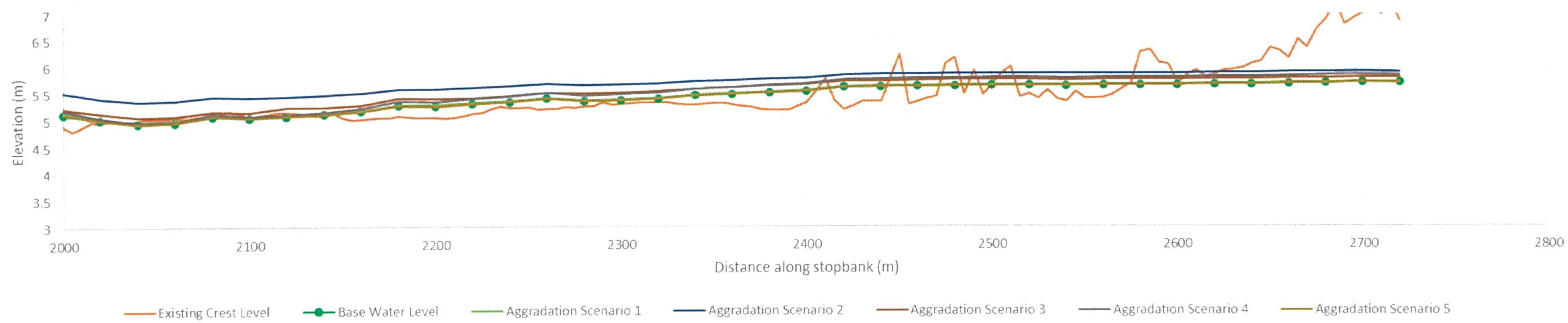
Hokitika Stopbank 1 – Sensitivity Scenario Results (Scenarios 13, 14, 15, 16, 17)







