BEFORE A HEARING PANEL: WHAKATĀNE DISTRICT COUNCIL AND BAY OF PLENTY REGIONAL COUNCIL

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of submissions and further submissions on Plan Change 1 (Awatarariki Fanhead, Matatā) to the Operative Whakatāne District Plan and Plan Change 17 (Natural Hazards) to the Bay of Plenty Regional Natural Resources Plan

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STATEMENT OF EVIDENCE OF CHRIS PHILLIPS ON BEHALF OF WHAKATĀNE DISTRICT COUNCIL

CATCHMENT MANAGEMENT

15 January 2020

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1. EXECUTIVE SUMMARY

1.1. In my opinion, and for the reasons set out in this statement of evidence, catchment management approaches in common use in New Zealand will not, either singly or collectively, alleviate the risk of future debris flows on the Awatarariki fanhead. This conclusion aligns with evidence from other experts and in several reports (Davies 2017, McSaveney et al. 2005).

1.2. Vegetation enhancement, stream clearance (i.e. log jam removal), or structural measures such as engineered detention systems (by example, checking dams within the catchment) while technically feasible (but not reasonably practicable) are likely to be cost-prohibitive and have little material impact on future debris flow hazard. This conclusion aligns with information contained in McSaveney et al's. 2005 report and with evidence from other experts (Davies, McSaveney, Bassett, and Massey).

1.3. In respect of submitters' concerns related to improved catchment management to reduce the hazard, in my opinion these would have little material impact on reducing future debris flow risk.

2. INTRODUCTION

2.1. My full name is Christopher John Phillips.

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; and

(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**).

2.3. My evidence relates to the catchment management effects aspects of the Proposed Plan Changes. My evidence will cover:

(a) The viability of proactive catchment management processes to reduce debris flow risk to properties on the Awatarariki fanhead to an acceptable level;

(b) It will not cover detailed planning issues, engineering design, debris flow early warning systems, nor formal hazard and risk assessment and analysis as this is covered by other experts; and

(c) My evidence is limited to the catchment of Awatarariki Stream <u>above</u> the fanhead (i.e. where the stream emerges from the 'canyon' cut through the old sea cliffs or about where the railway line is located) and does not cover the catchment between the fanhead and the Matatā Lagoon except for the consideration of log dam management practices in the catchment and their viability to reduce life safety risk and to properties on the fanhead.

3. QUALIFICATIONS AND EXPERIENCE

3.1. I am a Principal Scientist and Portfolio Leader for "Managing Land & Water" with Manaaki Whenua - Landcare Research, a Crown research institute, at Lincoln.

3.2. My qualifications include:

(a) A PhD in Agricultural Engineering from Canterbury University, and a Post-Graduate Diploma in Commerce from Lincoln University. My PhD studies focused on understanding the flow properties of debris flows.

(b) A BSc in Geology and Physical Geography from Otago University; and

(c) An MSc (Hons) in Earth Science from Waikato University.

3.3. I am a past member of the New Zealand Geological Society, a member of the New Zealand Hydrological Society, an honorary (life) member of the New Zealand Association of Resource Management, a past Director of the Australasian Chapter of the International Erosion Control Association, and Secretary and board member of ecorisQ (an international association of professionals working on sustainable solutions for natural hazard risk management).

3.4. I have 38 years' experience in research and consulting activities as part of the former New Zealand Forest Service, the Ministry of Forestry, and currently Manaaki Whenua - Landcare Research. I have provided consultancy services for most of New Zealand's forestry companies advising them on aspects of erosion, slope stability, and environmental impacts relating to plantation forestry. Similarly, I have provided advice to district and regional councils on matters relating to erosion and its management.

3.5. Throughout my career I have focused on studying how and why erosion occurs, with an emphasis on how vegetation affects erosion and slope stability (including forestry and its various phases of management).

3.6. I have been involved in and led research and consultancy projects on the effects of forestry on erosion, sediment generation, sediment yield and vegetation recovery in many regions of New Zealand including Hawke's Bay, Coromandel, Marlborough and Marlborough Sounds, Central North Island, Nelson, West Coast, Gisborne-East Coast, Auckland and Canterbury. This has included research on debris flows.

3.7. I have also been involved in integrated catchment management research having led aspects of research related to riparian management, erosion and sediment control, and knowledge management. I was the co-developer of a 10-year MBIE research programme "Integrated catchment management for the Motueka River catchment".

3.8. I developed and currently co-lead a 5-year MBIE research programme "Smarter targeting of erosion control".

3.9. I have appeared as an expert witness for forestry companies on district and regional council plan change hearings and in the Environment Court, providing evidence on erosion processes and sediment implications of forestry operations, including debris flows.

