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 REPLY EVIDENCE OF DR MICHAEL JOHN CRAWSHAW GREER

ON BEHALF OF GREATER WELLINGTON REGIONAL COUNCIL

HEARING STREAM 2 – OBJECTIVES, ECOSYSTEM HEALTH AND WATER QUALITY POLICIES

14th OF MAY 2025

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INTRODUCTION

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

2 I have prepared this Statement of Reply Evidence in respect to the matters raised during Hearing Stream 2 – Objectives, Ecosystem Health and Water Quality Policies of Proposed Plan Change 1 to the Natural Resources Plan for the Wellington Region (**PC1**).

3 I listened to submitters in Hearing Stream 2, read their evidence and tabled statements, and the written submissions and further submissions relevant to the Hearing Stream 2 topics.

QUALIFICATIONS AND EXPERIENCE

4 My qualifications and experience are set out in paragraphs 3 to 14 of my Statement of Primary Evidence[1]. I repeat the confirmation given in that report that I have read and agree to comply with the Code of Conduct for Expert Witnesses.

SCOPE OF REPLY

5 This Statement of Reply Evidence follows Hearing Stream 2 held on 7th April 2025 to 15th April 2025 and addresses:

5.1 The specific questions posed by the Hearings Panels (**the Panels**) in Minute 7 that relate to freshwater quality and ecology; and

5.2 Additional information requests made by the Panels during Hearing Stream 2 that were not captured by Minute 7.

RESPONSES TO QUESTIONS RAISED IN MINUTE 7

Response to questions raised in paragraph 16 of Minute 7

6 In paragraph 16 of the Panels' Minute 7, they request that I provide further advice on whether target attribute states (**TASs**) that require outcomes such as 'Improve within C band' are clear enough to plan users. A number of different professions are 'plan users' and I can only speak from the perspective of a scientist who regularly acts on behalf of both applicants and regional councils on consent applications.

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

7 In my opinion, TASs that simply require an improvement within a band do not provide a sufficiently clear outcome against which applications for resource consent can be assessed in the long term. Without a clearly defined endpoint at which improvement is no longer required it is unclear to me whether:

7.1 The TAS will be considered met as soon as a demonstrable improvement in the attribute has been achieved, regardless of the magnitude of that improvement; or

7.2 Whether the TAS requires continuous improvement within the specified band throughout the entirety of the timeframe specified in Table 8.4 or 9.2 of PC1.

8 I consider that scientists will struggle to assess resource consent applications against the TASs without additional interpretation guidance from the Council clearly specifying how compliance with the TASs is to be assessed. In my opinion, the incorporation of specific numeric thresholds would be clearer, regardless of whether they relate to effects thresholds (e.g., the Australian and New Zealand guidelines for fresh and marine water quality (**ANZG**) 2018[1] default guidelines values (**DGVs**)) or a desired proportional improvement (e.g., 50% of the improvement required for a change in band).

9 I note that in Appendix 2 of her Statement of Rebuttal Evidence[2] Ms O'Callahan has only recommended 'Improve within a band' type TASs for the following attributes:

9.1 Copper and Zinc – Te Awa Kairangi urban streams; and

9.2 Copper – Kaiwharawhara Stream.

Furthermore, she has only selected improvement within the 'C' band (i.e., not the A, B or D bands). As set out in the 'Attribute states for dissolved copper and zinc' tabled during Hearing Stream 2, the C band upper and lower thresholds represent protection thresholds for 95% and 80% of species respectively. However, ANZG[1] provides thresholds between these values which correspond to a 90% species protection level. Accordingly, there are effects-based thresholds that can be selected to drive an improvement within the C band for both copper and zinc. These are set out in Table 1.

[2] Rebuttal Evidence of Mary O'Callahan on Behalf of Greater Wellington Regional Council (dated 28th March 2025).

Table 1: 90% species protection for DGVs for copper and zinc that sit within the C band adapted from ANZG[1]

Value	Ecosystem health		
Freshwater Body Type	Rivers		
Attributes	Dissolved Copper and Zinc (Toxicity)		
Attribute Unit	µg DZn/L (micrograms of dissolved Copper of Zinc per litre)		
Attribute	**Numeric Attribute State within C band**		**Narrative Attribute State**
	Median*	**95th percentile**	
Copper	>1.4 and ≤1.8	>1.8 and ≤2.5	90% species protection level: Starts impacting occasionally on the 10% most sensitive species
Zinc	>8 and ≤15	>15 and ≤31	

10 Adoption of these numeric thresholds instead of Ms O'Callahan's recommended amendments would drive improvements in:

10.1 Median and 95th percentile dissolved copper concentrations in the Te Awa Kairangi urban streams part-Freshwater Management Unit (**FMU**); and

10.2 95th percentile dissolved copper concentrations in Kaiwharawhara Stream part-FMU.

However, they would not directly drive improvements in dissolved zinc in the Te Awa Kairangi urban streams part-FMU. Nevertheless, as copper and zinc are treated through the same stormwater devices, improvement in the zinc attribute can be expected as a byproduct of the copper TAS.

11 The load reductions required to achieve the thresholds set out in Table 1 are set out below in Table 2.

Table 2. Updated (from Table 18 of my Statement of Primary Evidence[1] and Table 1 of my Statement of Rebuttal Evidence) indication of the extent of the load reductions required to achieve the dissolved copper, dissolved zinc and *E. coli* TASs that seek an improvement in these attributes. Updates in blue ~~markup~~ markup account for changes required to meet the thresholds in Table 1. See Greer[2] for methodology. The red ~~markup~~ markup are the changes made between my Statement of Primary Evidence[1] and Table 1 of my Statement of Rebuttal Evidence.

