BEFORE THE INDEPENDENT HEARINGS PANELS APPOINTED TO HEAR AND MAKE RECOMMENDATIONS ON SUBMISSIONS AND FURTHER SUBMISSIONS ON PROPOSED PLAN CHANGE 1 TO THE NATURAL RESOURCES PLAN FOR THE WELLINGTON REGION

UNDER	the Resource Management Act 1991 (the Act)
AND	
IN THE MATTER	of Hearing of Submissions and Further Submissions on Proposed Plan Change 1 to the Natural Resources Plan for the Wellington Region under Schedule 1 of the Act

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STATEMENT OF EVIDENCE OF DR MICHAEL JOHN CRAWSHAW GREER

ON BEHALF OF GREATER WELLINGTON REGIONAL COUNCIL

TECHNICAL EVIDENCE

HEARING STREAM THREE – EARTHWORKS, VEGETATION CLEARANCE AND FORESTRY AND RURAL LAND USE.

15 APRIL 2025

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INTRODUCTION

1 My name is Michael John Crashaw Greer. I am the Principal Freshwater Scientist at Torlesse Environmental Ltd.

2 I have read the submissions relevant to the Section 42A reports on

2.1 Earthworks;

2.2 Vegetation clearance and forestry; and

2.3 Rural land use.

3 I have prepared this statement of evidence on behalf of Greater Wellington Regional Council (the Council) in respect of technical matters arising from the submissions and further submissions on Proposed Change 1 (PC1) to the Natural Resources Plan for the Wellington Region (NRP) in relation to the above topics.

4 These matters are considered from a scientific perspective only, and I do not make policy recommendations.

QUALIFICATIONS AND EXPERIENCE

5 I hold a PhD in Ecology and a Bachelor of Science in Zoology from the University of Otago.

6 I have over 14 years of work experience in freshwater quality and ecology, and have worked for local government, the Department of Conservation and NIWA. Since the 6th of June 2022 I have been the Principal Scientist at Torlesse Environmental Ltd. Prior to that I was employed by Aquanet Consulting Ltd as a Senior Freshwater Scientist, the Council as a Senior Environmental Scientist and Environment Canterbury as an Ecology Scientist.

7 Since 2018 I have been engaged by 19 different regional, district or city councils; the Department of Conservation; and various industry bodies, private companies, and corporations to provide a variety of technical and scientific services in relation to water quality and aquatic ecology. My work routinely involves:

7.1 Providing assessments of effects on water quality and/or aquatic ecology, recommending or assessing compliance with resource consent conditions;

7.2 Designing or implementing water quality/aquatic ecology monitoring programmes at the scale of a specific activity and at a wider catchment or regional scale; and

7.3 Advising regional councils on regional plan development and National Policy Statement for Freshwater Management (NPS-FM) implementation.

8 I was the Council's technical lead for the Surface Water Quality and Ecology Expert Panels for the Whaitua Te Whanganui-a-Tara (TWT) and Whaitua Kāpiti processes, and have sat on expert panels for Environment Canterbury, West Coast Regional Council and the Tasman District Council as part of their NPS-FM implementation processes. I have also authored or co-authored a number of catchment and region-wide water quality reports to inform the NPS-FM Implementation programmes of the Council (TWT, Ruamāhanga Whaitua and Whaitua Kāpiti), West Coast Regional Council (whole region), Environment Southland (whole region), and Environment Canterbury (Lower Waitaki Water Zone and Waimakariri Water Zone).

9 Between 2017 and 2022 I acted on behalf of the Council during the council hearings and environment court appeal processes for the NRP. That role involved writing evidence for Council and Environment Court hearings, contributing to mediation and attending expert conferencing on matters relating to the freshwater quality and aquatic ecosystem health, stream reclamation and drain management provisions in the NRP. I also authored the Council's guidance documents on implementing the vegetation clearance rules and watercourse classification definitions in the NRP and led the mapping of highly modified rivers and streams in the Wellington Region.

10 Since 2022 I have acted as a technical advisor for PC1. This role involved/involves:

10.1 Planning and preparing the technical work underpinning the process by which the freshwater and coastal objectives recommended in the TWT and Te Awarua-o-Porirua (TAoP) Whaitua Implementation Programmes (WIPs) were refined into the target attribute states (TASs), coastal objectives and contaminant load reduction targets in the notified version of PC1;

10.2 Developing the nutrient outcomes in PC1 to ensure consistency with the requirements of Clause 3.13 of the NPS-FM 2020 (as amended February 2023) and the associated national guidance;

10.3 Contributing to the drafting of provisions where necessary to ensure consistency with the relevant TAS and coastal objectives;

10.4 Using the best available information to assess the extent to which the regulatory provisions of PC1 will contribute to the achievement of the TASs; and

10.5 Providing on-going technical advice to officers and S42A report authors during the hearing process.

11 I have acted on behalf of appellants/submitters during the Environment Court appeals on Plan Change 10 (Lake Rotorua Nutrient Management) to the Bay of Plenty Regional Natural Resources Plan and Waikato Plan Change 1, and the Council hearings on Proposed Plan Change 9 (TANK Catchments) to the Hawke's Bay Regional Resource Management Plan. I also acted on behalf of the Southland Regional Council during Environment Court mediation on the Proposed Southland Water and Land Plan.

12 I have worked as a technical advisor on behalf of both consenting authorities and applicants on well over 200 resource consent applications, compliance assessments and/or prosecution cases. These applications have been for a wide range of activities, including stream reclamation, and stormwater discharges.

13 I am a member of New Zealand freshwater sciences society.

CODE OF CONDUCT

14 I have read the Code of Conduct for Expert Witnesses set out in the Environment Court's Practice Note 2023 (Part 9). I have complied with the Code of Conduct in preparing this evidence. My experience and qualifications are set out above. Except where I state I rely on the evidence of another person, I confirm that the issues addressed in this evidence are within my area of expertise, and I have not omitted to consider material facts known to me that might alter or detract from my expressed opinions.