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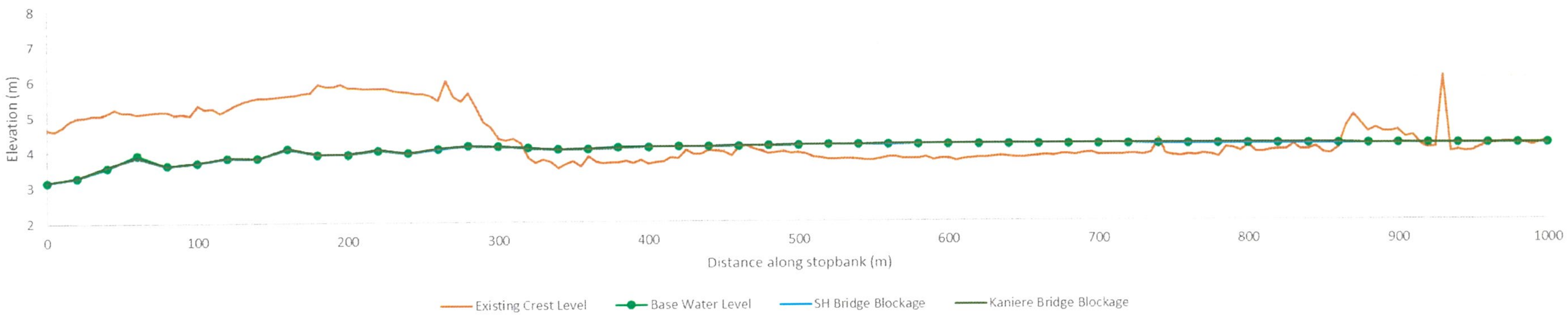
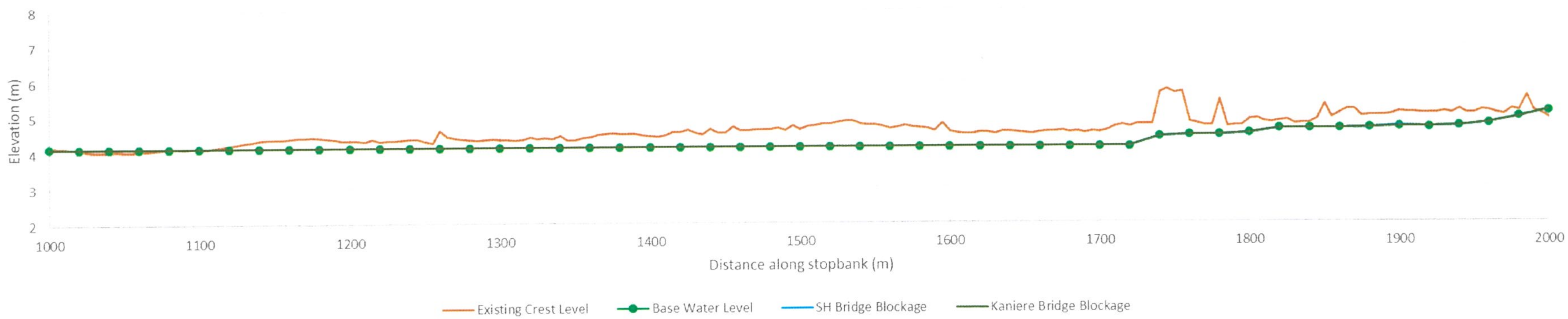
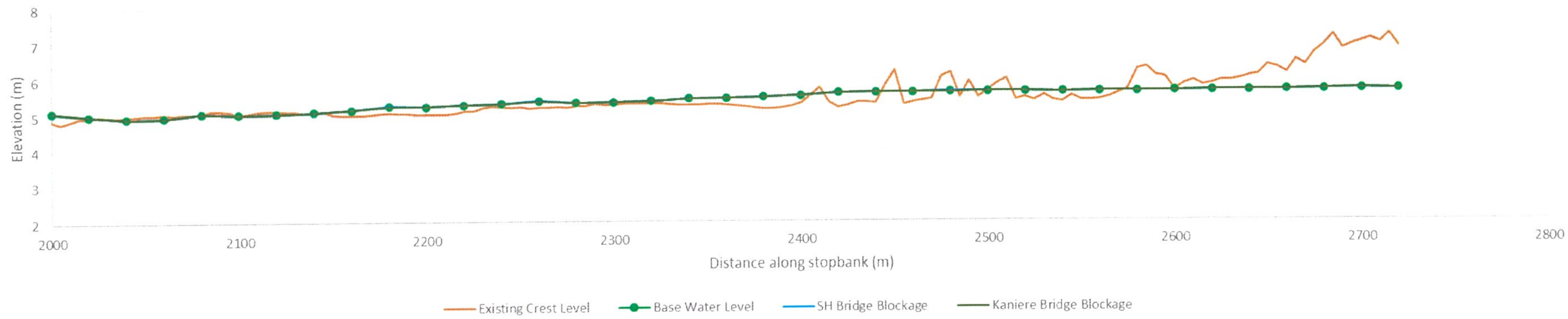
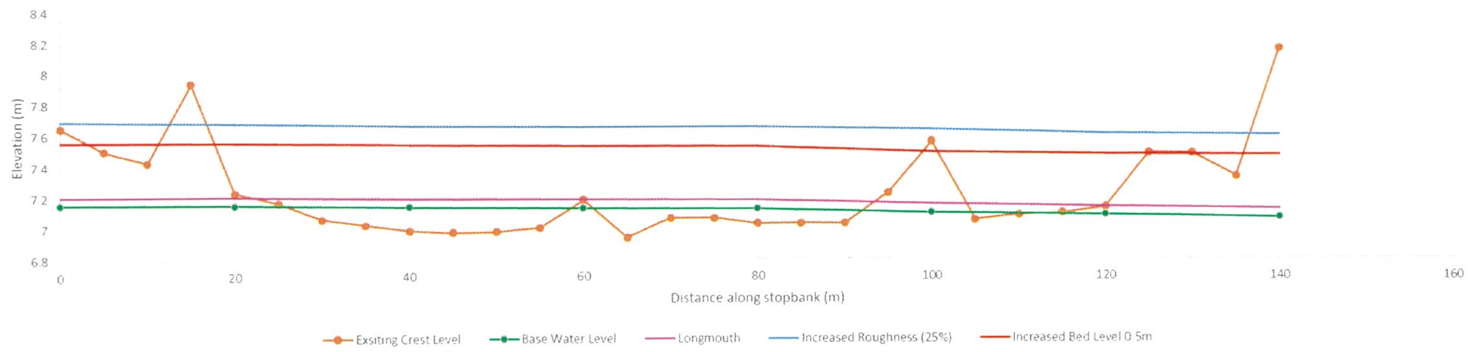
Hokitika Stopbank 1 – Sensitivity Scenario Results (Scenarios 18, 19)



