BEFORE THE ENVIRONMENT COURT **ENV-2020-AKL-000064**
AT AUCKLAND

I MUA I TE KOOTI TAIAO O AOTEAROA
TĀMAKI MAKAURAU ROHE

IN THE MATTER	of an appeal under the first schedule of the Resource Management Act 1991 (**RMA**)
BETWEEN	**AWATARARIKI RESIDENTS INCORPORATED** Appellant
AND	**BAY OF PLENTY REGIONAL COUNCIL** First Respondent
AND	**WHAKATĀNE DISTRICT COUNCIL** Second Respondent and Requestor of Plan Change 17

STATEMENT OF EVIDENCE OF DR WENDY SAUNDERS ON BEHALF OF WHAKATĀNE DISTRICT COUNCIL

RESOURCE MANAGEMENT – PLANNING

10 August 2020

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TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

1.1. My evidence relates to:

a) The 2013 Matatā hind-testing[1] of the risk-based approach outlined in Saunders et al (2013), and a revised version of the hind-test based on new information available since 2013; and

b) My assessment of the Proposed Plan Changes, issues raised in the submissions and appeal points.

1.2. The purpose of my evidence is to confirm the appropriateness of the risk-based approach underpinning the two plan changes, aimed at managing debris flow risk on the Awatarariki Fanhead. In this regard, the scope of my evidence covers:

a) The background of the risk-based planning approach to natural hazard management in New Zealand that formed the basis of the risk-based approach in the Bay of Plenty Regional Policy Statement (**RPS**);

b) Reassessment of a 2013 Matatā case study example of using the risk-based approach available on the GNS Science web site (noting that this example predates the RPS, so the assessment has no bearing on the plan changes and is provided for information only);

c) Support for the two plan changes; and

d) Comment on appellant's grounds of appeal.

1.3. Based on the technical risk information now available (i.e. since 2013), a desktop reassessment of the Saunders et al (2013) risk-based assessment of Matatā shows residential activities within the hazard zone as being discretionary. When taking into account climate change, the activity status would be non-complying or prohibited. Neither the original assessment nor this reassessment included any engagement with landowners or other stakeholders, which would inform the final outcome

[1] The process of testing the risk-based framework during its development against historical events to determine it is 'fit for purpose'.

as recommended in the 2013 report. I note that the RPS supersedes the assessment methodology outlined in this evidence.

1.4. In my opinion, the Proposed Plan Changes provide an appropriate planning response to the risk, ensuring the sustainable management of a high risk area. The Proposed Plan Changes provide for people's health and safety by changing the land use in the high risk area, manages the significant risk posed, and are consistent with the RPS.

2. INTRODUCTION

2.1. My full name is Dr Wendy Susan Anne Saunders.

2.2. My evidence is given on behalf of the Whakatāne District Council (the **District Council**) in relation to:

(a) Proposed Plan Change 1 (Awatarariki Fanhead, Matatā) to the Operative Whakatāne District Plan;

(b) Proposed Plan Change 17 (Natural Hazards) to the Bay of Plenty Regional Natural Resources Plan (a private plan change request from the District Council);

(together referred to as the **Proposed Plan Changes**); and

(c) Grounds of appeal, focusing on Appendix M of the RPS.

2.3. My evidence relates to the risk-based planning approach aspects of the Proposed Plan Changes and the risk-based assessment provided in Saunders et al 2013[2] that uses Matatā as an example of how the risk-based framework could be applied. My evidence will cover:

(a) The Matatā debris flow hind-testing case study in the Saunders et al (2013), which is also available on the associated risk-based website:

https://www.gns.cri.nz/Home/RBP/Risk-based-planning/A-toolbox/Examples/Hind-Testing/Matata-Debris-Flow. This hind-

[2] Saunders, W. S. A., Beban, J.G. & M Kilvington (2013). Risk-based land use planning for natural hazard risk reduction. GNS Science Miscellaneous Series 67, Lower Hutt, GNS Science: 97.

testing was used to test the 2013 risk-based approach on an event which had happened in the past.

(b) Selected appeal points on the Proposed Plan Changes; and

(c) Endorsement of the Proposed Plan Changes.