SCOPE OF EVIDENCE

15 My statement of evidence addresses the following matters:

15.1 The extent to which the notified provisions of PC1 (including those for earthworks and rural land use) contribute to the achievement of the TASs in Tables 8.2, 8.4 and 9.2 of PC1; and

15.2 Responses to the technical matters raised in submissions on the rural land use, forestry, vegetation clearance and earthworks provisions of PC1 that are related to freshwater quality and ecology.

BACKGROUND CONTEXT

16 PC1 implements the NPS-FM 2020 for TWT and the TAoP Whaitua. This involves setting objectives, policies, rules and other methods to manage activities such as urban development, earthworks, stormwater, wastewater and rural land use. Accordingly, PC1:

16.1 Defines TASs for the compulsory attributes in Appendix 2A and 2B of the NPS-FM 2020 and other attributes recommended in the WIPs; and

16.2 Establishes provisions that will contribute to the achievement of those TASs.

17 The primary purpose of this statement of evidence is to consider the extent to which the notified provisions of PC1 contribute to the achievement of the TASs in Tables 8.2, 8.4 and 9.2.

ASSESSMENT OF THE LIKELIHOOD OF THE NOTIFIED PC1 TASS BEING MET UNDER THE NOTIFIED REGULATORY PROVISIONS

18 At notification, the biophysical effects of the proposed PC1 provisions had not been explicitly modelled. Consequently, to inform the S32 analysis for PC1, scenario assessment results generated through the TAoP Collaborative Modelling Project (CMP) and TWT Biophysical Science Programme (BSP) (the science component of these Whaitua processes) were used to assess how effectively the proposed regulatory provisions of PC1 will achieve the **notified** TASs. The outputs of this process can be found at the links below[1][1,2] and are described in paragraph 87 to 92 of my Statement of Primary Evidence[2] for Hearing Stream 2.

19 To provide a broad indication of the potential effectiveness of the PC1 provisions considered in Hearing Stream 3 the relevant results from these earlier assessments are summarised in Table 1. However, this assessment differs from what is presented in my Statement of Primary Evidence[2] for Hearing Stream 2 in that:

[1] https://www.gw.govt.nz/assets/Documents/2023/10/Greer-M.J.C.-2023b.-Assessment-of-alignment-between-the-regulatory-provisions-and-target-attribute-states-in-proposed-Plan-Change-1-to-the-Natural-Resources-Plan-Te-Awarua-o-Porirua-Whaitua.pdf; and https://www.gw.govt.nz/assets/Documents/2023/10/Greer-2023a-Assessment-of-alignment-between-the-regulatory-provisions-and-target-attribute-states-in-proposed-Plan-Change-1-to-the-Natural-Resources-Plan-Whaitua-Te-Whanganui-a-Tara-1.pdf

[2] Evidence of Michael John Crawshaw Greer on Behalf of Greater Wellington Regional Council (dated 28th February 2025).

19.1 It incorporates new information that has become available since that evidence was drafted. Specifically, in March 2025 Collaborations modelled the reduction in sediment loads associated with the PC1 provisions through a bespoke annual load model (described in Easton *et al*.[3] and Mr James Blyth's Statement of Primary Evidence[3] for Hearing Stream 2). When paired with the visual clarity-sediment load relationships presented in Mr James Blyth's other Statement of Primary Evidence for Hearing Stream 2[4], this modelling allows for the more robust assessment of the extent to which the provisions contribute to the visual clarity TASs being met. It also factors in the sediment related impacts of the changes made to the Resource Management (Stock Exclusion) Regulations 2020 since PC1 was notified (Amended October 2024). This new information is incorporated in Table 1.

19.2 It does not only consider whether the TASs are achieved by the provisions, but whether they will be improved significantly beyond the TASs (i.e., where the provisions are potentially too stringent).

19.3 While, all of the TASs in Table 8.4 and 9.2 of PC1 are considered in my Statement of Primary Evidence[2] for Hearing Stream 2, only *E. coli*, nutrients (ammoniacal nitrogen, nitrate nitrogen, dissolved inorganic nitrogen and dissolved reactive phosphorus), and suspended fine sediment related attributes[5] are considered in this evidence. Furthermore, only rural and mixed rural catchments are considered[6]. This approach was taken to ensure only information that is relevant to the topics considered in Hearing Stream 3 is presented (i.e., the TASs impacted by the rural land-use (all attributes), earthworks (sediment), forestry (sediment) and vegetation clearance (sediment) provisions of PC1).

20 The results Table 1 indicate that the notified provisions (for all activities):

[3] Evidence of James Mitchell Blyth on Behalf of Greater Wellington Regional Council (dated 28th February 2025).
[4] Evidence of James Mitchell Blyth on Behalf of Greater Wellington Regional Council (dated 28th February 2025).
[5] These attributes are described in detail in paragraph 25 of my Statement of Primary Evidence for Hearing Stream 2.
[6] While, earth working is primarily associated with urban development, its impact in urban catchments cannot be considered from the CMP and BSP outputs effects of this activity cannot be separated out from stormwater treatment and land-use change in these areas.

20.1 Are generally consistent (i.e., only achieves the required attribute state) with the achievement of ~71% of the rural and mixed rural *E. coli*, nutrient and suspended sediment TASs (indicated by ✓);

20.2 Go beyond what is required to achieve ~13% rural and mixed rural *E. coli*, nutrient and suspended sediment TASs (e.g., improve an attribute from the C to the A state where the TAS is B, or generate a significant proportional improvement in an attribute with a TAS of maintain at A) (indicated by ↑). This is mostly driven by dissolved reactive phosphorus concentration reducing as a side effect of the sediment load reductions aimed at achieving the visual clarity TASs;

20.3 Are unlikely to achieve ~15% rural and mixed rural *E. coli*, nutrient and suspended sediment TASs, with most of the unachieved TASs applying to the *E. coli* attribute (indicated by ↓); and

20.4 Are only likely to achieve all of the TASs in three part-FMUs

20.4.1 Ōrongorongo, Te Awa Kairangi and Wainuiomata small forested and Te Awa Kairangi forested mainstems;

20.4.2 Te Awa Kairangi lower mainstem; and

20.4.3 Korokoro Stream.

***Note**: the impacts of the vegetation clearance and forestry provisions are not factored into the Table 1 results, which is also likely to reflect an overestimate of the extent of stock exclusion and its benefits on E. coli due to the changes made to the Resource Management (Stock Exclusion) Regulations 2020 since PC1 was notified.*

21 Overall, there appears to be a high level of consistency between the notified provisions and the notified TAS. However, for most part-FMUs there is a low likelihood of the *E. coli* TAS being achieved through the provisions alone.