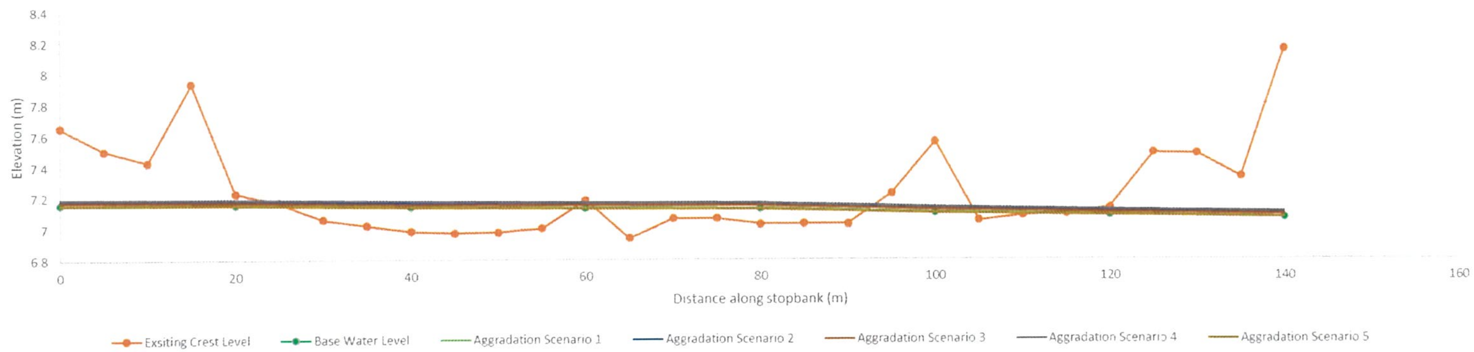




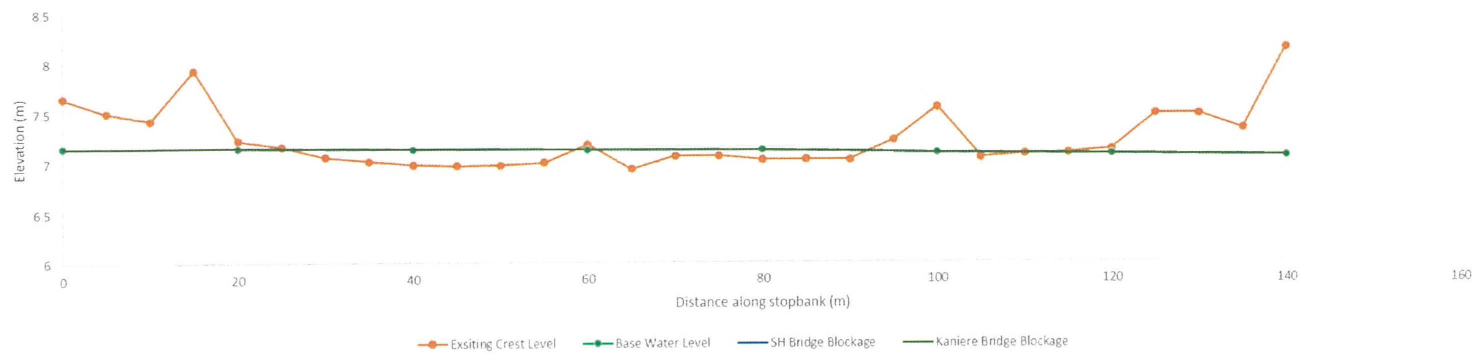
Hokitika Stopbank 2 – Sensitivity Scenario Results (Scenarios 11, 12, 20)



