

**BEFORE THE HEARINGS PANEL  
FOR PROPOSED PLAN CHANGE 21 TO THE MACKENZIE DISTRICT PLAN**

**UNDER** the Resource Management Act 1991 (RMA)  
**IN THE MATTER** of Proposed Plan Change 21 to the Mackenzie District Plan

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**STATEMENT OF EVIDENCE OF OLIVER FRANCIS MONTAGUE HERMANS  
ON BEHALF OF THE CANTERBURY REGIONAL COUNCIL**

**3 March 2023**

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**SUMMARY STATEMENT**

- 1 Flood modelling indicates that the land below the terrace adjacent to Glen Lyon Road in Twizel will be subject to significant flooding in a 500 year Average Recurrence Interval (ARI) flood event. In my opinion, areas below the terrace meet the Canterbury Regional Policy Statement definition of high hazard areas.

### **Introduction**

- 2 My full name is Oliver Francis Montague Hermans.
- 3 I am employed as a Science Analyst at the Canterbury Regional Council (**Regional Council**), and I have held this position since May 2021.

### **Qualifications and Experience**

- 4 My qualifications include a Master of Planning from Otago University and a Bachelor of Science and a Bachelor of Arts from Victoria University of Wellington.
- 5 I have worked in flood hazard management since 2021 and have experience in interpreting flood models and providing advice on flood hazards.

### **Code of Conduct**

- 6 I can confirm that I have read and am familiar with the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023. I have complied with the Code of Conduct in preparing this evidence and I agree to comply with it while giving any oral evidence during this hearing. Except where I state that I am relying on the evidence of another person, my evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.
- 7 Although I am employed by the Regional Council, I am conscious that in giving evidence in an expert capacity that my overriding duty is to the Hearings Panel.

### **Scope of evidence**

- 8 This evidence relates to Proposed Plan Change 21 to the Mackenzie District Plan (**PC21**). The Regional Council lodged a submission on PC21 largely seeking further alignment with the Canterbury Regional Policy Statement (**CRPS**).
- 9 My evidence has been structured to address:
- (a) The methodology behind flood modelling conducted by the Council;
- and

- (b) A summary of the flood hazards in and around Glen Lyon Road/Lyford Lane, and my opinion on whether the proposed rezoning area will meet the CRPS definition of a high hazard area.
- 10 In preparing my evidence I have reviewed the following documents:
- (a) Results of Twizel flood modelling investigation;
  - (b) The relevant PC21 notified provisions;
  - (c) The relevant parts of the Section 32 report for PC21 prepared and notified by Mackenzie District Council (**MDC**);
  - (d) The applicable section of CRC's submission on PC21;
  - (e) The relevant parts of the Section 42A report, associated appendices and memorandum;
  - (f) The relevant provisions of the CRPS; and
  - (g) The relevant provisions of the Mackenzie District Plan.
- 11 My evidence addresses the flood hazard issues raised by the Regional Council's submission.