Table 1: Assessment of which of the notified *E. coli*, nutrient and suspended sediment TAS in rural and mixed rural part-FMUs are expected to be achieved by the provisions considered in Hearing Stream 3 (based on findings of Greer[1,2] and Easton *et al*.[3] Green ticks indicates where the provisions are consistent with the achievement of the TAS, orange up arrows indicates where the provisions go beyond what is required to achieve the TAS and the red down arrows indicates where the provisions will not meet the TAS.

Whaitua	Part-FMU	Ammon.	Nitrate	Clarity	*E. coli*	Diss. inorg. N	Diss. react. P	Overall
TWT	Ōrongorongo, Te Awa Kairangi and Wainuiomata small forested and Te Awa Kairangi forested mainstems	✓	✓	✓	✓	✓	✓	✓
	Te Awa Kairangi lower mainstem	✓	✓	✓	✓	✓	✓	✓
	Te Awa Kairangi rural streams and rural mainstems	✓	✓	↓	↓	✓	↑	↓
	Wainuiomata rural streams	✓	✓	↑	↓	✓	✓	↓
	Parangārehu catchment streams and South-west coast rural streams	✓	✓	↓	↓	✓	✓	↓
	Korokoro Stream	✓	✓	✓	✓	✓	✓	✓
TAoP	Taupō	✓	✓	✓	↓	✓	↑	↓
	Pouewe	✓	✓	✓	↓	✓	↑	↓
	Wai-o-hata	✓	✓	↑	↓	✓	↑	↓
	Takapū	✓	✓	✓	↓	✓	↑	↓
	Te Rio o Porirua and Rangituhi	↑	✓	✓	↓	✓	↑	↓

ASSESSMENT OF THE LIKELIHOOD OF THE AMENDED PC1 TASS BEING MET UNDER THE NOTIFIED REGULATORY PROVISIONS

22 I understand that in her S42A Officer's Report[7] for HS2, Ms O'Callahan recommended a number of amendments to the TAS in Table 8.4 and 9.2. The recommended amendments that are relevant to the provisions considered in Hearing Stream 3 are:

22.1 Making the visual clarity TASs for Te Awa Kairangi rural streams and rural mainstems part-FMU more lenient to account for the naturally occurring process of colour in the Mangaroa River (see paragraph 150 and 151 of my Statement of Primary Evidence for Hearing Stream 2[2]);

22.2 Making the dissolved reactive phosphorus TASs for the Ōrongorongo, Te Awa Kairangi and Wainuiomata small forested and Te Awa Kairangi forested

[7] Plan Change 1 to the Natural Resources Plan for the Wellington Region Section 42A Hearing Report. Hearing Stream 2: Objectives. Prepared by Mary O'Callahan for Greater Wellington Regional Council (dated 28th February 2025)

mainstems part-FMU more lenient to account for current concentrations likely reflecting natural state (see paragraph 97 to 99 of my Statement of Primary Evidence for Hearing Stream 2[2]); and

22.3 Making the *E. coli* TASs for the following part-FMUs more lenient to acknowledge the achievability issues associated with the notified TAS.

22.3.1 Te Awa Kairangi rural streams and rural mainstems (B to C);

22.3.2 Pouewe (B to C);

22.3.3 Taupō (B to C);

22.3.4 Wai-O-Hata (C to D); and

22.3.5 Te Rio o Porirua and Rangituhi (C to D).

23 In Table 2 I provide an update to Table 1 that incorporates Ms O'Callahan's recommendations[7]. Results suggest that her amendments result in just 2% more of the TAS being met by the notified provisions (73%). However, two additional part-FMUs are expected to meet all of the relevant part-FMUs (Pouewe and Wai-o-hata).

Table 2: Updated assessment of which of the amended (as per the recommendations in Ms O'Callahan's S42A Officer's Report for Hearing Stream 2[7]) *E. coli*, nutrient and suspended sediment TASs in rural and mixed rural part-FMUs are expected to be achieved by the notified provisions considered in Hearing Stream 3 (based on findings of Greer[1,2] and Easton *et al*.[3] Green ticks indicates where the provisions are consistent with the achievement of the TASs, orange up arrows indicates where the provisions go beyond what is required to achieve the TASs and the red down arrows indicates where the provisions will not meet the TASs.

Whaitua	Part-FMU	Ammon.	Nitrate	Clarity	*E. coli*	Diss. inorg. N	Diss. react. P	Overall
TWT	Ōrongorongo, Te Awa Kairangi and Wainuiomata small forested and Te Awa Kairangi forested mainstems	✓	✓	✓	✓	✓	✓	✓
	Te Awa Kairangi lower mainstem	✓	✓	✓	✓	✓	✓	✓
	Te Awa Kairangi rural streams and rural mainstems	✓	✓	↓	↓	✓	↑	↓
	Wainuiomata rural streams	✓	✓	↑	↓	✓	✓	↓
	Parangārehu catchment streams and South-west coast rural streams	✓	✓	↓	↓	✓	✓	↓
	Korokoro Stream	✓	✓	✓	✓	✓	✓	✓
TAoP	Taupō	✓	✓	✓	↓	✓	↑	↓
	Pouewe	✓	✓	✓	✓	✓	↑	✓
	Wai-o-hata	✓	✓	↑	✓	✓	↑	✓
	Takapū	✓	✓	✓	↓	✓	↑	↓
	Te Rio o Porirua and Rangituhi	↑	✓	✓	↓	✓	↑	↓