Whaitua	Part-FMU	Attribute	Load reduction
TWT	Kaiwharawhara Stream	Copper	~~53% (38% - 68%)~~ ~~0%~~ 26% (14% - 39%)
		Zinc	~~76% (62% - 89%)~~ 0%
		E. coli	~~89% (84% - 94%)~~79% (64% - 93%)
	Wellington urban	Copper	4% (0% - 9%)
		Zinc	8% (7% - 10%)
		E. coli	~~96% (93% - 99%)~~92% (85% - 95%)
	Waiwhetū Stream	Copper	~~80% (67% - 93%)~~ 0%
		Zinc	~~76% (71% - 80%)~~ 31% (19% - 43%)
		E. coli	~~90% (82% - 98%)~~ 80% (61% - 98%)
	Te Awa Kairangi urban streams	Copper	~~69% (53% - 84%)~~ ~~0%~~ 50% (35% - 65%)
		Zinc	~~40% (35% - 45%)~~ 0%
		E. coli	~~91% (86% - 95%)~~ 85% (73% - 98%)
	Wainuiomata urban streams		~~91% (84% - 99%)~~ 80% (62% - 99%)
	Wainuiomata rural streams		18% (6% - 30%)
	Te Awa Kairangi rural streams and rural mainstems		~~61% (38% - 83%)~~ 53% (38% - 67%)
	Te Awa Kairangi lower mainstem		17% (0% - 33%)
	Parangārehu catchment streams and South-west coast rural streams		N/A (No wastewater infrastructure above TAS site)
	Korokoro Stream		N/A (Insufficient *E. coli* and flow data to determine required load reductions)
TAoP	Pouewe		~~67%~~ 48%
	Takapū		59%
	Taupō		~~99%~~ 74%
	Te Rio o Porirua and Rangituhi		~~92%~~ 60%
	Wai-O-Hata	Copper	~~99%~~ 67%
		Zinc	~~30%~~ 0%
		E. coli	~~83%~~ 54%

Response to questions raised in paragraph 18 of Minute 7

12 In paragraph 18 of Minute 7, the Panels ask whether I have revised the opinions presented in my Statement of Primary Evidence and Statement[1] and Statement of Rebuttal Evidence[3] in light of the submissions presented at the hearing by Mr. Eric Cairns (on behalf of the Wellington Branch of New Zealand Farm Forestry Association (**Wgn-NZFFA**)). I have read the transcript of Mr. Cairns' presentation, including his expression of the purported views of Dr Murray Hicks, and the resulting questioning from the Panels. This has not changed my opinions on Mr. Cairns' '*Further Submission to Stream Two Hearings for Plan Change 1 to the Natural Resources Plan*' presented in paragraphs 43 to 48 of my Statement of Rebuttal Evidence[3].

13 While I would welcome Dr Hicks' insights into how the suspended fine sediment TASs and load reductions for the Mangaroa River could be refined going forward, I note that despite Mr. Cairns presenting Dr Hicks' opinion throughout his presentation, Dr Hicks himself has not presented evidence due to what I understand to be a conflict of interest. Thus, I am unable to determine what his actual views are on this matter or the exact approaches he would take to develop alternative thresholds.

Response to questions raised in paragraphs 19, 20, 31 and 32 of Minute 7

14 In paragraph 19 and 31 of Minute 7, the Panels noted that they would like further information regarding whether financial constraints were the primary driver for Ms O'Callahan's recommended amendments[2] to the *E. coli* attribute states for the following part-FMUs:

14.1 Waiwhetū Stream;

14.2 Wainuiomata urban streams;

14.3 Te Awa Kairangi urban streams;

14.4 Kaiwharawhara Stream;

14.5 Wellington urban;

14.6 Te Awa Kairangi rural streams and rural mainstems;

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

14.7 Taupō;

14.8 Wai-O-Hata;

14.9 Takapū; and

14.10 Te Rio o Porirua and Rangituhi.

15 I did not make the recommendations amending these TASs. Thus, I will let Ms O'Callahan confirm the reasoning behind her decision on this matter. However, I am able to answer the Panels' follow-up questions.

16 In paragraphs 20 and 32 of Minute 7, the Panels have asked me to advise on the extent of the improvements to the wastewater network needed to achieve the notified *E. coli* TASs for the part-FMUs listed in paragraph 14. This information was previously provided to Mr Walker to inform the economic assessment in his Statement of Primary Evidence[4]. Specifically:

16.1 The commensurate load reductions required by the notified TASs were calculated as per paragraph 91 of my Statement of Primary Evidence[1];

16.2 The estimated relative contributions of wastewater overflows and dry weather leaks to urban *E. coli* loads in each part-FMU were calculated from:

16.2.1 The available urban Contaminant Load Model (**CLM**)[3,4] *E. coli* yields[5];

16.2.2 The wastewater overflow volumes presented in Blyth[7] (Appendix A) and Easton *et al.*[5] (Appendix B); and

16.2.3 The wastewater *E. coli* concentrations presented in Easton *et al.*[5].

16.3 The extent to which dry weather leaks and overflows would need to be reduced to achieve the TASs was calculated for three different scenarios whereby the required load reductions were assumed to be achieved by:

[4] Evidence of David Adrian Walker on Behalf of Greater Wellington Regional Council (dated 28th February 2025)

[5] Assuming that in the absence of wastewater overflows 77%[5,6] of urban *E. coli* loses are generated by wastewater leakage – See paragraph 24.1 of my Statement of Rebuttal Evidence[3])

16.3.1 Remediation of dry weather leaks through cross-connection repair and the replacement of grades 4 and 5 pipes;

16.3.2 Remediation of wastewater overflows only; and

16.3.3 A combination of dry-weather leak and wastewater overflow remediation.

16.4 I understand Mr Walker then paired this information with data regarding the location of wastewater overflows and grade 4 and 5 pipes to calculate the costs presented in his Statement of Primary Evidence[4].