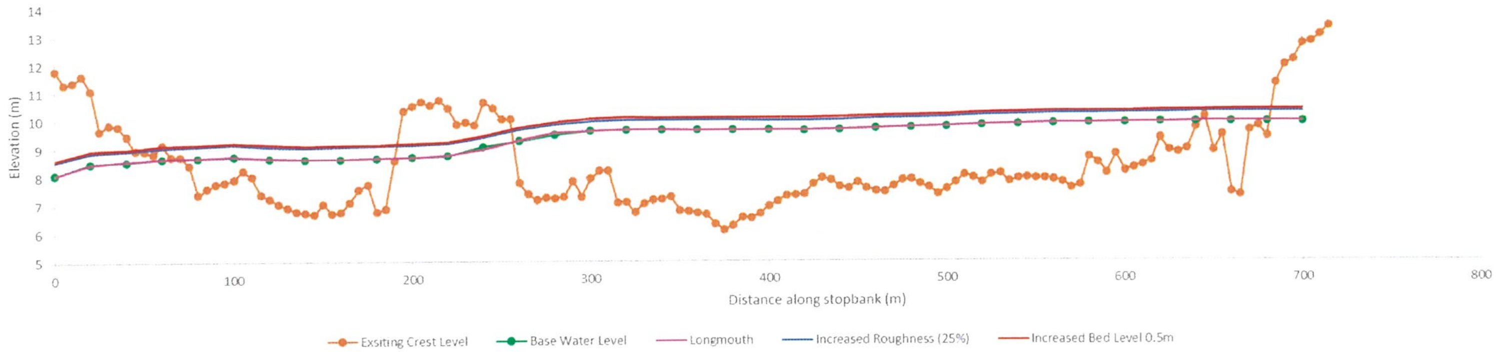
Hokitika Stopbank 2 – Sensitivity Scenario Results (Scenarios 13, 14, 15, 16, 17)



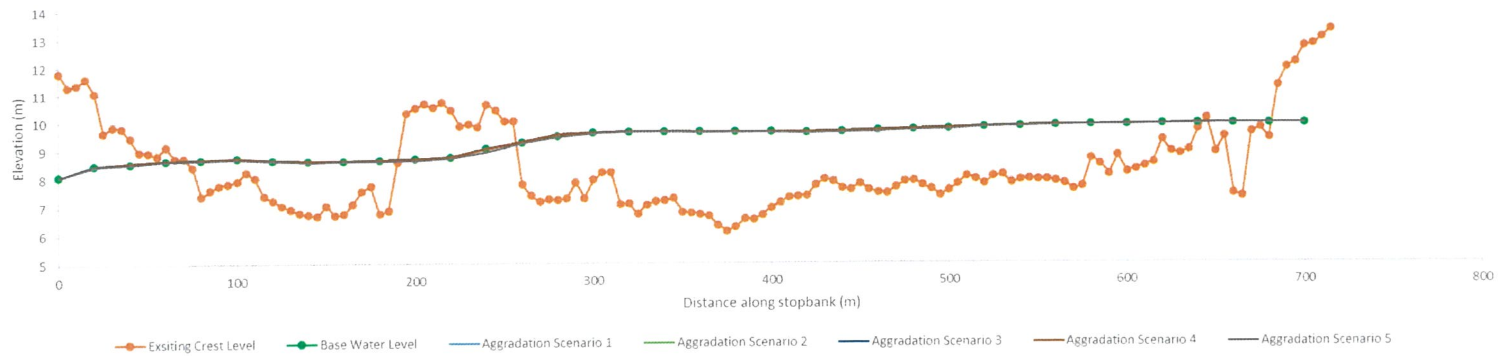
Hokitika Stopbank 2 – Sensitivity Scenario Results (Scenarios 18, 19)