2.4. My evidence will not include any geotechnical advice or opinion.

2.5. I attended the public hearing of submissions to the Proposed Plan Changes held in March 2020 and presented expert evidence to the Hearing Commissioners.

3. QUALIFICATIONS AND EXPERIENCE

3.1. I hold the position of Senior Natural Hazards and Climate Change Planner at GNS Science, Lower Hutt. I have been at GNS Science since 2005.

3.2. My qualifications include:

(a) A PhD from Massey University in risk-based land use planning, conferred in 2012;

(b) A Master of Social Science from the University of Waikato; and

(c) A Bachelors of Geography and Earth Science also from the University of Waikato.

3.3. I have been a full member of the New Zealand Planning Institute (**NZPI**) since 2006.

3.4. My PhD entitled 'Innovative land use planning for natural hazard risk reduction in New Zealand' was awarded the NZPI Graduate Research Award in 2012. The subsequent toolbox development of the risk-based approach and implementation of the risk-based approach by the Bay of Plenty Regional Council (**Regional Council**) in their Regional Policy Statement was awarded the NZPI Best Practice Award in 2017. The usefulness, usability and use of the approach by the Regional Council contributed to my gaining the Science New Zealand Emerging Scientist Award in 2018.

3.5. I have worked within the Social Science team at GNS Science, Lower Hutt since January 2005, with a focus on managing natural hazards and their

risks through land use planning. Prior to joining GNS Science I was a Resource Management Planner for Opus International Consultants (now WSP) in Nelson and Taupo; and in 1999-2000 I was the Natural Hazards and Emergency Management Officer for the Wellington Regional Council, Wairarapa Division.

3.6. During my time at GNS Science, I have been involved in the following relevant projects:

(a) In 2007, I was the compiling co-author of the publication "Guidelines for assessing planning policy and consent requirements for landslide prone land"[3], which takes a risk-based planning approach. Appendix 3 of the guidance provides a landslide risk assessment example from the Australian Geotechnical Society method (AGS 2000). This 2007 guidance is currently under review;

(b) Hutt City Plan Change 29 (2012) – the purpose of this plan change was to intensify mixed-use development in Petone. As a corporate citizen of Hutt City, GNS Science made submissions on the plan change to raise the importance of planning for natural hazards, and to advocate for further provisions to be included in the plan change to manage the risks from natural hazards. A report on our submission and process has been published[4] in order to share lessons on the contribution science can make to planning outcomes;

(c) Replacement Christchurch District Plan (2014-16) – I coordinated the all of government response to the Natural Hazards chapter of the proposed plan (i.e. submission), attended conferencing and mediation, provided expert witness evidence, and attended the hearings. This included conferencing with landslide experts for the Port Hill land instability issues, and submitting on the land instability provisions within the proposed plan; and

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3 Saunders, W, & P. Glassey (Compilers) 2007. Guidelines for assessing planning, policy and consent requirements for landslide-prone land, GNS Science Miscellaneous Series 7.

4 Saunders, W.S.A.; Beban, J.G. 2014 Petone Plan Change 29 : an example of science influencing land use planning policy. Lower Hutt, N.Z.: GNS Science. GNS Science report 2014/23 56 p.

(d) RPS Natural Hazard Chapter – I attended expert elicitation to gain agreement on what natural hazards were to be included in the proposed RPS; that the risk-based approach was appropriate; and timeframes. I also provided review comments on the draft chapter prior to notification. As a result of the engagement process used during the development of the RPS chapter to determine levels of risk (in which I did not participate), I co-authored a report with Dr Margaret Kilvington outlining the process involved[5]. The purpose of this report was to be able to share learnings and process with other councils embarking on a similar planning framework.

3.7. In July 2020, I received funding for three years by the EQC to be the "EQC Champion of Land Use Planning for Natural Hazards".

4. MY ROLE

4.1. I have not been involved in the development of the Proposed Plan Changes.

4.2. I first visited Matatā on the 26 November 2007 during the Joint Geological Society Conference of New Zealand and New Zealand Geophysical Society Conference field trip[6]. During this fieldtrip, I walked around the Matatā community to gain an understanding of the level of recovery; and walked up the Awatarariki stream floor to view the damage to the stream bed and walls of the catchment, and debris. On 15 August 2019, I viewed the catchment from above (by helicopter) to gain an understanding of its current environment. I drove through the area again in December 2019, along Kaokaoroa Street, Clem Elliot Drive, and Richmond Street to see the progress of house removal.