Note: *Paragraph 19 and 31 of Minute 7 also request information on the extent of the improvements to the stormwater network needed to achieve the notified E. coli TASs. However, Schedule 31 (Stormwater Management Strategy – Te Whanganui-a-Tara and Te Awarua-o-Porirua) does not require load reductions from the stormwater network commensurate with what is required to achieve the E. coli TASs. Without knowing the magnitude of the required improvement in E. coli from the stormwater network, I am unable to define the actions required to achieve it.*

17 In Table 3 I summarise the scenario results discussed above for the relevant part-FMUs; both for the notified and amended *E. coli* TASs recommended in Appendix 2 of Ms O'Callahan's Statement of Rebuttal Evidence[2]. For context I also provide the length of grades 4 and 5 wastewater pipes in each part-FMU. However, while potentially a necessary conservative assumption of Mr Walker's modelling, I am not suggesting here that achieving a given proportional reduction in *E. coli* loads from dry-weather sources requires the replacement of the same proportion of grades 4 and 5 pipe. Presumably pipes in the same condition category leak at different rates depending on factors such as the cause of the leak, their location in the network, and the volume of wastewater they carry. Accordingly, the percentage of pipe that needs to be replaced to achieve a certain *E. coli* load reduction is likely site-specific.

Table 3: The load reductions required to achieve the notified and recommended amended (as per amended Appendix 2 of Ms O'Callahan's Statement of Rebuttal Evidence[2] tables during Hearing Stream 2) *E. coli* TAS, and the estimated extent to which dry weather wastewater leaks and overflows would need to be reduced to achieve those load reductions. The length of grades 4 and 5 wastewater pipes in each part-FMU are provided for context.

Whaitua	Part-FMU	Notified TAS		Amended TAS as per Appendix 2 of Ms O'Callahan's Statement of Rebuttal Evidence		Km of Grade 4 & 5 pipe in part-FMU
		Load reduction to achieve TAS	Indicative actions to achieve load reduction	Load reduction to achieve TAS	Indicative actions to achieve load reduction	
TWT	Kaiwharawhara Stream	89% (84% - 94%)	Reduce dry weather leaks (replacing grade 4 and 5 pipes) by 100%.	79% (64% - 93%)	Reduce dry-weather leaks by 100%.	64.3
	Wellington urban	96% (93% - 99%)	• Reduce overflows by 96% and reduce dry-weather leaks (by replacing grade 4 and 5 pipes) by 100%; or • Remedy all overflows and reduce dry-weather leaks by 67%.	92% (85% - 95%)	• Reduce overflows by 92% and reduce dry-weather leaks by 100%; or • Remedy all overflows and reduce dry-weather leaks by 6%.	263.3
	Waiwhetū Stream	90% (82% - 98%)	• Reduce overflows by 91% and reduce dry-weather leaks by 100%; or • Reduce overflows by 96%.	80% (61% - 98%)	• Reduce overflows by 81% and reduce dry-weather leaks by 100%; or • Reduce overflows by 86% .	51.7
	Te Awa Kairangi urban streams	91% (86% - 95%)	Reduce dry-weather leaks by 100%.	85% (73% - 98%)	Reduce dry-weather leaks by 100%.	149.9
	Wainuiomata urban streams	91% (84% - 99%)	Reduce overflows by 92%.	80% (62% - 99%)	Reduce overflows by 81%.	29.3
	Te Awa Kairangi rural streams and rural mainstems;	17% (0% - 33%)	Reduce overflows by 17%	53% (38% - 67%)	Reduce dry-weather leaks by 68%.	113.2
TAoP	Takapū	59%	Reduce dry weather leaks by 77%.	15%	Reduce dry weather leaks by 20%.	0.3
	Taupō	99%	• Reduce overflows by 99% and reduce dry-weather leaks by 100%; or • Remedy all overflows and reduce dry-weather leaks by 63%.	74%	Reduce overflows by 74% and reduce dry-weather leaks by 95%.	1.6
	Te Rio o Porirua and Rangituhi	92%	Reduce overflows by 93%.	60%	Reduce overflows by 61%.	43.9
	Wai-o-hata	83%	• Reduce overflows by 83% and reduce dry-weather leaks by 100%; or • Reduce overflows by 86%.	54%	• Reduce overflows by 54% and reduce dry-weather leaks by 70%; or • Reduce overflows by 56%.	4.9

Response to questions raised in paragraph 21 of Minute 7

18 In paragraph 21 of Minute 7, the Panels raised some potential anomalies in Table 8.4 of PC1 and have requested that I review it and table an updated version. My assumption is that this request relates to Table 8.4 in amended Appendix 2 of Ms O'Callahan's Statement of Rebuttal Evidence[2] (tabled during Hearing Stream 2) rather than the notified version of PCC1. On that basis I note the following in relation to the specific points raised in Minute 7:

18.1 There is no error in the Macroinvertebrates (1 of 2) TASs for Wainuiomata urban part-FMU:

18.1.1 The state of this threshold is determined by both the MCI and QMCI. Thus, to be in C band, both indices must be in at least that band. The reason that the baseline state for the Wainuiomata urban part-FMU is graded as D despite having a higher MCI than the C state TASs is because the QMCI score is in the D state (i.e., <4.5);

18.1.2 The reason why the MCI baseline appears to be at a better state than the TAS is that the numeric thresholds included in the baseline state column are current state (as at June 2024) rather than the National Policy Statement for Freshwater Management (**NPS-FM**) 2020 baseline state (as per the associated footnote). It is my understanding that Ms O'Callahan has provided this current state information for context but has not used it to update the TASs. It is for this reason that the baseline appears to be more lenient that the TASs.

18.2 The issue identified with the periphyton biomass TASs for the Wainuiomata rural streams part-FMU is indeed an error. Specifically, only the band (i.e., A-D) has been updated; the associated changes to the numeric attribute state have not been made. This should be amended to ≤120 in Table 8.4.

18.3 The issue identified for the periphyton biomass TASs for the Kaiwharawhara Stream part-FMU is not an error. There is poor alignment between the cited numeric baseline states and the associated bands due to limited data available for the baseline period and the way the Council calculates and reports against the periphyton biomass attribute states. Specifically, the attribute state is

calculated based on percent exceedance basis as required by the NPS-FM 2020 (e.g., if B state threshold is exceeded in more than 8% of samples from a site, but the C state threshold is not, the site will be assigned to the C state). However, for simplicity the Council reports the numeric threshold as a 92nd percentile as that is a more understandable value than the alternative (i.e., the sample which is not exceeded by more than 8% of all samples in the dataset). When a full data set of 36 samples is available, this does not generally pose any reporting issues. However, in the case of the Kaiwharawhara Stream where there were just 12 samples available for the baseline period, it has.

19 I have also identified the following issues with the version of Table 8.4 in Appendix 2 of Ms O'Callahan's Statement of Rebuttal Evidence[2]:

19.1 The amended numeric suspended fine sediment attribute for the Te Awa Kairangi rural streams and rural mainstems part-FMU does not have the required '≥';

19.2 If the *E. coli* TAS for the Te Awa Kairangi rural streams and rural mainstems part-FMU is amended to C, the %>540/100mL numeric attribute state should be ≤18;

19.3 For the Waiwhetū Stream part-FMU:

19.3.1 The numeric 95th percentile attribute state for dissolved copper allows for a degradation from baseline state and should be amended to ≤4.0. Furthermore, there is no need for the requirement to achieve C by 2050 for this attribute, as it is already met;

19.3.2 The numeric *E. coli* attribute states have not been amended to account for the TASs being amended from the C band to the D band. The median, %>260/100mL, %>540/100mL and 95th percentile numeric attribute states should be ≤260, ≤50, ≤30 and ≤5,800 respectively.

19.4 I am unsure why the numeric DRP TASs for the Wainuiomata rural streams part-FMU have been amended in the way they have. If the intent is to maintain dissolved reactive phosphorus concentrations at baseline state, then the

median TAS should be set at ≤0.011 rather than ≤0.012. Furthermore, it is unclear why the 95th percentile numeric TASs has been made more stringent than the baseline; and

19.5 The inclusion of '%' in the *E. coli* baseline state estimates for the Korokoro Stream part-FMU is inconsistent with the format of the rest of Table 8.4.

20 The required amendments have been adopted into the revised table lodged with Ms O'Callahan's Reply Evidence[6].

Response to questions raised in paragraph 30 of Minute 7

21 In paragraph 30 of Minute 7, the Panels raised the potential for anomalies like those listed for Table 8.4 in paragraph 21 of Minute 7 to also exist in Table 9.2. Accordingly, they have requested that I also provide a review of this table, which has identified the following issues:

21.1 If the TASs for the Takapū and Wai-O-Hata part-FMU are amended to D, the %>260/100mL *E. coli* numeric attribute states should be ≤50 (not ≤34) while the %>540/100mL numeric attribute state should be ≤30 (not ≤20);

21.2 For the Te Rio o Porirua and Rangituhi the part-FMU, the %>260/100mL *E. coli* numeric attribute state has been struck out completely, and the amended value of ≤30 should be reinstated;

21.3 I note that the site name for Te Rio o Porirua and Rangituhi has been amended to include the word 'former'. This is not the formal site name for this site and is inconsistent with the reporting on the Council's website. I consider that this amendment should not be adopted.

22 The required amendments listed above have been adopted into the revised table lodged with Ms O'Callahan's Reply evidence[6].

Responses to paragraph 15 of Minute 7

23 In paragraph 15 of Minute 7, the Panels requested clarification regarding the extent to which a reduction in *E. coli* concentrations from the E band to the D band can drive an improvement in the values ecosystem health and human health.

[6] Reply Evidence of Mary O'Callahan on Behalf of Greater Wellington Regional Council (dated 14th May 2025).