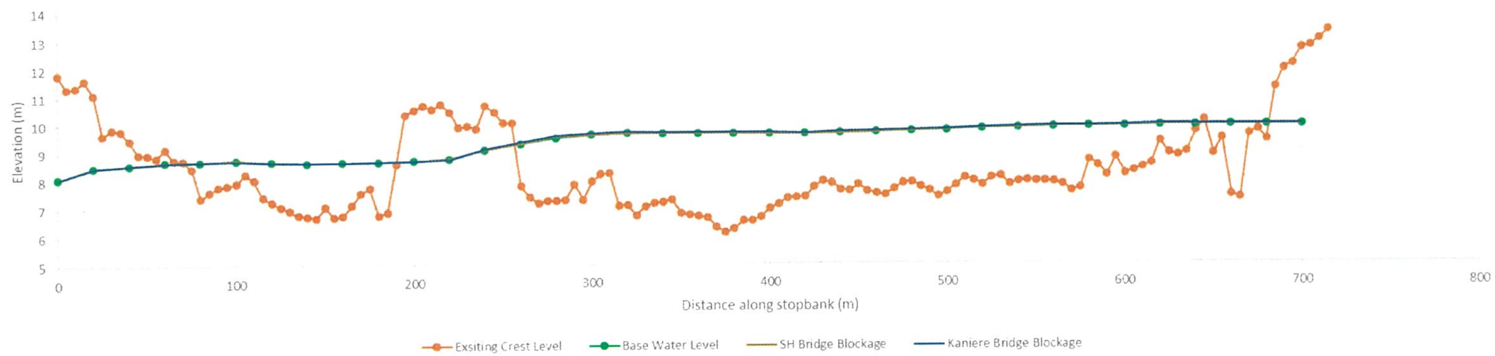
Kaniere Stopbank – Sensitivity Scenario Results (Scenarios 11, 12, 20)



Kaniere Stopbank – Sensitivity Scenario Results (Scenarios 13, 14, 15, 16, 17)



Kaniere Stopbank – Sensitivity Scenario Results (Scenarios 18, 19)



LANDRIVERSEA CONSULTING

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"D"

Our Reference: 3851

REESPONSE TO COMMISSIONER'S MINUTE No.7

a. *A copy of the subdivision plan overlaid by the coastal hazard alert (variation) overlay proposed in variation No.2 to the Te Tai o Poutini Plan.*

   Attached on a separate A3 page.

f. *A full explanation from Mr. Challenger regarding his estimations about the flood depths at the site resulting from the potential displacement of flood water from the Hokitika stop bank.*

   The Land River Sea Consulting Ltd Report "Hokitika River Hydraulic Modelling and Flood Hazard Mapping June 10 2020, shows that during a 100-year rain event with RCP 6.0, 1.0m of sea level rise and a 0.4m storm surge (with peak river flow occurring at the top of a spring tide) the flood level at the Hokitika Bridge will be 4.1m (NZVD 2016) and at the Kaniere Bridge the flood level will be 8.3m (NZVD2016). The water line distance between the two bridges is 4600m, so the water's average gradient is 1:1095.

