

**BEFORE THE HEARINGS PANEL  
FOR PROPOSED PLAN CHANGE 3 TO THE KAIKOURA DISTRICT PLAN**

**UNDER** the Resource Management Act 1991 (RMA)

**IN THE MATTER** of Proposed Plan Change 3 to the Kaikoura District Plan

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**STATEMENT OF EVIDENCE OF NICHOLAS DAVID ROBERT GRIFFITHS  
ON BEHALF OF THE CANTERBURY REGIONAL COUNCIL AND  
KAIKOURA DISTRICT COUNCIL**

**PROPOSED PLAN CHANGE 3**

**29 October 2021**

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## SUMMARY STATEMENT

- 1 I agree with the Section 42A report recommendation to retain the Urban Flood Assessment Overlay and the Non-urban Flood Assessment Overlay as notified.
- 2 I agree with the Section 42A report recommendation to refine the Landslide Debris Inundation and Debris Flow Fan Overlays based on further investigations recently completed by GNS Science.

## INTRODUCTION

- 3 My full name is Nicholas David Robert Griffiths.
- 4 I hold a Bachelor of Science with Honours degree in Geography and Geology. I have been employed by the Canterbury Regional Council (**CRC**) as a natural hazard scientist since September 2011. This role involves assessing and providing advice on natural hazards and associated planning provisions.
- 5 I have been involved with the development of Proposed Plan Change 3 (**PC3**) to the Kaikoura District Plan over the last four years. My role has included the provision of technical natural hazards information, participation in community workshops, and working with KDC staff to develop planning provisions that are informed by the available information. I have also contributed to the natural hazard components of several other district plan review processes in Canterbury.
- 6 Although I am employed by the Regional Council, 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 2014 and I am giving this evidence as an independent expert. 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.

## SCOPE OF EVIDENCE

- 7 I have prepared my evidence on behalf of Kaikoura District Council (**KDC**) and CRC.
- 8 My evidence primarily relates to issues raised in submissions on proposed PC3 regarding the extent of the proposed flood assessment overlays (the Urban Flood Assessment Overlay and the Non-urban Flood Assessment Overlay), and Debris Flow Fan and Landslide Debris Inundation Overlays. This evidence supports the recommendations made in the Section 42A report regarding these matters.
- 9 I have reviewed the following documents and evidence in preparing my evidence:
  - (a) The notified provisions of proposed PC3 and accompanying Proposed District Plan Map Series;
  - (b) The Section 32 report for proposed PC3 to the Kaikoura District Plan;
  - (c) The Section 42A report prepared by KDC, including the evidence of Matthew Hoggard on behalf of KDC;
  - (d) The Canterbury Regional Policy Statement 2013 (**CRPS**);
  - (e) The submissions and further submissions on proposed PC3;
  - (f) The evidence of Jane Doogue on behalf of CRC.

## URBAN AND NON-URBAN FLOOD ASSESSMENT OVERLAYS

- 10 I agree with the Section 42A report recommendation to retain the Urban and Non-Urban Flood Assessment Overlays as notified.
- 11 The overlays are based on mapping that I produced as part of the Environment Canterbury technical report 'Natural hazards update for Kaikoura District Plan review' (March 2021). This report describes the background to the mapping and the methodology used.
- 12 The mapping is intended to broadly identify areas of the district where the potential for flooding **may** exist.
- 13 The mapping focusses on areas of the district where future development is most likely to occur, and where the potential for flooding is not always obvious. It was not deemed time or cost effective to produce mapping for every part of the district, and as a result there will inevitably be areas that are susceptible to flooding that it does not identify.

- 14 The mapping does not attempt to define the likely extent of any particular sized flood event (for example a 200 year or 500 year average recurrence interval (ARI) flood event) and for the most part the map boundary follows natural boundaries between areas of relatively flat land and areas of steeper hill county.
- 15 However, in some locations where flood model results are available, the 500 year ARI results have been used to inform the map boundary (for example, within parts of the Kaikoura township). The mapping in these areas is likely less extensive than it would have been without the model results, as the map boundary closely follows the modelled 500 year ARI flood extent rather than extending further back into higher ground as it may have otherwise.
- 16 The 500 year ARI model results have been used to inform the map boundary (where model results are available) to align with the flood mitigation standards outlined in proposed PC3. Mathew Hoggard's evidence describes the rationale behind the proposed use of a 500 year ARI flood mitigation standard for hazard sensitive buildings.
- 17 Given the nature of the mapping used to produce the flood assessment overlays, I consider the proposed use of the overlays is appropriate. That is, the overlays trigger the requirement for a site-specific flood hazard assessment, with avoidance or mitigation requirements (or lack thereof) dependant on the findings. This is discussed further below.