4.3. In preparing this evidence I have reviewed the following documents and reports:

(a) Saunders, W. S. A., et al. (2013). Risk-based land use planning for natural hazard risk reduction. GNS Science Miscellaneous

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5 Kilvington, M. and W. S. A. Saunders (2015). 'I can live with this': the Bay of Plenty Regional Council public engagement on acceptable risk. GNS Science Miscellaneous Series 86. Lower Hutt, GNS Science.

6 https://securepages.co.nz/~gsnz/siteadmin/uploaded/gs_downloads/Abstracts/2007Tauranga_abstracts.pdf

Series 67, Lower Hutt, GNS Science, p97; and associated webpage https://www.gns.cri.nz/Home/RBP/Risk-based-planning/A-toolbox;

(b) Bull, J. M., et al. (2010). "Assessing debris flows using LIDAR differencing: 18 May 2005 Matatā event, New Zealand." Geomorphology 124(1-2), pp 75-84;

(c) GNS Science letter to Dr Rob Burden, Whakatāne District Council, dated 2 November 2012;

(d) Plan Change 1 and 17;

(e) S32 evaluation report dated 8 June 2018 by Boffa Miskell;

(f) Summary of submissions;

(g) Section 42A report dated 20 December 2019 by John Olliver;

(h) “Matatā Flooding 18 May 2005: Meteorology Update” dated 22 November 2019 by Mr Peter Blackwood and Mr Tom Bassett;

(i) Letter dated 28 November 2019 from Enfocus to Julie Bevan (BOPRC) entitled “Policy and Planning Assessment of the GHD Technical Assessment of Debris Flow Risk Management”;

(j) Evidence of Mr Tom Bassett, Mr Craig Batchelar, Prof Tim Davies, Mr Kevin Hind, Dr Chris Massey, Dr Mauri McSaveney, and Mr Gerard Willis; and

(k) Massey, C.I., Potter, S.H., Leonard, G.S., Strawbridge, G., Rosser, B.J., 2020: Awatarariki catchment debris flow early warning system design framework. GNS Science Report 2019/77, Lower Hutt.

5. CODE OF CONDUCT

5.1. I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Consolidated Practice Note 2014. I also agree to comply with the Code when presenting evidence to the Court. I confirm that the issues addressed in this brief of evidence are within my area of expertise, except where I state that I rely upon the

evidence of another expert witness. I also confirm that I have not omitted to consider material facts known to me that might alter or detract from the opinions.

6. REASSESSMENT OF THE 2013 MATATĀ RISK-BASED DESKTOP ASSESSMENT

6.1. In 2013, GNS Science released a risk-based toolbox for land use planning, which outlines a five step process:

1) Know your hazard;

2) Determine severity of consequences;

3) Evaluate likelihood of event;

4) Take a risk-based approach; and

5) Monitor and evaluate.

6.2. In 2013, as part of developing the GNS Science risk-based planning toolbox, the consequence and likelihood framework developed was hind tested against a number of previous events, one of which is provided in the online toolbox – the Matatā debris flow. The purpose of the testing was to see if any perverse outcomes resulted, or if the results seemed to produce an expected outcome. It was subsequently used as an example of how the risk-based approach could be applied.

6.3. The original 2013 assessment used in the risk-based approach documentation pre-dates the 2018 mapped Awatarariki Debris Flow Risk Area. The example provided in 2013 was based on a basic hazard extent for the entire debris flow hazard area. The revised assessment provided in this evidence is based on the high-risk portion of the 2018 Debris Flow Area as provided in Appendix 5 of the Section 32 report.

6.4. The 2013 desktop consequence assessment of the 2005 debris flow was undertaken using the best publicly available information at the time, from StatsNZ (population and GDP figures); journal article by Bull et al (2010, p77) [7] for return period (1:500 years) and damage descriptions; and

[7] Bull, J. M., et al. (2010). "Assessing debris flows using LIDAR differencing: 18 May 2005 Matata event, New Zealand." Geomorphology 124(1-2), pp 75-84.