24 *E. coli* does not affect ecosystem health. Accordingly, an improvement in this attribute from the NPS-FM 2020[7] E band to the D band will not directly drive an improvement in this value. However, such a change would likely result in reduced loads of other contaminants (nutrients, sediments etc.) that do impact ecosystem health. Accordingly, there may be some unintentional benefits to this value under a scenario where *E. coli* improves from the E band to the D band.

25 In terms of the value of human health, the improvements resulting from a shift from the *E. coli* E band to the D band can be significant. The E band has no upper bounds on its median or 95th percentile statistics, and, theoretically, a site in this attribute state can be unsuitable for primary contact (i.e., have *E. coli* concentrations greater than 540/100mL) 100% of the time. In contrast, the D state sets upper bounds for all assessment statistics for the *E. coli* attribute state except the 95th percentile, including the percentage of samples above the threshold at which a river is no longer safe for primary contact (i.e., 540 *E. coli*/100mL). As a result, an improvement from the E to the D band can, theoretically, result in a river that is never suitable for swimming improving to a level where it is swimmable 70% to 80% of the time. For example, in Taupō Stream, a shift from the E to the D state would result in an 84% increase in the proportion of the time the stream is safe to swim in (see Table 4). It is important to note, however, that the human health benefits of a shift between the E and D bands will be site-specific and dependent on the extent to which the D band thresholds are currently exceeded. Specifically, in contrast to the Taupō Stream example above, if a river only has *E. coli* concentrations slightly above the D band thresholds, then an improvement to that band may be of negligible benefit to human health, especially if that improvement only just results in the D band thresholds being achieved.

26 For context I have tabulated the proportion of time each monitoring site listed in Table 8.4 and 9.2 of PC1 is safe for primary contact under baseline state, the notified TASs and the amended TASs recommended by Ms O'Callahan[8]. I have also parenthesised the proportional improvement in this statistic that will result from the notified and amended TASs.

[7] Ministry for the Environment. 2023. National policy Statement for Freshwater Management 2020 - Amended February 2023. Ministry for the Environment, Wellington, New Zealand.
[8] As per the Amendments to Appendix 2 of Ms O'Callahan's Statement of Rebuttal Evidence[2] tabled during Hearing Stream 2

Note: *This '% of time suitable for contact recreation' assessment is not the same as the metric proposed for inclusion in Table 8.3 of PC1 by Mr Pat van Berkel's submission. His submission relates to the Table 22 E. coli attribute in the NPS-FM 2020, while this assessment relates to the E. coli attribute in Table 9 of that document.*

Table 4: Assessment of the percent of time each of the sites listed in Table 8.4 and 9.2 of PC1 are expected to be suitable for primary contact (i.e., *E. coli* concentration <540/100mL) under baseline state, the notified *E. coli* TAS and the recommended amended *E. coli* TASs (as per amended Appendix 2 of Ms O'Callahan's Statement of Rebuttal Evidence[2] tables during Hearing Stream 2). Parenthesised values represent the expected proportional improvement (from baseline state) in the percent of time a site is safe for primary contact under the notified and amended TASs. N/A denotes where no amendment has been made to the TASs, while merged cells indicate where the notified and amended TASs achieve the same outcome.

Whaitua	Part-FMU	Site	% of time safe for primary contact		
			Baseline	Notified	Amended
TWT	Ōrongorongo, Te Awa Kairangi and Wainuiomata small forested and Te Awa Kairangi forested mainstems	Whakatikei R. @ Riverstone	97%	97% (+0%)	N/A
	Te Awa Kairangi lower mainstem	Hutt R. @ Boulcott	92%	92% (+0%)	N/A
	Te Awa Kairangi rural streams and rural mainstems	Mangaroa R. @ Te Marua	82%	90% (+10%)	82% (0%)
	Te Awa Kairangi urban streams	Hulls Ck adj. Reynolds Bach Dr.	21%	80% (+281%)	70% (+233%)
	Waiwhetū Stream	Waiwhetū S. @ Whites Line East	58%	80% (+38%)	70% (+21%)
	Wainuiomata urban streams	Black Ck @ Rowe Parade	29%	80% (+176%)	70% (+141%)
	Wainuiomata rural streams	Wainuiomata River D/S of White Br.	93%	95% (+2%)	N/A
	Parangārehu catchment streams and South-west coast rural streams	Mākara S. @ Kennels	68%	70% (+3%)	N/A
	Korokoro Stream	Korokoro S. @ Cornish St. Br.	?	90% (?)	N/A
	Kaiwharawhara Stream	Kaiwharawhara S. @ Ngaio Gorge	50%	80% (+60%)	70% (+40%)
	Wellington urban	Karori S. @ Mākara Peak	17%	80% (+371%)	70% (+312%)
TAoP	Taupō	Taupō S. @ Plimmerton Domain	38%	90% (+137%)	70% (+84%)
	Pouewe	Horokiri S. @ Snodgrass	68%	90% (+32%)	80% (+18%)
	Wai-o-hata	Duck Ck @ Tradewinds Dr. Br.	41%	90% (+120%)	70% (+71%)
	Takapū	Pāuatahanui S. @ Elmwood Br.	82%	82% (0%)	
	Te Rio o Porirua and Rangituhi	Porirua S. @ Milk Depot	17%	80% (+371%)	70% (+312%)

27 Related to the matters in Minute 7 described in paragraph to 23 to 26 above, during Hearing Stream 2, the Panels also asked me to assess the impact Ms O'Callahan's recommended amendments to the *E. coli* TASs in Tables 8.4 and 9.2 of PC1[8] will have on the suitability of 'specified rivers'[9] for primary contact in relation to the NPS-FM 2020 Appendix 3 'National target for primary contact'. That target is for 90% of specified rivers to be suitable for primary contact (i.e., attribute state C or better) by 2040. To be clear, the target does not relate to the 'percent of time suitable for primary contact' metric presented in Table 4. Instead, it relates to the length of specified river considered generally suitable for primary contact recreation on a pass-fail basis.