## **FLOOD ASSESSMENT CERTIFICATE**

- 18 PC3 proposes new rules that apply to the establishment of new hazard sensitive buildings (Rules 8.5.2 and 8.5.3), additions to existing hazard sensitive buildings (Rule 8.5.6), the change of use of existing buildings to hazard sensitive buildings (Rule 8.5.10), and the establishment of new camping grounds (Rule 8.5.12) within the flood assessment overlays.
- 19 These activities are permitted if the permitted activity standards of the respective rules are met. The standards generally include the requirement for building floor levels to be equal to or higher than the minimum floor level stated in a Flood Assessment Certificate, and in some cases also require the building site to be outside of High Flood Hazard Areas.
- 20 In practice, someone constructing a new dwelling in the proposed Non-Urban Flood Assessment Overlay for example, would trigger proposed Rule 8.5.3 and would need to provide KDC with a site specific flood hazard assessment. This

could be obtained from Environment Canterbury (at a current cost of \$172.50) or from another suitably qualified and experienced person. The assessment would state if the building site is assessed to be within a High Flood Hazard Area or not, and if not, it would provide a floor level that is assessed to be 300 mm above the 500 year ARI flood level. This would be determined based on the most up to date information that is available at the time.

- 21 KDC staff would then need to satisfy themselves that the assessment provided to them is adequate to inform a decision, considering matters such as whether the author is suitably qualified and experienced, whether they have used the most up to date flooding information in the assessment, and if that they can have confidence in the conclusions reached.
- 22 Assuming the information is adequate, and the site is not assessed to be within a High Flood Hazard Area, KDC would then issue a flood assessment certificate that requires the finished floor level to be built equal to (or above) that outlined in the site specific flood assessment.
- 23 In many cases, someone wishing to build in a flood assessment overlay would be able to get a good indication of what a site specific flood hazard assessment is likely to say by viewing flood modelling information that is publicly available online (<https://apps.canterburymaps.govt.nz/FloodModelResults/>).
- 24 While compliance with the permitted activity standards would ultimately be determined by the information contained within the site specific flood hazard assessment (and subsequent flood assessment certificate), the publicly available information would help someone to get an initial idea of what is likely to be required to achieve a permitted activity status.
- 25 The proposed framework enables the most-up-to-date information to be used to assess the flood hazard at a specific site at the time that an activity is proposed (and for this information to be made readily available to the public), whilst avoiding the need for the planning maps to be updated via a plan change.

#### **SUBMISSION OF L. ADAMS**

- 26 The submission of Ms L. Adams seeks to have her property at Koura Bay Drive removed from the Non-Urban Flood Assessment Overlay. Ms Adams has not provided any information to demonstrate why her property could not be susceptible to flooding. The property is situated on an upper part of the Kaikoura fans, with the toe of the Mt Fyffe hillslopes approximately 1 km to the north-west.

- 27 My view that the property may be susceptible to flooding has not changed since I completed the mapping. I consider that rainfall runoff could be generated on the area of 'flats' up-plain of the property, possibly supplemented by runoff from the hillslopes above. I agree with the Section 42A report recommendation to retain the property within the overlay.

#### **SUBMISSION OF S. SEMMENS**

- 28 The submission of Ms S. Semmes seeks to have the Waitane Road, Oaro area removed from the Urban Flood Assessment Overlay. Ms Semmens has not provided any information to demonstrate that this area could not be susceptible to flooding.
- 29 There are two small clusters of residential properties in this area, and I assume the submission is intended to relate to both. The area is bounded by steep hill slopes immediately to the west, Main North Railway Line/State Highway One to the east, with un-named stream channels emanating from the ranges to the north and south.
- 30 Both streams have developed alluvial/debris flow fans where they exit the range front. These fans were identified in the report 'Deterministic mapping of potential landslide debris inundation in the Kaikoura District' (GNS Science, 2020). The southern cluster of properties are positioned within the mapped fan extent of the southern stream.
- 31 I conducted a site visit with my colleague Michelle Wild on 29 September 2021, and Ms Wild (who has completed several flood modelling investigations within the Kaikoura District) has since developed a basic rain-on-grid flood model of the area.
- 32 The model includes a 500 year ARI – 12 hour nested storm input (accounting for climate change) applied to the area of interest. This includes the steep hill slopes immediately to the west, but does not include the catchment areas of the streams to the north and south. The model results are shown in **Figure 1**.