DESCRIPTION OF THE LENGTH OF PASTORAL STREAMS IN THE MĀKARA AND OHARIU CATCHMENT GREATER THAN ONE-METRE WIDE

24 To provide context around the implications of the stock exclusion provisions of PC1 I have been asked to interrogate the River Environment Classification (REC)[8] and other spatial databases to provide a breakdown of the length of river running through grassland[9] in the Mākara and Ohariu catchment that is, in combination:

24.1 Less than and greater than one-metre wide based on national scale modelling by Booker[4];

24.2 On low slope land and not on low slope land (as previously defined in the Resource Management (Stock Exclusion) Regulations 2020 and mapped by the Ministry for the Environment (MfE) in 2022[10]); and

24.3 On farms greater than and less than 20 hectares (as mapped by Easton *et al*.[5]).

The results of this analysis are provided in Table 3.

Table 3: Summary of pastoral stream length in the Mākara and Ohariu catchment that is in combination a) Less than and greater than one metre wide; b) on low slope land and not on low slope land; c) on farms greater than and less than 20 hectares.

Farm type	Pastoral stream classification	Length of river (km)
Across all farms	>1m wide streams on low slope land	13.5
	<1m wide streams on low slope land	4.6
	>1m wide streams outside low slope land	28.5
	<1m wide streams outside low slope land	23.2
Across farms >20 ha	>1m wide streams on low slope land	10.3
	<1m wide streams on low slope land	3.6
	>1m wide streams outside low slope land	25.8
	<1m wide streams outside low slope land	20.2
Across farms <20 ha	>1m wide streams on low slope land	3.2
	<1m wide streams on low slope land	1.0
	>1m wide streams outside low slope land	2.8
	<1m wide streams outside low slope land	3.0

[8] The REC2 (version 5) is a database of catchment spatial attributes, summarised for every segment in New Zealand's network of rivers.
[9] High producing grassland, low producing grassland and depleted grassland in the Land Cover Database version (LCDB) 5.0.
[10] https://data.mfe.govt.nz/layer/111150-stock-exclusion-low-slope-land-2022-deprecated/

Table 3 shows ~77% of streams >1m wide on low slope land and ~90.5% of streams >1m wide *outside* of low slope land in the Mākara and Ohariu catchments fall within farms >20 ha, respectively.

RESPONSES TO SPECIFIC MATTERS RAISED IN SUBMISSIONS

Submissions on TAS site network and the need for local water quality data to identify where improvements in *E. coli* and sediment are required

25 In their submissions, Upper Hutt Rural Communities (96 individual submissions) Kim Bowen, John Bowen, Tearawhiti Farming Co Ltd, Mākara and Ohariu large farms, Tearawhiti Farming Co Ltd and Mr John Easther raise general concerns regarding the lack of monitoring sites referenced in Tables 8.4 and 9.2 of PC1. To paraphrase them, it appears that these submitters are concerned that the use of monitoring sites located at the bottom of large catchments means that all emitters upstream are treated the same, regardless of local water quality. For example, Tearawhiti Farming Co Ltd state that "[I]*t is inappropriate* [sic] *to extrapolate the results of one monitoring site across all of Mākara and Ohariu*" and have requested the Policy WH.P21 be amended so that "[w]*ork to reduce E-coli* [sic] *levels should only target areas where e-coli* [sic] *is shown to be an issue*. I do not agree with those submissions, and I consider the TASs site network in Tables 8.4 and 9.2 of PC1 to be fit for purpose.

26 PC1 is primarily focused on managing cumulative effects at a catchment scale, rather than direct effects at a farm scale. The TASs site network in PC1 has been specifically designed with this in mind, with sites selected to reflect the land-cover patterns across the entirety of the part-FMUs they fall within, and the cumulative adverse water quality effects associated with that land-cover (see Section 3 and Appendix B of Greer *et al*.[6] at the link below[11]). Thus, in simple terms, water quality at the TAS sites can be seen as a reflection of the average impact of contaminant discharges and land-use from the entire upstream catchment. Achieving the TASs that require an improvement at these sites can, therefore, be achieved by:

26.1 Requiring that all streams meet the TASs set for the downstream site, thereby driving improvements from those farms that discharge contaminants to a

[11] https://www.gw.govt.nz/assets/Documents/2023/10/Greer-M.J.C.-Blyth-J.-Eason-S.-Gadd-J.-King-B.-Nation-T.-Oliver-M.-Perrie-A.-2023.-Technical-assessments-undertaken-to-inform-the-target-attribute-state-framework-of-proposed-Plan-Change-1-to-the-.pdf

primary receiving environment with water quality in a more degraded state than the TASs or

26.2 Requiring all emitters to reduce, regardless of water quality in their primary receiving environment, so that the TASs is achieved at the specified sites while allowing for some '*unders and overs*' in their upstream catchment.

27 I understand that PC1 takes the latter approach. Whether this is the best option from a policy perspective is not within the scope of my expertise. However, from a scientific perspective it is a sensible approach for achieving the TASs.

28 Accordingly, it is my opinion that submissions suggesting that local (farm scale) water quality should be monitored by the Council and, where found to be 'good', used as a justification for not requiring improvements from specific farms is not scientifically justified, as:

28.1 The extent to which contaminant loss reductions are feasible on a specific farm is more relevant to achieving the TAS at the bottom of the catchment than it is for local water quality. For example, it makes more scientific sense to achieve the TASs by requiring the largest sediment loss reductions from farms with the most untreated erosion prone land, even when those farms are adjacent to streams with visual clarity in a better state than the TAS at a downstream location. On the other hand, there is little justification for requiring the largest reductions in sediment losses from farms with small amounts of well-treated erosion prone land, simply because a nearby stream has poor visual clarity.