4. MY ROLE

4.1. I have not been directly involved in the development of the Proposed Plan Changes. Manaaki Whenua - Landcare Research was approached by the District Council in 2018 to review a report by Prof. Tim Davies on “The significance of sediment stored behind log jams to the 2005 Awatarariki debris flow; implications for risk management”. In that assessment I concluded:

(a) Log jams (or dams), while posing a risk in principle to the generation and volume of future debris flows, are not likely to be significant in terms of total volume of sediment generated and future debris flow hazard; and

(b) The removal of such dams would be logistically difficult, involve on-going cost, and provide only marginal benefit to the reduction in risk from future debris flows.

4.2. I was approached by District Council in February 2019 to attend a meeting of “experts” in preparation for a hearing later in 2019 (now 2020). Following that meeting I was asked to prepare evidence on the ‘catchment management effects’ aspects of the Proposed Plan Changes, and to respond to submitters concerns.

4.3. I visited the Awatarariki Stream catchment in August 2019 and took a helicopter reconnaissance flight over the catchment. I have not walked within the catchment beyond about 100 m upstream of the railway bridge or been to the headwaters. I have “explored” the catchment using Google Maps and aerial photographs to understand the topography, vegetation cover, and relevant catchment attributes. I have viewed photographs, including those of the stream and its catchment immediately following the event in 2005 in addition to those in power point presentations and numerous reports to gain as full an understanding of the area. I am also familiar with similar streams affected by debris flows in the Coromandel and other parts of New Zealand caused by intense rainstorms and associated landsliding having observed these in the course of my research.

4.4. In preparing this evidence I have read and assessed documents and reports related to the 2005 event (impacts and proposed future mitigation measures) and attended meetings of expert witnesses to gain an understanding of the initial event, the subsequent responses to it, and the Proposed Plan Changes aimed at addressing the significant risk from debris flow hazards to loss of life and damage to buildings and structures on the Awatarariki fanhead.

5. CODE OF CONDUCT

5.1. Although this is a Council hearing, 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 Hearings Panel. 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. ASSESSMENT OF THE PLAN CHANGES

7.1 To assess the viability of proactive catchment management processes to reduce debris flow risk to properties on the Awatarariki fanhead to an acceptable level, one needs to understand:

(a) Firstly, the physical nature of the catchment and the natural hazards present;

(b) Secondly, what 'catchment management' is and the approaches/methods that can be used to manage natural hazards such as debris flows; and

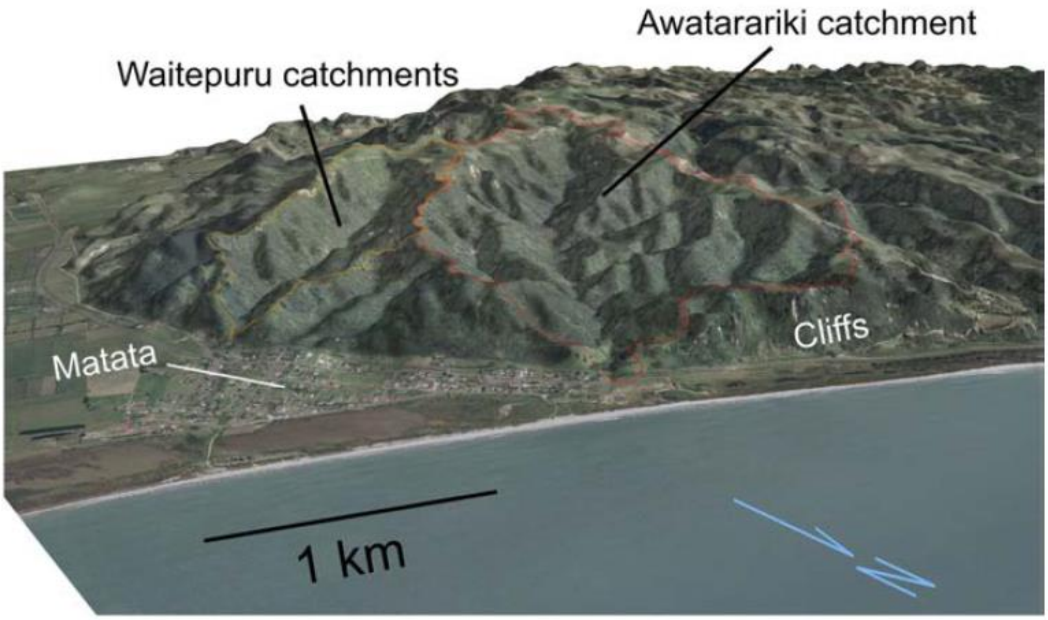
(c) Finally, if the Proposed Plan Changes are feasible in managing the hazard.

6.2. In this evidence, I use the term landslide as a broad encompassing term to include debris avalanches, debris slides, land slips and debris flows but concur with McSaveney et al. (2005) that the use of the term debris flow can be a keyword for the entire phenomenon; from an initiating landslide on a steep slope, the rapid flow along a steep confined channel, and the deposition on a debris fan (Hungr 2005).