Ministry of Transport (for cost of deaths and injuries). Since this time, further information has been produced which warrants a reassessment.

6.5. The 2013 assessment was purely a desktop exercise; it did not include any input from the community or other stakeholders to inform the resulting levels of risk. As outlined in Dr Chris Massey's evidence (15 January 2020, paragraph 7.2), it is not the role of the technical expert to make decisions about risk thresholds – these should be set by the decision makers in consultation with those at risk. The aim of the example was to show how the assessment framework could be used by decision makers; the results would change depending on any council, community, expert and stakeholder consultation to determine appropriate levels of risk. This level of engagement was subsequently undertaken as part of the development of the RPS, the process of which is documented in Kilvington & Saunders (2015)[8], and is a key input into the 2013 risk based approach.

6.6. The steps taken to determine the results of the desktop assessment are provided at https://www.gns.cri.nz/Home/RBP/Risk-based-planning/A-toolbox/Examples/Hind-Testing/Matata-Debris-Flow and in the report Saunders, Beban and Kilvington (2013, p 44-46).

6.7. The assessment purposefully showed six consent activity status categories to show what was possible. In reality not all these categories would necessarily be required within a policy framework. The outcome was that the Matatā debris flow was assessed as being a 'tolerable' level of risk, resulting in a theoretical 'discretionary' activity status.

6.8. Since 2013 more investigations and detailed information has become available, particularly the 22 November 2019 report by Blackwood and Bassett that provides an updated meteorology analysis which includes climate change projections from the Ministry for the Environment's coastal guidance[9]. Other investigations and details that have become available include: a mapped Awatarariki Debris Flow Risk area (Appendix 5 of the Section 32 report); the number of buildings in the high hazard zone; the return period; building costs, and costs of casualties (injury and death).

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8 Kilvington, M. and W. S. A. Saunders (2015). 'I can live with this': the Bay of Plenty Regional Council public engagement on acceptable risk. GNS Science Miscellaneous Series 86. Lower Hutt, GNS Science.

8 https://www.mfe.govt.nz/publications/climate-change/coastal-hazards-and-climate-change-guidance-local-government

6.9. Table 1 below shows the original 2013 assessment criteria, and a December 2019 assessment using more recent information.

Table 1 Comparison between the 2013 and 2019 assessments

Risk-based planning inputs	**2013**	**2019**[10]
Number of private properties in hazard zone	122	34
Number of buildings in hazard zone	144[11]	16 houses
Likely number of occupants (as per StatsNZ)	300 (based on 2.64 per dwelling)	43 (based on 2.7 per dwelling)[12]
Regional GDP	$4.318 billion (2003)	$13,071 billion (2016)[13]
Lifelines	Road, rail, power, telecommunications, water	Road, rail, power, telecommunications, water
Critical buildings	None	None
Social cultural buildings	None	None
Building value	$28.5 million (114 houses @ $250k)	$8.1 million (for 16 houses, as per MoU

10 The 2019 assessment is based on the high risk debris flow area as per Appendix 5 of s32 report, rather than the larger hazard area in 2013 as outlined in point 6.5 of my evidence.

11 The number of buildings within the hazard zone in 2013 was based on a desktop count of the number of buildings within the hazard zone for theoretical purposes only; no ground-truthing was undertaken.

12 http://archive.stats.govt.nz/Census/2013-census/profile-and-summary-reports/qstats-families-households/households.aspx

13 http://archive.stats.govt.nz/browse_for_stats/economic_indicators/NationalAccounts/RegionalGDP_HOTPYeMar16.aspx