28 The requested assessment is provided in Table 5 below and was undertaken using geospatial analysis. Specifically, a layer containing the PC1 part-FMUs were joined with a second layer containing MfE's nationally modelled estimates of *E. coli* baseline state in specified rivers[8]. Using the joined layer, the attribute state improvements signalled by the notified and recommended amended *E. coli* TASs[8] for each part-FMU were directly applied to MfE baseline state estimates to calculate:

28.1 The percentage (by length) of specified river in each part-FMU that would be considered suitable for primary contact under Appendix 3 of the NPS-FM 2020:

28.1.1 At baseline state:

28.1.2 Under the notified *E. coli* TASs; and

28.1.3 Under the recommended amended *E. coli* TASs[8].

29 The proportional improvement (from modelled baseline state) in length of specified river suitable for contact recreation in each part-FMU resulting from the notified and amended TASs (e.g., if the percentage of specified river length suitable for primary contact in part-FMU increased from 50% to 75% the proportional increase would be 50%). These results are the parenthesised values in Table 5.

30 The results presented in Table 5 below should be considered indicative only, and there is uncertainty associated with:

[9] Rivers that are fourth order or greater, using the methods outlined in the River Environment Classification System, National Institute of Water and Atmospheric Research, Version 1

30.1 The assumption that improving *E. coli* concentrations by a given number of attribute states at one site in a part-FMU will result in *E. coli* in all specified rivers in the part-FMU improving by the same number of attribute states regardless of current state or the extent to which they are impacted by activities managed by PC1; and

30.2 The uncertainty in the modelled estimates of baseline state.

Table 5: Assessment of the percent of specified rivers (by length) in each part-FMU that are expected to be suitable for primary contact under baseline state, the notified *E. coli* TAS and the recommended amended *E. coli* TASs (as per amended Appendix 2 of Ms O'Callahan's Statement of Rebuttal Evidence[2] tables during Hearing Stream 2). Parenthesised values represent the proportional improvement (from modelled baseline state) in length of specified river suitable for contact recreation in each part-FMU resulting from the notified and amended TASs. Denotions of +1000% represent where the magnitude of the improvement cannot be calculated as a percentage due to the baseline state being 0%. N/A denotes where no amendment has been made to the TASs, while merged cells indicate where the notified and amended TASs achieve the same outcome.

Whaitua	Part-FMU	% of specified river suitable for primary contact		
		Baseline	Notified	Amended
TWT	Ōrongorongo, Te Awa Kairangi and Wainuiomata small forested and Te Awa Kairangi forested mainstems	100%	100% (+0%)	N/A
	Te Awa Kairangi lower mainstem	99%	99% (+0%)	N/A
	Te Awa Kairangi rural streams and rural mainstems	73%	100% (+37%)	
	Te Awa Kairangi urban streams	100%	100% (+0%)	
	Waiwhetū Stream	0%	100% (+1000%)	0% (0%)
	Wainuiomata urban streams	45%	100% (+121%)	45% (+0%)
	Wainuiomata rural streams	100%	100% (+0%)	N/A
	Parangārehu catchment streams and South-west coast rural streams	0%	0% (0%)	N/A
	Korokoro Stream	No specified rivers in part-FMU		
	Kaiwharawhara Stream	0%	100% (+1000%)	0% (0%)
	Wellington urban	0%	100% (+1000%)	
TAoP	Taupō	No specified rivers in part-FMU		
	Pouewe	0%	100% (+1000%)	
	Wai-o-hata	No specified rivers in part-FMU		
	Takapū	0%	100% (+1000%)	0% (0%)
	Te Rio o Porirua and Rangituhi	0%	100% (+1000%)	0% (0%)
Total		**77%**	**94%**	**94% (+22%)**

31 Overall, the results in Table 5 suggests that:

31.1 The notified *E. coli* TASs could increase the proportion of specified river length that is suitable for primary contact from 77% to 94%, which exceeds the NPS-FM 2020 Appendix 3 national target; and

31.2 The recommended amended *E. coli* TASs[8] are expected to result in 83% of the total specified river length being suitable for primary contact, which is below the 90% national target in the NPS-FM 2020.

32 It must be noted that while the amended TASs are expected to result in less than 90% of specified rivers in Te Whanganui-a-Tara (**TWT**) and Te Awarua-o-Porirua (**TAoP**) being suitable for primary contact, this does not necessarily mean that they are inconsistent with the NPS-FM 2020 Appendix 3 targets, which do not apply at the sub-regional scale considered in this assessment. At a national scale the NPS-FM 2020 targets require an 18% increase in the length of specified river that is suitable for primary contact. While the amended PC1 *E. coli* achieves less than half of this (8%), only 15% of the total length of specified rivers in the Wellington Region are located within the TAoP and TWT Whaitua. Accordingly, there is still potential for the Council to fully contribute towards the achievement of the national targets through the *E. coli* TASs for the other Whaitua in the region.