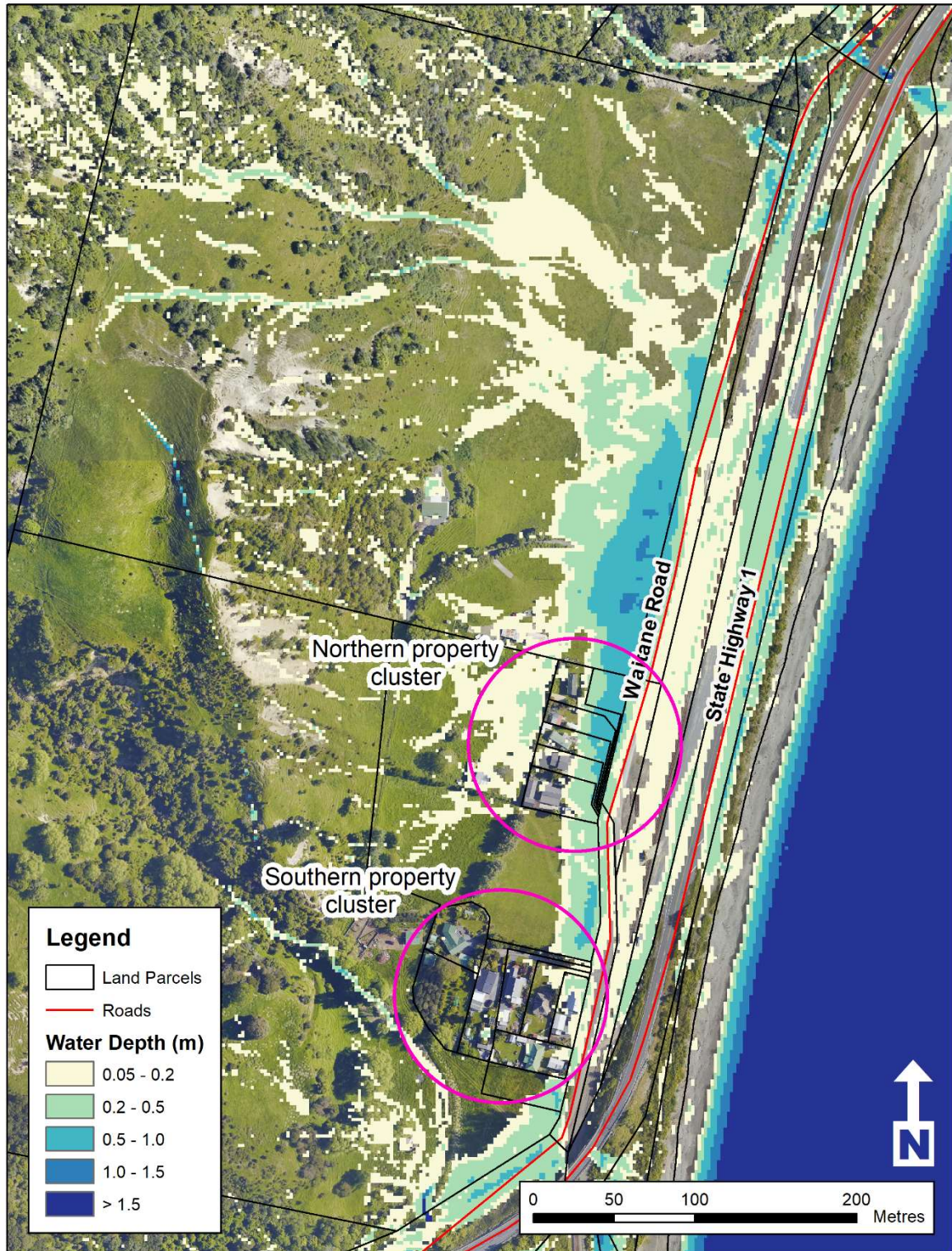


Figure 1: Rain-on-grid model results for the Waitane Road area.