28.2 A proportion of the sediment, phosphorus, and *E. coli* that enters a stream is stored on the bed and re-suspended at a later date[7,8,9]. Thus, the extent to which a tributary contributes to a dissolved reactive phosphorus, *E. coli* or suspended fine sediment TAS not being met at the bottom of the catchment is not necessarily reflected by the attribute states of that tributary. As a hypothetical example, a short first-order tributary may receive a significant amount of sediment input during flood flows. However, due to its short length and high energy, that sediment may have no impact on the median visual clarity of the tributary itself, which may be in the A state for suspended fine sediment under the NPS-FM 2020. Nevertheless, the sediment discharged from that tributary will be deposited and resuspended in its downstream receiving

environments until it is ultimately discharged to the coastal environment, thereby contributing to the TAS not being met at the monitoring site at the bottom of its downstream catchment.

Note: *Related submissions points specifically related to the Mākara catchment are discussed further in paragraphs in 44 to 48.*

Submissions on the source of *E. coli* in the Hutt River

29 In their submissions, Upper Hutt Rural Communities (96 individual submissions) contend in regard to *E. coli* that "[a]*ll readings in the Upper Hutt reaches are excellent. Those reaches are fed by the rural rivers of Akatarawa and Mangaroa. It is not until downstream of Taita Gorge that the readings decline rapidly in quality. This clearly establishes that whatever contamination is present in the lower reaches is not originating from the farming communities of Akatarawa and Mangaroa*". This is incorrect.

30 As stated in paragraph 28.2 the extent to which a tributary contributed to downstream *E. coli* concentrations is not necessarily reflected by local baseflow concentrations. This is especially true when considering the contact recreation water quality data referenced in the Upper Hutt Rural Communities submissions, which are only collected during the bathing season. To demonstrate the relative contribution of different catchments I have extracted the load workings conducted for the current state assessment that informed the TWT whaitua process[10]. Those results, shown in Table 4, suggest the input from the main tributaries above the Taita Gorge contribute to ~55% of the *E. coli* load in the Hutt River at the Boulcott monitoring site, With the Mangaroa River contributing a full 21%. The residual load is likely from smaller rural tributaries and urban land-use through Upper and Lower Hutt.

Table 4: Contribution of major sub-catchments to *E. coli* loads in the Hutt River @ Boulcott. Extracted from workings behind Greer & Ausseil[10]

Site	Contribution to *E. coli* load at Hutt R. @ Boulcott
Hutt River at Te Marua Intake Site	7%
Akatarawa River at Hutt Confluence	8%
Pakuratahi River 50m Below Farm Creek	14%
Whakatikei River at Riverstone	5%
Mangaroa River at Te Marua	21%
Total	**56%**

Submissions on contribution of forestry to visual clarity TASs not being met and the scientific justification for regulation of this land-use

31 In their submissions PF Olsen Ltd (PF Olsen), the New Zealand Farm Forestry Association (NZFFA), the Wellington Branch of New Zealand Farm Forestry Association (Wgtn-NZFFA), Forest Enterprises and China Forestry Group (CFG) ask for the policies and rules related to commercial forestry (Policies WH.P28 and P.P26, and Rules WH.R20; WH.R21; WH.R23; P.R19; P.R20; and P.R21) be deleted or significantly amended. Relevant issues to the evidence cited in those submissions are suggestions that there is:

31.1 A lack of scientific evidence linking sediment losses from commercial forestry to exceedances (non-achievement) of the suspended fine sediment TASs in Tables 8.4 and 9.2;

31.2 A lack of scientific evidence that the PC1 commercial forestry provisions are necessary to achieve the suspended fine sediment TASs in Tables 8.4 and 9.2;

31.3 A lack of scientific evidence that the Resource Management (National Environmental Standards for Commercial Forestry) Amendment Regulations 2023 (NES-CF) are insufficient to reduce sediment losses from commercial forestry to the extent required to achieve the suspended fine sediment TASs in Tables 8.4 and 9.2; and

31.4 A lack of scientific evidence that the PC1 forestry provisions will result in lower sediment losses from commercial forestry than the requirements of the NES-CF.

32 It is my understanding that the forestry provisions of PC1 are not driven by a scientific argument that they are necessary to achieve the suspended fine sediment TASs in Table 8.4 and 9.2 of PC1. Rather, they are at least partially driven by a policy viewpoint on equity. Specifically, PC1 requires significant reductions in sediment losses from agricultural land-use to meet the suspended fine sediment TAS. Thus, all sediment losing activities should be treated in a similar fashion. Whether this approach is appropriate is a policy matter outside my scope of evidence. However, I am able to comment on submissions expressing concern regarding the general lack of scientific inputs supporting the need for PC1 to regulate forestry activities.

33 In his Statement of Primary Evidence for this Hearing Stream[12], upon which I rely, Mr Blyth has drawn on the available literature to describe the relative sediment losses of pasture, native forest and commercial forestry over a 30-year period. Mr Blyth's analysis lends support to submissions suggesting that sediment losses from commercial forestry are significantly less than from pasture (40% to 70%[13]) despite significantly greater losses 0-5 years post-harvest. Accordingly, I agree with NZFFA's submission that "*In terms of sediment, commercial forests discharge less than any other commercial land use, and are second only to indigenous forests*". Nevertheless, Mr Blyth's Statement of Primary Evidence highlights that commercial forestry is still a source of anthropogenic sediment, losing approximately three to six times more than native forest over a 30 year time frame. From a scientific perspective this supports a position that forestry does contribute to the visual clarity TASs not being met in catchments where it comprises a significant proportion of **modified** land-cover[14]. i.e., the following part FMUs (and sites):

33.1 Te Awa Kairangi rural streams and rural mainstems (Mangaroa R. @ Te Marua – 33% of modified land-cover);

33.2 Takapū (Pāuatahanui S. @ Elmwood Br. – 20% of modified land-cover);

33.3 Te Awa Kairangi lower mainstem (Hutt R. @ Boulcott – 52% of modified land-cover).

This is most true for Te Awa Kairangi lower mainstem part-FMU where the TAS for suspended fine sediment is A.