33 Importantly, the results presented in Table 5 do not provide any indication of the extent to which health risk may be improved in those rivers that remain unsuitable for primary contact under the notified or recommended amended *E. coli* TAS[8]. All rivers that are assumed to remain unsuitable for primary contact under the TAS have a modelled baseline state of E and are assumed to improve to at least the D state. As set out in paragraph 25, such an improvement can significantly increase the amount of time a river is safe to swim in, even if it still categorised as 'not suitable for primary contact' under the pass-fail system described in Appendix 3 of the NPS-FM 2020. To demonstrate this I have combined the key results set out in Table 4 and Table 5 to compare for each part-FMU the proportional improvement in:

33.1 The percent of time the site listed in Table 8.4 or 9.2 is safe for primary contact; and

33.2 The proportion of specified river length considered suitable for primary contact,

under baseline state, the notified TAS and the amended TAS recommended by Ms O'Callahan[8]. The results are shown in Table 6 and demonstrate that while Ms O'Callahan's recommended amendments to the *E. coli* TAS do reduce the improvement in length of specified river suitable for primary contact in some part-FMUs, they still result in either:

33.3 The same level of improvement in the percent of time the site listed in Table 8.4 or 9.2 is safe for primary contact as the notified TASs; or

33.4 An 18% to 312% improvement in the percent of time the site listed in Table 8.4 or 9.2 is safe for primary contact.

Table 6: Assessment of the proportional improvement for each part-FMU in (a) the percent of time the site listed in Table 8.4 or 9.2 is safe for primary contact percent and (b) the percent of specified river length considered suitable for primary contact under baseline state, the notified *E. coli* TAS and the recommended amended *E. coli* TASs (as per amended Appendix 2 of Ms O'Callahan's Statement of Rebuttal Evidence[2] tables during Hearing Stream 2). Denotions of +1000% represent where the magnitude of the improvement cannot be calculated as a percentage due to the baseline state being 0%. N/A denotes where no amendment has been made to the TASs, while merged cells indicate where the notified and amended TASs achieve the same outcome.

Whaitua	Part-FMU	Proportional improvement expected			
		% of time site is safe for primary contact		% of specified river length suitable for primary contact	
		Under the notified TASs	Under the amended TASs	Under the notified TASs	Under the amended TASs
TWT	Ōrongorongo, Te Awa Kairangi and Wainuiomata small forested and Te Awa Kairangi forested mainstems	0%	N/A	0%	N/A
	Te Awa Kairangi lower mainstem	0%		0%	
	Te Awa Kairangi rural streams and rural mainstems	+10%	0%	+37%	+37%
	Te Awa Kairangi urban streams	+281%	+233%	0%	
	Waiwhetū Stream	+38%	+21%	+1000%	0%
	Wainuiomata urban streams	+176%	+141%	+121%	0%
	Wainuiomata rural streams	+2%	N/A	0%	N/A
	Parangārehu catchment streams and South-west coast rural streams	+3%		0%	
	Korokoro Stream	0%		No specified rivers in part-FMU	
	Kaiwharawhara Stream	+60%	+40%	+1000%	0%
	Wellington urban	+371%	+312%	+1000%	
TAoP	Taupō	+137%	+84%	No specified rivers in part-FMU	
	Pouewe	+32%	+18%	+1000%	
	Wai-o-hata	+120%	+71%	No specified rivers in part-FMU	
	Takapū	0%		+1000%	0%
	Te Rio o Porirua and Rangituhi	+371%	+312%	+1000%	0%

ADDITIONAL MATTERS THAT AROSE DURING HEARING STREAM 2

E. coli load reductions for Pouewe

34 In her oral presentation to the Panels, Ms Vanessa Rodgers identified that the load reduction estimates provided in Table 11 of my Statement of Primary Evidence[1] and Table 1 of my Statement of Rebuttal Evidence[3] were inconsistent. Specifically, the same load reduction (48%) was provided to achieve both the D and C states for *E. coli* in the Pouewe part-FMU.

35 Upon review, I have identified that the modelling generated an incorrect value for the minimum required improvement (**MRI**) for this part-FMU in Table 11 of my Statement of Primary Evidence[1]. This discrepancy arises from differences between the modelled and measured baseline states. Specifically, the modelled baseline state was D, leading to the assumption that the MRI was the C band. In reality, the measured baseline state was E, translating to an MRI of D and a much lower required load reduction (3%). A corrected version of Table 11 from my Statement of Primary Evidence is provided below with red ~~markup~~ in Table 7.

Table 7: Estimated load reductions required to achieve the *E. coli* TASs for rivers compared to the reductions required to achieve the minimum improvement required by the NPS-FM 2020 (one attribute state). Calculated using the methodologies documented in Greer[2]. Parenthesised values in the load reduction columns represent the range of results from produced by the four modelling approaches employed for the TWT Whaitua (the top value is the average result from these four approaches). Update to Table 11 of my Statement of Primary Evidence in red ~~markup~~.