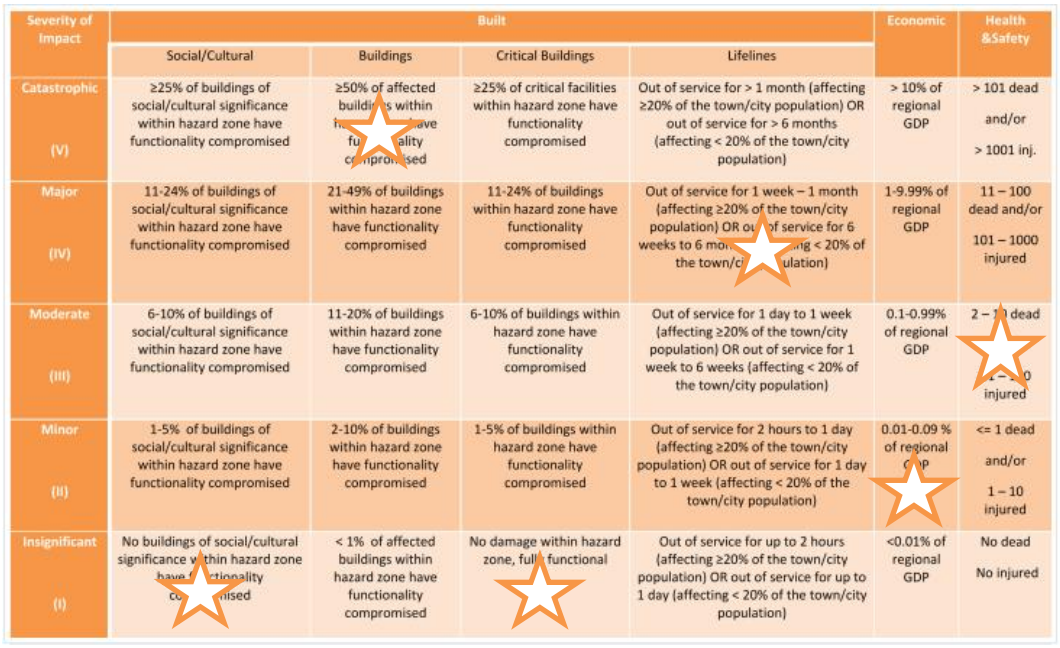
		between funding partners)[14]
Debris flow return period	1:500 (Bull et al, 2010)	1:200-250 (Blackwood & Basset, 2019)
Number of deaths	0	5.6[15]
Cost of injury	$207k	$458k[16]

6.10. Plotting the 2019 assessment on the consequence table, the result is presented below. Like the 2013 assessment a number of assumptions have been made in this reassessment. As per the evidence of Kevin Hind, and supported by Professor Davies and Dr. McSaveney, it is expected that a similar event could cause multiple deaths or injuries, with modelling showing there could be 5.6 deaths; and that more than 50% (i.e. more than 8) homes within the hazard zone, would have their functionality compromised (i.e. not be able to be used immediately after an event).

14 Memorandum of Understanding to effect managed retreat at Awatarariki Fanhead, Matatā between the Crown, the Whakatāne District Council, and Bay of Plenty Regional Council

15 As per Table 6.4 of the T&T Supplementary Risk Assessment (Appendix 4, s32 report).

16 Ministry of Transport, 2018 non-fatal injury social cost (serious), https://www.transport.govt.nz/mot-resources/road-safety-resources/roadcrashstatistics/social-cost-of-road-crashes-and-injuries/report-overview/



Severity of Impact	Built				Economic	Health &Safety
	Social/Cultural	Buildings	Critical Buildings	Lifelines		
Catastrophic (V)	≥25% of buildings of social/cultural significance within hazard zone have functionality compromised	≥50% of affected buildings within hazard zone have functionality compromised	≥25% of critical facilities within hazard zone have functionality compromised	Out of service for > 1 month (affecting ≥20% of the town/city population) OR out of service for > 6 months (affecting < 20% of the town/city population)	> 10% of regional GDP	> 101 dead and/or > 1001 inj.
Major (IV)	11-24% of buildings of social/cultural significance within hazard zone have functionality compromised	21-49% of buildings within hazard zone have functionality compromised	11-24% of buildings within hazard zone have functionality compromised	Out of service for 1 week – 1 month (affecting ≥20% of the town/city population) OR out of service for 6 weeks to 6 months (affecting < 20% of the town/city population)	1-9.99% of regional GDP	11 – 100 dead and/or 101 – 1000 injured
Moderate (III)	6-10% of buildings of social/cultural significance within hazard zone have functionality compromised	11-20% of buildings within hazard zone have functionality compromised	6-10% of buildings within hazard zone have functionality compromised	Out of service for 1 day to 1 week (affecting ≥20% of the town/city population) OR out of service for 1 week to 6 weeks (affecting < 20% of the town/city population)	0.1-0.99% of regional GDP	2 – 10 dead injured
Minor (II)	1-5% of buildings of social/cultural significance within hazard zone have functionality compromised	2-10% of buildings within hazard zone have functionality compromised	1-5% of buildings within hazard zone have functionality compromised	Out of service for 2 hours to 1 day (affecting ≥20% of the town/city population) OR out of service for 1 day to 1 week (affecting < 20% of the town/city population)	0.01-0.09 % of regional GDP	<= 1 dead and/or 1 – 10 injured
Insignificant (I)	No buildings of social/cultural significance within hazard zone have functionality compromised	< 1% of affected buildings within hazard zone have functionality compromised	No damage within hazard zone, fully functional	Out of service for up to 2 hours (affecting ≥20% of the town/city population) OR out of service for up to 1 day (affecting < 20% of the town/city population)	<0.01% of regional GDP	No dead No injured