34 The suspended fine sediment attribute state framework in the NPS-FM 2020 was developed by Franklin *et al.*[11,12] who built on earlier research by Depree *et al*.[13]. It is my understanding that those developing the attribute states set the A/B state threshold at a level that allows for only a 3% deviation from their own modelled estimates of the median reference (natural) condition of visual clarity in rivers within the same REC[15] class as the

[12] Evidence of James Mitchell Blyth on Behalf of Greater Wellington Regional Council (dated 15th April 2025

[13] As stated in My Blyth' Statement of Primary Evidence these figures are a "*generalisation and sediment generation may be different at the local scale depending on how the landuse is managed, the geology, slope and the climate that are present*".

[14] Based on Mr Blyth's Statement of Primary Evidence. Figures presented is the area of the catchment in planation forestry as a percentage of the total area in pasture and plantation forest

[15] The REC is a database of catchment spatial attributes, summarised for every segment in New Zealand's network of rivers. The REC climate-topography- geology class of the Hutt R. @ Boulcott site is cool-wet, low elevation, hard sedimentary.

lower reaches of the Hutt River [12]. Importantly, other widely used reference state models suggests the A state threshold for the Hutt River may be as much as 25 centimetres less (worse) than the median reference state of rivers in its REC class[14]. This suggests that the suspended fine sediment TAS effectively requires a return to natural state in the Hutt River, and by extension any activity (including commercial forestry), that increases sediment losses compared to indigenous forest contributes to the TAS not being met.

Note: *The catchments of Dry Creek; Speedy's Stream; Hull's Creek and the Whakatikei, Pākuratahi, Mangaroa and Akatarawa rivers all contribute to the visual clarity TASs for the Te Awa Kairangi lower mainstem part-FMU not being met.*

35 While it is my opinion there is evidence to suggest that forestry contributes to suspended sediment TASs not being met in those catchments where it is conducted, I agree with submissions that raise the concerns outlined in paragraph 33.2 to 33.3. Specifically:

35.1 The extent to which the notified PC1 provisions will reduce sediment losses has not been considered through the whaitua or PC1 development processes; and

35.2 The extent to which the NES-CF will reduce sediment losses has not been considered through the whaitua or PC1 science processes.

Thus, it is uncertain whether either the PC1 provisions or the NES-CF will contribute to the TAS being met, or that one will achieve demonstrably greater sediment losses than the other[16]. Whether this justifies amendments to the provisions is outside the scope of my evidence, given they were not drafted on the basis of scientific need, but equity (se paragraph 32 above).

Submissions on contribution of vegetation clearance to visual clarity TASs not being met and the scientific justification for regulation of this land-use

36 In its submission, Wairarapa Federated Farmers (WFF) note that they "*oppose* [the] *vegetation clearance policies and rules in the proposed NRP and seek relief that the policies and rules in the operative NRP remain*". As for commercial forestry (see paragraph 32) it is my understanding that the vegetation clearance provisions of PC1 are driven by a

[16] While the prohibition of re-planting on highest erosion risk land should reduce losses from this land, I have not considered it relevant here, as those improvement will not be realised until the next harvest cycle in c. 30 years (i.e., c.15 years after the visual clarity TASs are supposed to be achieved).

policy viewpoint on equity and I consider that there is limited scientific evidence to suggest that they are necessary to achieve the visual clarity TASs in Tables 8.4 and 9.2.

37 I understand that 'vegetation clearance' does not include clear felling and mechanical stump removal (which is captured by the earthworks definition of the NRP). Thus, in the short-term, vegetation clearance is at worse, comparable to harvesting activities associated with commercial forestry (although I understand that it may involve significantly less heavy vehicle activity). Consequently, I consider that there are three primary sources of sediment associated with this activity:

37.1 An immediate increase in erosion associated with lowering of canopy cover[17];

37.2 A medium-term (four to eight year) increase in land-slide risk associated with root dye back[17]; and

37.3 A long-term increase in sediment losses associated with a change to a higher losing land-use.

38 The first two of the sources described above are similar to those from harvested commercial forests described in Mr Blyth's Statement of Primary Evidence[12]. Accordingly, it is likely that vegetation clearance has the potential to result in the similar significant short-term increases in sediment losses (equivalent to four times the pastoral load) to forest harvesting when conducted over the same scale. However, unlike forest harvesting, vegetation clearance is undertaken for a multitude of reasons in a multitude of ways. Thus, the risk of sediment loss will vary between operations depending on:

38.1 The size and proportion of vegetation removed and the manner in which clearance is undertaken. For example, mechanically clear felling large trees would be expected to generate significantly more sediment than selectively spraying smaller pest species from a partially undisturbed stand of native trees; and

38.2 The rate and extent of remediation of the cleared land, either for the purposes of erosion control (e.g., the deliberate planting of woody vegetation) or to facilitate a land-use change (e.g., seeding with grass to establish pasture).

[17] As described in Mr Blyth's Statement of Primary Evidence[12].

39 While it is possible that vegetation clearance has the potential to contribute to suspended sediment TASs not being met in those catchments where it is conducted, I do not consider there to be a strong scientific evidence base to support the need for the notified PC1 provisions relevant to this activity. Specifically, as for commercial forestry (see paragraph 35):

39.1 The extent to which the notified PC1 provisions will reduce sediment losses from vegetation clearance has not been considered through the whaitua or PC1 science processes; and

39.2 The extent to which the existing NRP vegetation clearance rules reduce sediment losses has not been considered through the whaitua or PC1 science processes.

Thus, it is uncertain whether either the PC1 provisions or the operative NRP provisions will contribute to the TAS being met, or that one will achieve demonstrably greater sediment losses than the other[18]. Whether this justifies amendments to the provisions is outside the scope of my evidence, given they were not drafted on the basis of scientific need, but equity (se paragraph 36 above).