The Awatarariki Stream catchment

6.3. The Awatarariki Stream catchment rises in elevation from sea level to about 300 m. The catchment is quite steep in the mid-upper reaches and is deeply incised lower down with the stream gradient increasing through a gorgy section (“box canyon” – McSaveney et al. 2005; Lambert 2008) before emerging on the fanhead (Figure 1). Awatarariki Stream is approximately 4.15 km long and drains a 4.5 km^2 catchment (Arts 2005; Bull et al. 2010). However, Davies (2017) suggests that the main stem stream length is 2.8 km and that of the main channel and its tributaries as 7.5 km. Regardless of which figures are “correct” this is a small steep catchment and therefore responds quickly to rainfall events with an estimated time of concentration of 45 minutes (Arts 2005). Such a small, steep catchment is also prone to landslide-induced debris flows (McSaveney et al. 2005; Bassett 2006).

6.4. The fanhead comprises an area of approximately 7 ha, with the Awatarariki Stream flowing through or across the fanhead to a sediment basin and then to Matatā Lagoon (Boffa Miskell 2017).



From Bull et al. (2010). A 3-D perspective of the Awatarariki catchment.

6.5. Most of the catchment is in a native reserve (Matatā Reserve). Most forest in Awatarariki and Waitepuru Stream Valleys is relatively young (Lambert 2008). The condition of the vegetation, other than where landslides have occurred is reported by Douglas (2017) to be in good condition. The vegetation cover as interpreted from Google Earth and the reconnaissance flight, indicate past phases of landslide activity and subsequent revegetation.

Catchment management issues

6.6. The Proposed Plan Change aims to reduce life safety and property damage risks from future debris flows and the associated sediment and debris transport onto the fanhead and beyond to the Matatā Lagoon.

6.7. Catchment management actions or interventions in New Zealand are primarily designed to improve water quality, reduce erosion, and enhance biodiversity. The latter can largely be ignored in this case as the Awatarariki Stream catchment is almost entirely within the Matatā Reserve comprising native vegetation in various stages of recovery from past logging activities (Douglas 1993, 2017) and from past erosion events (Lambert 2008).

6.8. At the time of the May 2005 storm that caused the debris flows, the catchments above the town of Matatā were largely vegetated in secondary and regenerating native forest, with some pastoral land on the crests of the southern and western ridges (Bassett 2006).

6.9. For catchment management purposes, an intact cover of indigenous vegetation is generally regarded as the “gold standard” where the erosion protection value of the vegetation is regarded as high for all but the most severe storm events (e.g., Marden & Rowan 1988; 1993; Douglas 2017). It is also the sought after “endpoint” of most catchment restoration efforts.

6.10. Because of the steep contributing slopes and bluffs, any catchment management/soil conservation measure such as vegetation enhancement, physical land contouring, or any other structural measure to provide any additional benefit beyond the native vegetation that is there, is likely to have limited value, even if it might be feasible to implement.

6.11. The contributions of sediment and runoff from the small amounts of farmland at the top and western margins of the catchment would not, in my opinion, contribute to any elevated risk of sediment delivery, build up or enhanced debris flow activity.

6.12. The southern and western margins of the catchment are currently in pastoral farmland. Planting these or allowing them to regenerate to indigenous forest, while aesthetically pleasing or potentially enhancing biodiversity, would not reduce the risk of future debris flows because:

(a) The areas in pasture/farmland are small relative to the whole catchment;

(b) The slopes are gentler here and less prone to landslides and sediment delivery to the catchment is likely to be small; and

(c) Debris flows are often generated in severe storms where the 'vegetation" effect is overridden by the amount and/or intensity of the rainfall (see McSaveney et al. 2005).

6.13. The only "gain" within the reserve would be to more actively manage the steeper parts, by including supplementary indigenous planting and vegetation management (weed removal) and including pest management to improve the health of the forest. However, the feasibility of doing this as mentioned above, is questionable as large parts of the catchment are very steep with many bluffs. In my view, any increase in "erosion protection" would be negligible and it would not reduce the landslide hazard and overall risk from future debris flows. This concurs with the observations of Douglas (2001; 2017) that "the interception potential of the bush during storm events is high and a higher level of protection would be difficult to achieve", i.e., manipulating the vegetation would not add any value in terms of risk reduction.

6.14. Interventions that promote <u>rapid</u> revegetation of any <u>future</u> landslide-affected areas within the catchment might be beneficial in terms of reducing surface erosion and sediment delivery to the stream to help reduce sediment build up in the stream bed. However, techniques such as hydroseeding (usually with exotic grasses) are not feasible (nor desirable) as this reserve is largely native, and access would not be reasonably practical. Broadcast aerial delivery of native seeds might help enhance the natural processes of revegetation on these bare surfaces. However, in my opinion this would not be a significant improvement over the natural process because the reserve is of reasonable size, adequate seed sources exist, and the natural revegetation-recovery process has occurred following past landslide events.