6.11. The economic consequence is calculated using (building value / RGDP) * 100, i.e. ($8.1 million / $13,071 billion) * 100 = 0.06% of regional GDP (noting the Economic column of the consequence table is not included in the RPS).

6.12. The next step is to assess the likelihood of an event occurring. The likelihood descriptor used in the example from the table developed for the risk-based planning approach, was informed by timeframes associated with the Building Act (i.e. 50 years building life up to 2,500 years for critical infrastructure with post-event roles); 100 years as referred to in the NZ Coastal Policy Statement; and the Ministry for the Environment's Active Fault Guidelines.

6.13. Based on the Blackwood & Bassett (2019) assessment that "It is wisest to regard [rainfall] as around 12 to 18 percent greater than the 1% AEP rainfall intensities" (p2), this suggests that at least a 200-250 year return period should be used in the latest assessment. While the likelihood has changed from the 2013 assessment to this one (i.e. from 1:500 to 1:200-250), it does not change the overall likelihood assessment i.e. it remains at 'unlikely'. The table below shows the likelihood table used in the 2013

assessment.

Level	Descriptor	Description	Indicative frequency
5	Likely	The event has occurred several times in your lifetime	Up to once every 50 years
4	Possible	The event might occur once in your lifetime	Once every 51 – 100 years
3	Unlikely	The event does occur somewhere from time to time	Once every 101 - 1000 years
2	Rare	Possible but not expected to occur except in exceptional circumstances	Once every 1001 – 2,500 years
1	Very rare	Possible but not expected to occur except in exceptional circumstances	2,501 years plus

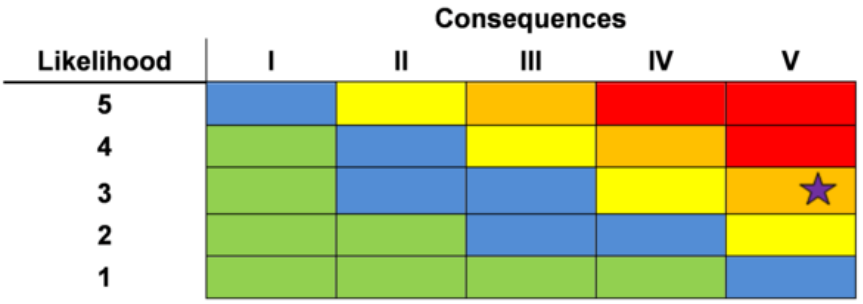
6.14. This likelihood, combined with the catastrophic consequences for the Matatā community (being 50% or more homes, within the hazard zone), equates to the same level of risk outcome in 2013.

6.15. I note that Mr Hind's evidence paragraph 6.69 presents a modified version of the AGS (2007) qualitative measures of likelihood where "Likely" is described as having a recurrence interval of between 100 years and 1,000 years, and that "The event will probably occur under adverse conditions over the design life". This description refers to the 'design life' only of property; it does not incorporate other measures of risk.

6.16. The likelihood table that was developed for the risk-based approach was for use beyond just property, it also includes social/cultural, economic, and health and safety risks. The likelihood levels were aimed at land use planning outcomes; the requirements of the Building Act allow for design life criteria. As such, with testing and expert elicitation, the likelihood table was developed to take into account more factors than AGS (2007) covers.