- 33 As the modelling does not account for overflows into the area from the streams to the north or south (which could also occur during extreme rainfall events), it is possible that flooding could be more severe than shown by the model results.
- 34 Observations made during my visit to the area combined with the results of the modelling carried out by Ms Wild have further cemented my initial view that the area may be susceptible to flooding. I therefore agree with the Section 42A report recommendation to retain the area within the Urban Flood Assessment Overlay.

### **LANDSLIDE DEBRIS INUNDATION AND DEBRIS FLOW FAN OVERLAYS**

- 35 I agree with the Section 42A report recommendation to refine the Landslide Debris Inundation and Debris Flow Fan overlays based on further investigations recently completed by GNS Science.
- 36 The notified Landslide Debris Inundation and Debris Flow Fan overlays are based on information presented in the report 'Deterministic mapping of potential landslide debris inundation in the Kaikoura District' (GNS Science, 2020). This report quantified which parts of the study area could be subject to debris inundation from a range of different sized landslides, triggered by either earthquakes or rainfall. The report also identified active debris flow fans within the study area based on a review of detailed topographic (LiDAR) data and aerial imagery.
- 37 It was beyond the scope of the investigation to quantify the likelihood of landslides or debris flows occurring within the mapped areas.
- 38 To try and address the lack of probabilistic data, KDC and CRC jointly decided to exclude the two largest landslide classes (1,000,000 m<sup>3</sup> and 10,000,000 m<sup>3</sup>) when producing the notified Landslide Debris Inundation Overlay. While the likelihood of these very large landslides occurring had not been determined, it was known that it would be lower than for the smaller landslide classes.
- 39 It was more challenging to try and account for the lack of probabilistic data when dealing with the active debris flow fans identified in the GNS Science 2020 report, and the full extent of the mapped fans were used in deriving the notified Debris Flow Fan Overlay.
- 40 GNS Science have recently completed a second report 'District-scale landslide risk analysis of debris inundation for the Kaikoura District' (GNS Science, 2021) that builds on their earlier work.



- 41 This latest report quantifies the risk to people within areas previously identified as susceptible to landslides and debris flows based on local personal risk (**LPR**) and annual individual fatality risk (**AIFR**). The LPR represents the annual probability of death for a theoretical imaginary person present at a particular location 100% of the time. The AIFR can be calculated from the LPR by estimating the probability of a person being present.
- 42 Following discussions between GNS Science, KDC, and CRC, eight different LPR scenarios (and one AIFR scenario) were modelled. The LPR scenarios were based on different combinations of the following input variables:
- 'Mean' statistical estimates (50<sup>th</sup>%) or 'Upper' statistical estimates (84<sup>th</sup>%) of landslide production rates and debris runoff.
  - Rainfall frequency estimates based on historic rainfall data or estimates accounting for the projected future impact of climate change.
  - Variable vulnerability values (assuming impacts reduce with increased distance from the landslide source area) or a fixed vulnerability value (assuming the impact is always fatal).
- 43 I understand from the Section 42A report and evidence of Mr Matthew Hoggard that KDC is recommending a new 'Debris Inundation Overlay' be derived (to replace the notified Landslide Debris Inundation and Debris Flow Fan overlays) based on the LPR model scenario which uses;
- The 'Upper' statistical estimates (84<sup>th</sup>%) of landslide production rates and debris runoff;
  - Rainfall frequency estimates accounting for the projected future impact of climate change, and;
  - A fixed vulnerability value (of 1, or 100%)
- Note this is 'Scenario 8' referenced in Table 3.10 of GNS Science, 2021.
- 44 I also understand that KDC is recommending that an LPR threshold of 1:10,000 ( $1 \times 10^{-4}$ ) per year be used to define the boundary of the new 'Debris Inundation Overlay'. I.e., areas that are identified as having an LPR of 1:10,000 or greater based on the above model scenario would be included in the overlay.
- 45 As the new overlay would be used to trigger the requirement for a site specific landslide hazard assessment (via a restricted discretionary consent pathway), and the district plan provisions are concerned with damage to buildings and infrastructure as well as risk to human life, I consider that the model scenario and

LPR threshold outlined above are appropriate for deriving the new 'Debris Inundation Overlay'.

- 46 The evidence of Mr Hoggard discusses why a precautionary approach to managing landslide risk is appropriate. I agree with his evidence, and consider that the recommended approach is precautionary (without being overly precautionary) whilst enabling more detailed site specific information to be incorporated into to the decision making process when development is proposed.

**Nicholas David Robert Griffiths**

**29 October 2021**