### **Flood modelling conducted by the Regional Council**

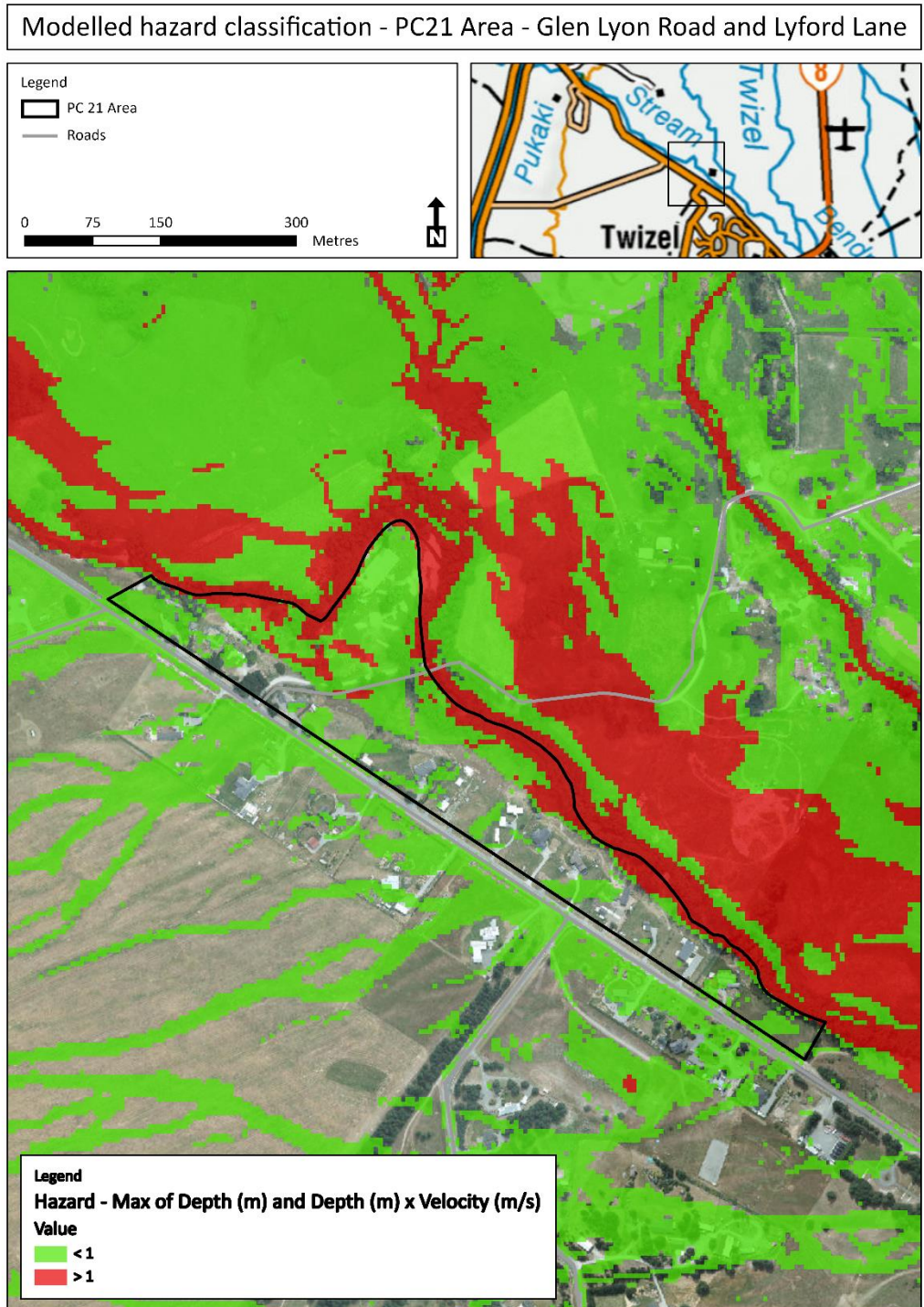
#### *Methodology*

- 12 Previous understanding of the flood hazards in and around Twizel township has been limited to observations made during and following past flood events. An investigation was initiated in 2021 which sought to provide more detailed information on the likely extent and severity of flooding associated with large flood events in the Twizel River catchment through the creation of a model.
- 13 The investigation uses a combined one-dimensional/two-dimensional (1D/2D) hydraulic computer model to estimate flood depths, velocities, levels, and extent for 20, 50, 100, 200, and 500 year Average Recurrence Interval (ARI) flood events. Current design flow and rainfall estimates were increased to allow for climate change (to 2100).
- 14 The model outputs are intended to assist with land use planning for the area. Modelled flood water depths and velocities can be used to determine appropriate floor levels for buildings and extensions and inform future decisions around flood protection works and emergency planning.

- 15 This modelling was carried out by Daniel Ward, employed as a Scientist by the Canterbury Regional Council. Mr Ward has a Master of Environmental Science from the University of Auckland and has been employed at the Regional Council since February 2021. The model has been externally reviewed by Beca (engineering consultancy) and suggested changes incorporated.
- 16 There are a number of uncertainties associated with hydraulic modelling. These include:
  - (a) Model inputs;
  - (b) Topographic data; and
  - (c) Hydraulic model assumptions.
- 17 Sensitivity testing was carried out as part of the modelling investigation to assess the influence of differences in input flow, roughness, infiltration, and bridge capacity. The sensitivity of the model to these parameters is consistent with other models built using the same software for similar purposes.
- 18 Specific to this location, the 1D component of the model assumes a straight channel flow, and does not account for the sharp bend in Fraser Stream directly upstream of Lyford Lane. The model is therefore likely to be underpredicting overflows from the stream toward the area of floodplain directly below the terrace.
- 19 Additionally, the model does not account for channel scour and erosion, or channel blockages which could also result in additional overflows from Fraser Stream toward this area during a large flood event compared to the overflows predicted by the modelling.
- 20 Based on the above, the model results broadly provide a useful quantification of the extent and characteristics of flooding that could occur under a range of design flood events in the Twizel area. However, model limitations mean that flood depths and velocities could be higher than predicted by the model in this location.

*Summary of the model's outcome*

- 21 A draft report summarising the modelling has been prepared, but has not yet been finalised and published. However, the modelling itself is complete, and can be used as a tool to assess the flood hazard in the Twizel River catchment.
- 22 Based on the modelled scenarios, no significant flooding is likely to occur within Twizel township itself, with most surface runoff being concentrated along roads.
- 23 Within the Glen Lyon Road/Lyford Lane area, flooding mainly occurs due to overflows at the confluence of the Twizel River, Fraser Stream, and Dry Stream below the river terrace. The river terrace provides a natural barrier to overflows from these watercourses and provides protection from flooding for areas above the terrace, even in a 500 year ARI flood.
- 24 However, the model results show significant flooding in areas below the terrace, parts of which are shown to meet the CRPS definition of high hazard areas (**Figure 1**). High hazard areas are areas where the water depth (metres) x velocity (metres per second) is greater than or equal to 1, or where depths are greater than 1 metre, in a 0.2% annual exceedance probability flood event. For clarity, a 0.2% annual exceedance probability event is the same as a 500 year ARI event.
- 25 Due to the limitations of the modelling described above, it is likely that additional areas beyond those shown in Figure 1 will also meet the definition of high hazard areas.



**Figure 1:** Map showing modelled high hazard areas (in red) where depth (metres) x velocity (metres per second) is greater than or equal to 1, or where depths are greater than 1 metre in a 500 Year ARI flood event.

**Conclusion**

26 Modelling of flooding in and around Twizel township has been carried out. This investigation has identified the area below the terrace that runs parallel to Glen Lyon Road as subject to significant flood hazard, including areas that meet the CRPS definition of high hazard areas. Due to model limitations, high hazard areas are likely to be more extensive than those shown by the model results.

Dated this 3<sup>rd</sup> day of March 2023



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**Oliver Francis Montague Hermans**