6.17. Notwithstanding this, the AGS table and framework has been used for risk assessments as part of planning consents and policy making, such as in this case, and in Christchurch's Port Hills. Another example of the AGS method used to inform risk assessments for planning is provided in the 2007 Landslide Guidelines for Consent and Policy Planners, published by GNS Science (Saunders & Glassey, 2007).

6.18. The final step in applying the risk-based approach is to assess the activity status based on consequence and likelihood. Taking into account the increased likelihood, the reassessment shows that activities within the hazard zone, would be discretionary.



Likelihood		Level of risk	Consent
5	Likely	Acceptable	Permitted
4	Possible	Acceptable	Controlled
3	Unlikely	Tolerable	Restricted Discretionary
2	Rare	Tolerable	Discretionary
1	Very Rare	Intolerable	Non complying, prohibited

The risk-based planning framework (adapted from Saunders, 2012)

6.19. To allow an equal comparison, neither the 2013 or this assessment took into account the increased frequency and intensification of storms due to climate change. The effect of climate change on this assessment is outlined below.

6.20. The effects of climate change must be recognised and provided for as required by Policy IR 2B of the RPS (p155). As per Blackwood and Bassett (2019, p5), “By the end of this century, under RCP 8.5 scenario these storms could be expected to occur on a 40 to 50 year return period, under RCP 6.0 on a 60 to 80 year return period”. Using the Saunders et al (2013) risk-based approach, applying the RCP 8.5 or the RCP 6.0 scenario would increase the likelihood level to 5 and 4 respectively. In both cases this would result in the assessment outcome changing to ‘intolerable’, and have a non-complying/prohibited consent activity status.

6.21. The intent of the 2013 assessment was to show how the risk-based approach could be applied; it was not a full assessment that would be required if the approach were to be adopted. For example, no engagement was undertaken as part of the assessment with anyone (e.g. council, key stakeholders, experts, iwi, community representatives, critical

lifeline providers); nor was a policy framework developed to support and guide the assessment process – this would now be achieved via the RPS.

6.22. The reassessment provided in this evidence demonstrates the iterative process of risk-based natural hazard assessments undertaken at different points in time using updated information. It should have no impact on the Proposed Plan Changes, as the RPS provides the natural hazard risk assessment framework which councils in the BOP region are required to follow.

7. ASSESSMENT OF THE PLAN CHANGES

7.1. I agree with the 'avoidance' approach outlined in the Proposed Plan Changes. The approach takes a risk-based approach, whereby the level of restrictions increases with the level of risk e.g. high risk is prohibited; medium risk has restricted development requirements via a resource consent process; and low risk areas retain residential zoning.

7.2. In my opinion, the 2007 AGS methodology for assessing landslide risk is appropriate as a natural hazard risk management framework to inform land use planning decision-making and policy. This opinion is reinforced by its inclusion in the Saunders & Glassey (2007) publication "Guidelines for assessing planning policy and consent requirements for landslide prone land", and in the RPS (Appendix L and 'User Guide').

7.3. I agree with Gerard Willis' planning assessment of the GHD report outlined in a letter to the Regional Council dated 28 November 2019 (Appendix 5 in s42A report), in particular his comment that "Risk is something that applies at all scales but by simply focusing on the individual property scale, the potential exists for cumulative effect on community well-being, services and infrastructure to be over-looked" (p2). A community wide, integrated view of risk is required to ensure the best possible outcome - in this case, the management of significant risk to the community. I agree with Mr Willis' conclusion that the natural hazard zone is an appropriate scale for assessment and is consistent with the RPS.

7.4. I agree with Craig Batchelar's evidence at paragraph 1.6 that the Proposed Plan Changes achieve a reduction in risk to those currently exposed within the High Risk Debris Flow Areas of the Awatarariki Fanhead.

7.5. Based on these assessments, I am satisfied and support the Proposed Plan Changes as being appropriate planning responses to the risk, and as a way of ensuring the sustainable management of a high risk area. In my opinion, to not proceed with these changes would not provide for people's health and safety, would result in a status quo of intolerable risk, and be contrary to the RPS.