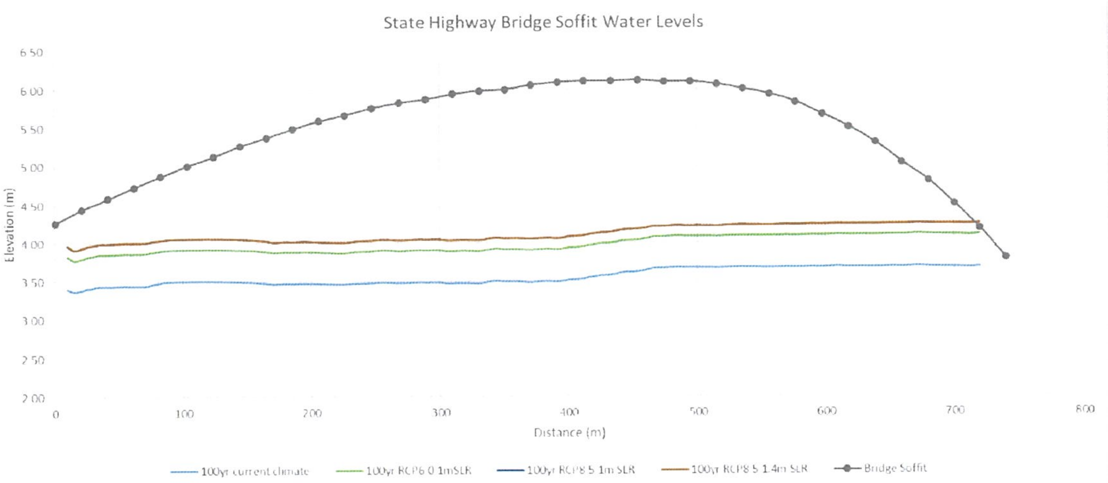


Figure 7-3 – Peak Water Levels for 100 year runs – State Highway Bridge

Figure 1. Extract from Land River Sea Consulting Report

To assess the water level at the applicant's site, it is assumed that the water is at a straight line between the two bridges. (It will not be as the bridges provide a constraint, so there will be localised 'mounding' of the water at the bridges, and the water level will be lower in places where the water can spread out. So, a straight line assumption will provide a more conservative approach) The site starts about 0.5km upstream of the Hokitika Bridge and extends to about 1.4km upstream of the Hokitika Bridge. The water level at the start of the property will be about 4.1+0.5/1.095 = 4.557m and about 4.1+1.4/1.095 = 5.379 at the upstream end of the property.

The existing ground level of the right hand bank is not provided in the Land River Sea Report but has been obtained from the Hokitika bridge upstream for 1100m, from the design plans for the Hokitika Flood Wall Upgrade. That upgrade ties into the previously completed upgrade of the flood wall behind the Westland Milk Products, I was unable to obtain levels for this prior to it being upgraded.

Using a straight line approximation for the flood levels, there would have been up to 180mm depth of water spill that is now contained by the flood wall. As shown on Table 1 below.

Table 1: Flood level and Ground height on the Right hand side, upstream of the Hokitika Bridge

Chainage from Bridge	GL prior to upgrade	Flood level	Difference between GL and FL	
0	4.31	4.10	0.21	
50	4.04	4.15	-0.11	Spill
100	4.3	4.19	0.11	
150	4.16	4.24	-0.08	Spill
200	4.25	4.28	-0.03	Spill
250	4.51	4.33	0.18	
300	4.46	4.37	0.09	
350	4.44	4.42	0.02	
400	4.48	4.47	0.01	
450	4.5	4.51	-0.01	Spill
500	4.54	4.56	-0.02	Spill
550	4.65	4.60	0.05	
600	4.73	4.65	0.08	
650	4.79	4.69	0.10	
700	4.7	4.74	-0.04	Spill
750	4.6	4.78	-0.18	Spill
800	4.7	4.83	-0.13	Spill
850	4.93	4.88	0.05	
930	4.89	4.95	-0.06	Spill
1000	5.21	5.01	0.20	
1050	5.15	5.06	0.09	
1095	4.96	5.10	-0.14	Spill
		maximum spill	-0.18	

A 180mm difference is about the difference in flood height between the 100-year rain event RCP6, 1m sea level rise and the 100-year rain event RCP8.5, 1.4m sea level rise at the Hokitika Bridge.