40 Regarding the risk of vegetation clearance causing long term increases in sediment loss through the facilitation of a land use change, I understand that is managed through other rules in PC1, and the vegetation clearance provisions are not needed for this purpose. For example:

40.1 Vegetation clearance to establish an earthworks site is covered by the relevant earthworks rules (Rules WH.R23, WH.R24, WH.R25 P.R23 and P.R24); and

40.2 Vegetation clearance for the purposes of changing a rural land use is covered by the relevant rural land use rules (WH.R31, WH.R32, P.R28 and P.R29).

Submissions requesting that colour be accounted for in the visual clarity TAS for Te Awa Kairangi rural streams and rural mainstems part-FMU in Table 8.4 of PC1

41 In its submission, the Wellington Branch of New Zealand Farm Forestry Association (NZFFA) correctly identify that the suspended fine sediment TAS for Te Awa Kairangi rural

[18] While the prohibition of re-planting on highest erosion risk land should reduce losses from this land, I have not considered it relevant here, as those improvement will not be realised until the next harvest cycle in c. 30 years (i.e., c.15 years after the visual clarity TASs are supposed to be achieved).

streams and rural mainstems part-FMU does not account for the naturally occurring processes of high coloured dissolved organic matter in the Mangaroa River. This was addressed in the Statements of Primary Evidence of the following scientists for Hearing Stream 2:

41.1 Dr Amanda Valois[19];

41.2 Mr Blyth[4]; and

41.3 Myself[20].

42 Based on this evidence, Ms O'Callahan[7] recommended the amendments to the visual clarity TAS for Te Awa Kairangi rural streams and rural mainstems part-FMU described in paragraph 22.1 and a consequential amendments to the corresponding sediment load reductions in Table 8.5. I note that despite these amendments, the suspended fine sediment TASs for the Mangaroa River is still not expected to be met by the provisions alone (Table 2). Consequently, I do not agree with submissions that the rural provisions in this catchment are not justified.

Submissions relating to the location of the TAS site in the Mākara-Ohariu Stream catchment

43 In their submissions Mākara and Ohariu large farms, Tearawhiti Farming Co Ltd and Mr John Easther focus heavily on the fact there is just one monitoring site in the Mākara-Ohariu catchment and they consider that this means improvements are being required in sub-catchments where there is no demonstrable sediment problem. I do not agree. The TAS site is downstream of the confluence of the Mākara and Ohariu streams and is influenced by 92% of the Mākara-Ohariu catchment. Thus, effectively all sub-catchments contribute to the sediment load and *E. coli* load at the TASs site and need to be managed given the large load reductions (see paragraph 45and 48 below) required to achieve the TASs.

Submissions related to *E. coli* in the Mākara-Ohariu Stream catchment

44 In its submission Mākara and Ohariu large farms[21] note that "*the source of high e-coli levels in the Mākara Stream is unknown* [but] *need*[s] *to be known for each catchment in*

[19] Evidence of Amanda Elizabeth Valois on Behalf of Greater Wellington Regional Council (dated 28th February 2025)
[20] Evidence of Michael John Crawshaw Greer on Behalf of Greater Wellington Regional Council (dated 28th February 2025)
[21] Supported by Ms Diane Strugnell's further submissions.

order for them to be addressed". I do not agree with this statement. While the potential benefits of exploring the sources of *E. coli* in this catchment are documented[15], it is not needed to identify the specific activities and sub-catchments that need to be regulated to achieve the TASs.

45 Approximately 80% of the Mākara-Ohariu catchment is in pastoral land-cover and a very large reduction in *E. coli* load is required to achieve the TAS for this catchment (>70 % based on the Our Land and Water Science Challenge Scenario Builder WebApp[22]). Thus, there is little doubt that:

45.1 Livestock contribute a significant, albeit undefined, proportion of the *E. coli* in the Mākara-Ohariu catchment and

45.2 Large *E. coli* reductions from livestock will be necessary throughout **the entire catchment** to achieve the *E. coli* TASs.

46 Furthermore, while Mākara and Ohariu large farms submission that "*there are several potential sources (livestock, septic tanks, waterfowl)*" is correct, it is also my understanding that of these, only livestock can be managed through PC1. Specifically, I understand that a regional plan cannot manage the location and number of waterfowl in an area and that septic tank discharges are already controlled through the operative provisions of the NRP (Rules R62 and R63).

Submissions related to sediment in the Mākara-Ohariu catchment

47 In its submission, Mākara and Ohariu large farms note that PC1 "*focuses on hill country erosion as a source of sediment* [in the Mākara-Ohariu catchment] *and not streambank erosion resulting from high flow events*". I understand that this interpretation is not correct and that together Policy WH.P26 Rule WH.R28, Rule WH.R29 and Schedule 27 of PC1 require significant increases in stock exclusion in the wider Mākara-Ohariu catchment for the purposes of reducing sediment loads.

48 As stated above in paragraph 43, Mākara and Ohariu large farms and Mr John Easther focus heavily on the fact there is just one monitoring site in the Mākara-Ohariu catchment in their submissions and they consider that this means improvements are being required in sub-catchments where there is no demonstrable sediment problem. I do not agree for the reasons set out in paragraph 29 to 27. Furthermore, the TAS site is downstream of the

[22] https://www.freshwater-scenario-builder.co.nz/rivers

confluence of the Mākara and Ohariu streams and is influenced by 92% of the Mākara-Ohariu catchment. Thus, effectively all sub-catchments contribute to the sediment load at the TASs site and need to be managed given the large load reductions (38%) required to achieve the TASs.

Submissions related to provisions related to nitrogen loss from small blocks

49 In regard to the small block nutrient management provisions of PC1 WFF note in their submission that "*N loss management is unnecessary because nitrogen is not a significant problem in the region's freshwater bodies to begin with. The Council's own attribute state baselines show that river and stream surface water bodies are almost all within the NOF 'A' Band for nitrate and ammonia toxicity under the National Policy Statement for Freshwater Management*" (2020) (NPS-FM). I do not agree with this statement from a scientific perspective.