6.15. The rainfall figures reported for the 2005 event (McSaveney et al. 2005; and others) are typical of those that have and continue to cause landslides and debris flows in many parts of New Zealand in similar terrain. Such localised high intensity rainstorms with their associated severe landscape responses (i.e., landslides and debris flows) are also not uncommon, with areas outside of the storm cell showing little or no landscape response.

6.16. I concur with McSaveney et al. (2005) that "rainfall interception by the native vegetation was not a useful mitigating factor in the 2005 storm because the forest and soils already were wet from earlier rain, in the hours before the deluge". I also concur with McSaveney et al. (2005) that "the risk of future debris flows caused by such extreme rainfall will not be materially changed by enhancing the present vegetation".

6.17. On-going pest management can also help to ensure that the mature and recovering native forest in the reserve stays healthy. However, due to the steepness of the terrain, these interventions may not be practical or feasible across the whole reserve. I concur with the conclusion of John Douglas that "apart from animal pest work, which has been carried out, to improve the native vegetation status, little more can be done in the upper catchment". This conclusion is also based on my own experience (Phillips & Davie 2007) in that natural factors (e.g. storm intensity, soil and geological structure) have a far greater influence on erosion rates and sediment yield than animal pests.

6.18. Within the stream channel over time, debris and sediment is delivered from erosion of the side slopes causing the stream bed to aggrade. Logs and vegetation may also create barriers or log jams behind which sediment and debris can accumulate. This is a natural process. These log jams are removed only in the largest erosion events such as in 2005 when debris flows evacuate all (or nearly all) stored material within the channel delivering it downstream onto the fanhead where it is deposited as the debris flow loses energy as the slope gradient lessens, the flow depth reduces, and the debris flow loses water.

6.19. It takes many years for the cycle to repeat but it is clear from past records that these events have happened in the past and are likely to happen in the future (McSaveney et al. 2005). In some places, active intervention by removing debris dams and “mining” the sediment in the channel can reduce the risk, but in this situation it is not feasible (Douglas 2017).

7. RESPONSE TO SUBMISSIONS

7.1. The relatively small number of submissions raised several issues including:

(a) Inadequacy of consideration of non-regulatory options;

(b) Education;

(c) Monitoring systems;

(d) Warning systems;

(e) Catchment management;

(f) Bunding; and

(g) Channel to sea.

7.2. I have read a summary of the submissions and confine my comments in this evidence to “consider improved catchment management (farming/forestry)” and “improve riparian management” as mechanisms to reduce the hazard and risk of future debris flows.

7.3. The objective of the Proposed Plan Change is to identify the risk areas on planning maps, remove residential zoning from the High-Risk Area and establish rules to appropriately manage activities in the risk areas.

7.4. In my opinion, debris flows will continue to be a natural hazard for the Awatarariki fanhead and that it will not be possible to mitigate the risk associated with future events by <u>any</u> catchment management intervention above the fanhead. This view aligns with earlier reports (Davies 2017, McSaveney et al. 2005) and with evidence from other experts (Davies, McSaveney, Bassett).

8. CONCLUSION

8.1. I concur with the findings of McSaveney et al. (2005) that severe rain caused landslides (debris avalanches) which resulted in debris flows that caused the disaster on the Awatarariki fanhead. Such a storm would override any commonly used catchment management mitigations (if they were present). This suggests that implementing such interventions to manage <u>future</u> debris flows, even if practicable, would have limited efficacy.

8.2. I concur with McSaveney et al. (2005) that “maintaining a healthy forest cover has many beneficial effects, however, the storm of 18 May 2005 was too extreme, and way beyond the capacity of any forest cover to protect Matatā from major debris flows and flooding. The risk of future debris flows caused by such extreme rainfall will not be materially changed by enhancing the present vegetation cover”. Thus, even if the current forest could be enhanced it will <u>not mitigate</u> against future events such as those that caused the 2005 event.

8.3. Other catchment management actions within the catchment upstream of the fanhead, such as removing log jams, will not have any material effect on changing the nature of the debris flow hazard.

8.4. In conclusion, there is little that can be done that is practicably reasonable in terms of catchment management practices within the catchment that would reduce the risk from future landslide-induced debris flows and that proposed planning provisions to manage the risks on the area of the fanhead are the most appropriate methods for managing the threats to life and property. This conclusion aligns with those of other experts (Davies 2005; Boffa Miskell 2017; others; McSaveney et al. 2005).

Chris Phillips

15 January 2020

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