BEFORE INDEPENDENT HEARING COMMISSIONERS APPOINTED BY WAIMAKARIRI DISTRICT COUNCIL

IN THE MATTER	Of the Resource Management Act 1991 (**RMA** or **the Act**)
AND	
IN THE MATTER	Of the Proposed Waimakariri District Plan

Joint Witness Statement – Flood Assessment Overlays

Dated: 9 June 2023

INTRODUCTION

1 This joint witness statement (JWS):

(a) relates to the notified Flood Assessment Overlays associated with the Proposed Waimakariri District Plan.

(b) It is between:

(i) Mr Chris Bacon (Waimakariri District Council)

(ii) Mr Nick Griffiths (Canterbury Regional Council)

2 A meeting between Mr Bacon and Mr Griffiths was held on 1 May at the offices of Waimakariri District Council in Rangiora, and further discussions about the notified overlays and revised overlays have been held since. This JWS and revised overlays have resulted from the meeting and discussions.

3 In preparing this statement, the experts have read and understood the Code of Conduct for Expert Witnesses as included in the Environment Court of New Zealand Practice Note 2023.

4 Mr Bacon and Mr Griffiths agree to the following statements.

DEVELOPMENT OF THE NOTIFIED FLOOD ASSESSMENT OVERLAYS

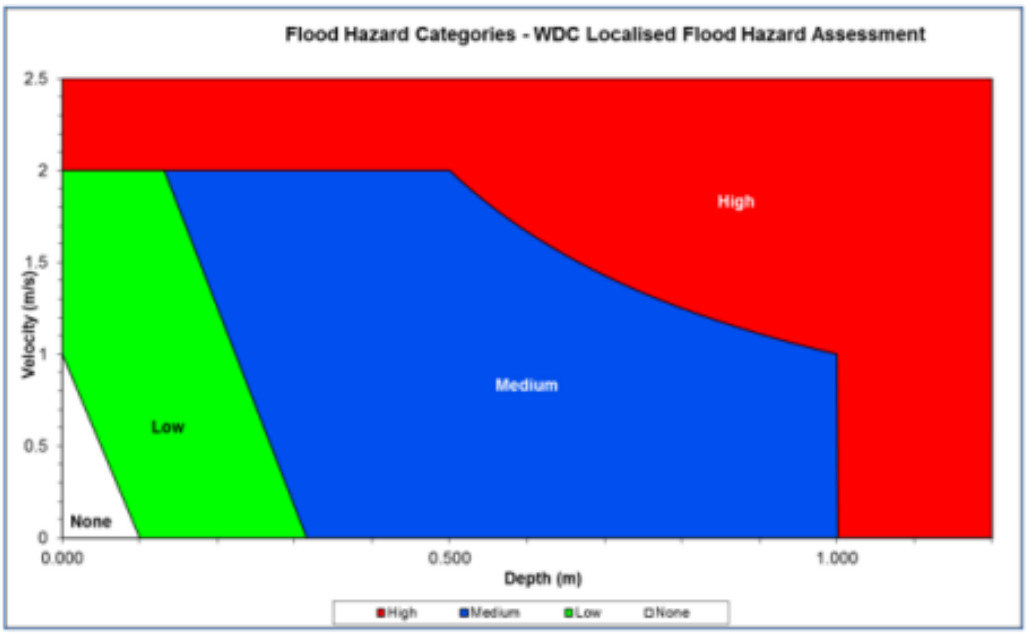
5 The notified Waimakariri District Plan Urban and Non-Urban Flood Assessment Overlays were based on flood modelling undertaken by DHI in 2020.

6 The modelling used a combination of LiDAR data from 2005 and 2014, and the coarser LINZ 8 m DEM derived from topographic maps.

7 Models for the urban areas of Rangiora, Kaiapoi, Woodend, and Oxford, were relatively high resolution, and accounted for all stormwater infrastructure (including pipes and pumpstations).

8 The model for the rest of the district was lower resolution and only included major culverts.

9 Flood hazard layers were produced from the model results by multiplying the modelled flood depths and velocities. The layers were then classified based on the following schema.



10 The flood hazard layers were subsequently 'thinned' to remove localised pixels and other 'noise'.

11 The Proposed Flood Assessment Overlays were produced from the thinned flood hazard layers where the flood hazard class was Low, Medium, or High.

LIMITATIONS OF THE NOTIFIED FLOOD ASSESSMENT OVERLAYS

12 Limitations of the flood modelling methodology and overlay creation methodology mean that the notified overlays do not capture all areas of the district that are potentially susceptible to flooding. Key limitations are:

(a) LiDAR crop classification errors causing underprediction of flood depths, and subsequent exclusion of affected areas from the overlays.

(b) Thinning of the flood hazard layers resulting in some overland flow paths being excluded from the overlays.

(c) Lees Valley was outside the model study area so is not included in the notified overlays, but could be susceptible to flooding.

13 Further to these limitations, there are other fundamental limitations associated with using model results to derive district plan overlays, particularly in rural areas where the flooding is widespread and relatively shallow.

14 The model results represent the best estimate of what could occur during specific design flood events, but cannot account for the inevitable changes to the physical environment that will occur over the life of the plan.

15 Future modelling could produce different results due to these physical changes, but also due to our understanding of other model inputs and advancements in technology.

REVISED FLOOD ASSESSMENT OVERLAYS

16 Revised overlays have been produced, based primarily on an analysis of land slope. Areas with slopes that are typically less than 5 degrees have been considered as 'flat' (and therefore **potentially** susceptible to flooding) and have been included in the revised overlays.

17 Within the hill country areas of the district, the flood hazard layers have been used to identify the main stream channels, and these have been included in the revised overlays.

18 Land within the townships of Rangiora, Kaiapoi, Woodend, and Oxford that is shown to be clear of flooding (based on the detailed modelling undertaken for these locations) has not been included in the revised overlays. In these areas, the revised overlays are therefore the same as the notified overlays.

19 Land within Pegasus township has also not been included in the revised overlays, as it has already been designed to meet current flood mitigation requirements.

DIFFERENCE BETWEEN THE NOTIFIED AND REVISED OVERLAYS

20 The main difference between the notified and revised overlays is that the notified overlays were based on model results, whereas the revised overlays are based primarily on the slope of the land. Model results have only been used in the revised overlays to identify main stream channels in the hill country and to exclude some urban areas where detailed modelling has been undertaken.

21 Most areas of the district that could be subject to flooding (and where development is most likely to occur) are captured within the revised overlays.

22 The revised overlays broadly address the limitations of the notified overlays outlined above, and concerns raised in the Canterbury Regional Council submission.

23 While there will inevitably still be some areas outside of the proposed overlays that are susceptible to flooding, these will generally be where the potential for flooding is relatively obvious (e.g., areas in or immediately adjacent to watercourses, gullies, or depressions) and where little development is likely to occur. Buildings constructed in these areas will still need to meet the requirements of the Building Code and Building Act.

24 The impact of using the revised overlays instead of the notified overlays is difficult to quantify, as it will be dependent on several other factors, including decisions on other Proposed District Plan provisions, how much development occurs in the district over the life of the plan, where that development occurs, and how applicants choose to navigate the associated rule requirements.

25 Overall, compared to the notified overlays, the revised overlays will help to reduce the likelihood of future buildings being flooded.

Signed **9 June 2023**

Chris Bacon

Nick Griffiths