50 The nutrient outcomes set for dissolved inorganic nitrogen in Tables 8.4 and 9.2 of PC1 are far more stringent than the TAS for ammonia and nitrate cited in WFF's submission and have been set primarily for periphyton biomass, which is generally not in the A state in most monitored catchments. These DIN nutrient outcomes have been set in accordance with available national guidance from MfE[16,17]. Importantly, they assume that where feasible, sites will be shaded to achieve the periphyton biomass TASs where an improvement is required from baseline state. Thus, contrary to WFFs submission there is an environmental risk associated with allowing nitrogen losses to increase, that being non-compliance with the DIN nutrient outcomes and, consequently, the periphyton biomass TASs in Tables 8.4 and 9.2 of PC1. Whether that justifies managing nitrogen loss from small blocks is a policy matter that is outside the scope of my evidence, as to my knowledge, the current N-loss from these blocks and the potential for intensification of these blocks to generate measurable increases in instream dissolved inorganic nitrogen concentrations has not been investigated.

Note: *A fulsome description of the process by which nutrient outcomes were set can be found in Section* [23] *6 of Greer et al.*[6] *while a review of the process can be found in the Dr Antonius Snelder's Statement of Primary Evidence for Hearing Stream 2*[24]*.*

CONCLUSIONS

51 The notified provisions of PC1:

51.1 Are consistent with the achievement of 71% of the rural and mixed rural *E. coli*, nutrient and suspended sediment TASs, but go beyond what is required to achieve 13% of these TASs and are unlikely to achieve the remaining 15%.

51.2 Are only likely to achieve all of the notified TASs in three part-FMUs (Ōrongorongo, Te Awa Kairangi and Wainuiomata small forested and Te Awa Kairangi forested mainstems, Te Awa Kairangi lower mainstem and Korokoro Stream).

52 Overall, there appears to be a high level of consistency between the notified provisions and the notified TASs. However, for most part-FMUs there is a low likelihood of the *E. coli* TASs being achieved through the PC1 provisions alone.

53 The amendments to the TAS recommended by Ms Mary O'Callahan[7] are expected to result in just 2% more of the TAS being met by the notified provisions (73%). However, two additional part-FMUs are expected to meet all of the relevant part-FMUs (Pouewe and Wai-o-hata)

54 Submissions that the *E. coli* contamination in the lower reaches of the Hutt River is not originating from the farming communities of Akatarawa and Mangaroa are incorrect. These rivers are estimated to contribute 8% and 21% of the *E. coli* load in the lower reaches of the Hutt River respectively.

55 I do not agree with submissions that the use of monitoring sites located at the bottom of large catchments is resulting in some upstream emitters being unfairly targeted by the provisions of PC1. PC1 is primarily focused on managing cumulative effects at a catchment scale, rather than direct effects at a farm scale. The TASs site network in PC1 has been

[23] https://www.gw.govt.nz/assets/Documents/2023/10/Greer-M.J.C.-Blyth-J.-Eason-S.-Gadd-J.-King-B.-Nation-T.-Oliver-M.-Perrie-A.-2023.-Technical-assessments-undertaken-to-inform-the-target-attribute-state-framework-of-proposed-Plan-Change-1-to-the-.pdf

[24] Evidence of Antonius Hugh Snelder on Behalf of Greater Wellington Regional Council (dated 28th February 2025)

specifically designed with this in mind, with sites selected to reflect the land-cover patterns across the entirety of the part-FMUs they fall within, and the cumulative adverse water quality effects associated with that land-cover

56 I do not agree with submissions that there is a lack of scientific evidence linking sediment losses from commercial forestry to exceedances (non-achievement) of the suspended fine sediment TASs in Tables 8.4 and 9.2. However, I do agree that there is:

56.1 A lack of scientific evidence that the PC1 commercial forestry provisions are necessary to achieve the suspended fine sediment TASs in Tables 8.4 and 9.2;

56.2 A lack of scientific evidence that the NES-CF is insufficient to reduce sediment losses from commercial forestry to the extent required to achieve the suspended fine sediment TASs in Tables 8.4 and 9.2; and

1.1 A lack of scientific evidence that the PC1 provisions will result in lower sediment losses from planation forestry than the requirements of the NES-CF[16].

57 Similarly, I consider that there is limited scientific evidence to suggest the vegetation clearance provisions of PC1 are necessary to achieve the visual clarity TAS in Tables 8.4 and 9.2.

58 While I agree with submissions that there is a lack of scientific evidence linking sediment losses from commercial forestry to exceedances (non-achievement) of the suspended fine sediment TASs in Tables 8.4 and 9.2. However, I do agree that there is:

58.1 A lack of scientific evidence that the PC1 commercial forestry provisions are necessary to achieve the suspended fine sediment TASs in Tables 8.4 and 9.2;

58.2 A lack of scientific evidence that the NES-CF is insufficient to reduce sediment losses from commercial forestry to the extent required to achieve the suspended fine sediment TASs in Tables 8.4 and 9.2; and

59 A lack of scientific evidence that the PC1 provisions will result in lower sediment losses from planation forestry than the requirements of the NES-CF[16]

60 I agree with submissions that the suspended fine sediment TAS for Te Awa Kairangi rural streams and rural mainstems part-FMU does not account for the naturally occurring processes of high coloured dissolved organic matter in the Mangaroa River. However, I do

not agree that this means the rural provisions in this catchment are not justified as this TASs continues to fall below a revised colour adjusted bottom line.

61 I do not agree with the submissions suggesting that nitrogen loss management is unnecessary in TAoP and TWT as there is an environmental risk associated with allowing nitrogen losses to increase, that being non-compliance with the DIN nutrient outcomes and, consequently, the periphyton biomass TASs in PC1. However, I am unable to comment on the import of managing nitrogen losses from small blocks.

DATE: 15 APRIL 2025

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