8. RESPONSE TO APPEAL GROUNDS

8.1. The Awatarariki Residents Incorporated Society submits that the Proposed Plan Changes do not promote sustainable management. In my opinion, Plan Change 1 and 17 both promote the sustainable management of a high risk area, in doing so giving effect to Section 6(h) of the RMA (the management of significant risks from natural hazards). The purpose of the RMA includes 'health and safety', and in this case the life safety risk has been assessed as intolerable and other options (such as building design, warning systems, and reliance on insurance) are not appropriate. As outlined in the article by Saunders & Becker (2015)[17], a community needs to be sustainable and resilient; this approach allows for a safer, more resilient community by removing those properties most at risk from a future event from a catchment known to have had historic events[18], therefore providing for a future sustainable land use. This ensures the safety of those living, visiting, or maintaining services to these properties.

8.2. Point 23(c) of the appeal refers to Appendix M of the RPS, which provides options available to avoid or reduce natural hazard risks. While the list is not exclusive and is for information purposes only, in my opinion the management options outlined in Appendix M are not appropriate in this case for the following reasons (Appendix M text is in italics):

8.3. *(a) Ensuring new subdivision and development avoids specific hazard locations.* No new subdivision or development should take place within the identified at risk area.

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17 Saunders, W. S. A. and J. S. Becker (2015). "A discussion of resilience and sustainability: land use planning recovery from the Canterbury earthquake sequence, New Zealand." International Journal of Disaster Risk Reduction: 9.

8.4. *(b) Replacement or modification of existing development over time to reduce potential consequences*. It is the intent of the Proposed Plan Changes to remove the existing houses and turn the land into reserve to reduce the risks to life and property.

8.5. *(b1) Promoting the use of natural defences against coastal hazards and discouraging hard protection structures.* Not applicable in this case.

8.6. *(c) Providing only for low intensity activities in specific locations.* The proposed reserve that will be created meets this low-density activity objective;

8.7. *(d) Setbacks and undeveloped buffer land within areas of new subdivision and development.* As per (a), no new subdivision or development should occur in the identified high risk areas.

8.8. *(e) Use of relocatable or recoverable structures.* Not appropriate in this case, as the life risk remains as long as people are living in the high risk area.

8.9. *(f) Restoration, retention or enhancement of natural defences against natural hazards (e.g. dunes and wetlands) as part of development proposals and promotion of the sustainable functioning of such natural defences to reduce the risk to existing development.* There are no natural defences available to reduce the risks.

8.10. *(g) Property-specific works (e.g. debris nets and slope stability works) as part of development proposals (excepting that community scale hard protection structures should be avoided in the coastal environment).* As discussed in the evidence of Professor Davies, Kevin Hind, and Tom Bassett, debris nets and other works are not proven to work at this scale, and their costs are prohibitive.

8.11. *(h) Smart urban and building design (e.g. heights of building platforms, retention or reinstatement of stormwater overland flow paths, hazard resilient buildings and construction materials).* As this is an existing development, there is little option to change the design of buildings or change construction materials, or provide adequate mitigation (see evidence of Professor Davies). Regardless, the design and materials may still not reduce the life safety risk in the high risk zone.

8.12. *(i) Ensuring new development anticipates possible hazard event emergencies and provides means to enable effective responses by people and communities …* No new development should occur in the identified high risk areas, an outcome the proposed plan changes seek to address; … *including requiring:*

(i) *Hazard warning systems.* As per Davies (2017) and Massey et al (2020) report, a warning system is not deemed appropriate in this case.

(*ii)* *Urban form and transport infrastructure (including for motor vehicles, cycles and pedestrians) that enables rapid and efficient evacuation.* As per Davies (2017) and Massey et al (2020), rapid and efficient evacuation is not considered to be possible for the high risk area.

(iii) *Provision for, and safeguarding of, safe and accessible evacuation routes and zones (including, where appropriate, vertical evacuation zones).* As per Davies (20117) and Massey et al (2020), there would not be insufficient time to ensure all those in the high risk area could evacuate in a timely way. Vertical evacuation is not considered an option.

9. CONCLUSION

9.1. For the reasons described in my evidence statement, I support the Proposed Plan Changes. In summary, in my opinion the Proposed Plan Changes appropriately manage the significant risk of debris flow from the Awatarariki Stream and allows for the future sustainable use of the land.

Dr Wendy Saunders,

10 August 2020