The extent of flooding in the RCP6.0 modelled event has been plotted for the extent of the light green (0.1-0.3m depth of flooding), orange (1-2m depth of flooding) and Red (2m+ depth of flooding) on the RCP8.5 modelled event as shown in Figure 2, which shows minimal difference between the two scenarios, additional flooding extends beyond the black lines in Figure 2. So, it is concluded that the effect of raising the flood walls on the right hand side of the Hokitika River will have minimal effect on the flooding on the South side of the Hokitika River.

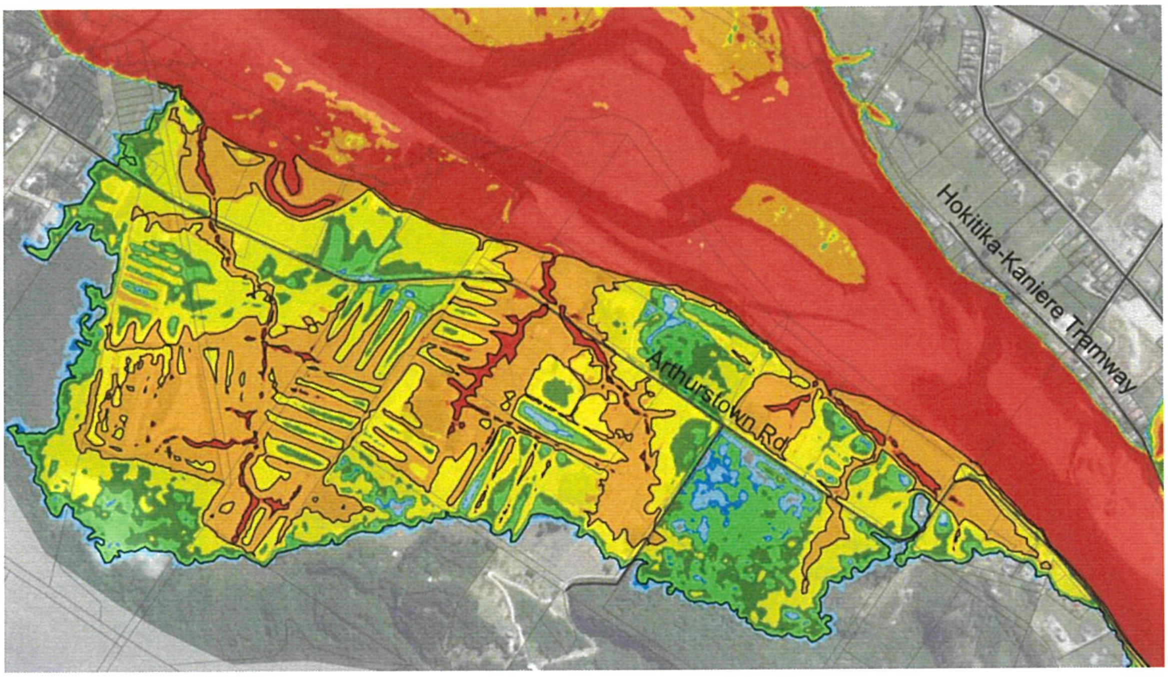
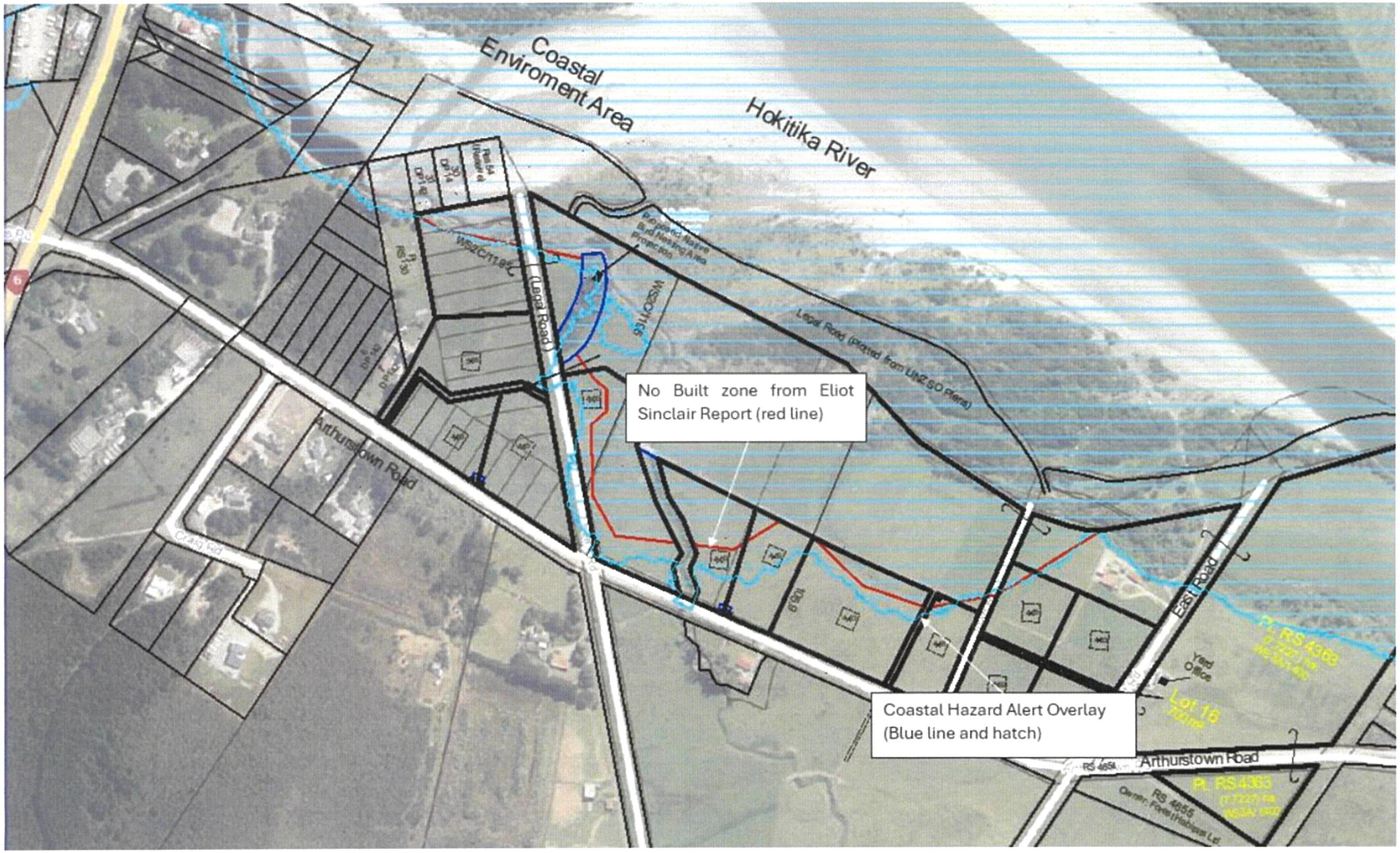


Figure 2. Modelled flood levels from RCP6.0 (Black lines) plotted over the modelled flood level for the RCP 8.5 with 1.4m sea level rise.

Prepared by:	Signature:	Date:
Stuart Challenger Civil & Environmental Engineer BE NatRES, BSc, CMEngNZ, CPEng	[signature]	11/02/2025



Coastal Hazard Alert Overlay: New Buildings for Sensitive Activities NH-R43 Discretionary activity if located within the overlay