Whaitua	Part-FMU	TAS site	Baseline state	Achieve PC1 TAS		Minimum required improvement	
				State	Load reduction	State	Load reduction
TAoP	Takapū	Pāuatahanui S. @ Elmwood Br.	E	C	59%	D	15%
	Pouewe	Horokiri S. @ Snodgrass	E	B	67%	D	~~48%~~3%
	Taupō	Taupō S. @ Plimmerton Domain	E	B	99%	D	49%
	Te Rio o Porirua and Rangituhi	Porirua S. @ Milk Depot	E	C	92%	D	60%
	Wai-O-Hata	Duck Ck @ Tradewinds Dr. Br.	E	C	83%	D	54%
TWT	Kaiwharawhara Stream	Kaiwharawhara S. @ Ngaio Gorge	E	C	89% (84%-94%)	D	79% (64%-93%)
	Wellington urban	Karori S. @ Mākara Peak	E	C	96% (93%-99%)	D	92% (85%-95%)
	Waiwhetū Stream	Waiwhetū S. @ Whites Line E.	E	C	90% (82%-98%)	D	80% (61%-98%)
	Te Awa Kairangi urban streams	Hulls Ck adj. Reynolds Bach Dr.	E	C	91% (86%-95%)	D	85% (73%-98%)
	Wainuiomata urban streams	Black Ck @ Rowe Parade end	E	C	91% (84%-99%)	D	80% (62%-99%)
	Te Awa Kairangi rural streams and rural mainstems	Mangaroa R. @ Te Marua	D	B	61% (38%-83%)	C	53% (38%-67%)

Additional information on trends

36 During Hearing Stream 2 the Panels expressed an interest in understanding the trend analysis that was previously conducted Dr Antonius Snelder for the Environment Court Appeals on the Operative NRP[10]. That evidence has been tabled with this Statement of Reply Evidence. Acknowledging that the Panels may be interested in reading the full statement, I note that paragraph 60 provides a succinct summary of how water quality and ecology has changed over the past decade, and is replicated below:

> "*[T]he analyses described above provide strong evidence of water quality improvement across the Wellington Region over the past decade (i.e., ending December 2017). Water quality has degraded at some sites and for some indicators. However, the analyses indicate degradation is isolated rather than occurring in a consistent and regional scale manner. Decreasing trends in nutrient concentrations (e.g., dissolved forms of nitrogen and phosphorus) are particularly relevant to the question of whether broad-scale changes in resource use are influencing water quality because intensification of agriculture can be expected to increase nutrient concentrations. Based on these findings, I conclude that there is no evidence that broad-scale changes in resource use across multiple catchments has degraded regional scale water quality in the Region over the past decade*."

37 I have also spoken to Dr Snelder (Antonius Snelder *pers. comm.* 28th April 2025) who noted the following regarding the analysis summarised above:

> "*The three studies that I have done previously are now obviously out of date but the findings are robust;*
>
> *These studies did not indicate significant water quality degradation in the Wellington region. Unless there has been a significant recent change in water quality drivers, it is unlikely that more up to date trend assessments would indicate degradation has occurred;*
>
> *The last of the three studies (Snelder 2020) considered the influence of climatic variation on water quality. After accounting for climatic effects, the study did not indicate significant water quality degradation in the region.*

[10] Evidence of Antonius Hugh Snelder on Behalf of Greater Wellington Regional Council in the matter of appeals on the Proposed Natural Resources Plan (dated 14 June 2021)

There has been further research on controlling for climatic influence since the 2020 report and this can be done more robustly now. The recent research indicates that trend analyses should be interpreted very cautiously because the effect of climatic influence is so important at timescales of a decade and less".

Additional information on climate change data provided to TWT Freshwater Quality and Ecology Expert Panel

38 Through Hearing Stream 2 the Panels requested the climate change information that was considered as part of the baseline for all scenarios assessed by the TWT Freshwater Quality and Ecology Expert Panel[9] (see paragraph 36 of Statement of Primary Evidence[1]). That information included estimates of mean annual low flow (**MALF**), mean flow, and mean annual flood (**MAF**) under moderate and high emissions scenarios at two time points (mid-century and late century) and is tabled in its original memorandum format[10] with this Statement of Rebuttal Evidence. Acknowledging that the Panels may be interested in reading the full memorandum the key points are set out in page 3 and 5, and replicated below:

38.1 In relation to mean annual low flow:

- "*MALF is expected to reduce across all catchments and under all modelled scenarios of the Whaitua (only a very small number of reaches – less than 10 – show a marginal increase under the highest emission scenario at late century);*
- *Under three of the four modelled scenarios (those relating to mid-century and/or moderate emission pathways) a large majority of reaches have predicted MALF reductions of less than 10 per cent. In the late century, high emission pathway scenario there is a shift to the large majority of reaches having MALF reductions of 10 to 20 per cent;*
- *One reach, a tributary of the Mangaroa River, has a predicted MALF reduction of 20 to 30 per cent under three of the four scenarios. Five other reaches in the same general part of the Whaitua also fall into this category but only under the late century, high emission scenario;*
- *In general terms, MALF is predicted to decline more in the central and eastern catchments (Hutt, Wainuiomata, Ōrongorongo) than the western*

catchments, mainly the small stream catchments around the Wellington peninsula".

38.2 In relation to mean flow:

- *Predicted changes in mean* [flow] *are relatively modest (essentially within 10 percent of the baseline period) across all scenarios and across all parts of the Whaitua;*
- *Under the mid-century, moderate emission scenario more reaches are predicted to have slightly increased mean* [flow] *than decreased and the opposite is true for the late century, high emission scenario;*
- *In general terms, the declines in mean* [flow] *are predicted to occur more in the central and eastern catchments (Hutt, Wainuiomata, Orongorongo) and increases in the western stream catchments, including those around the Wellington peninsula.*

38.3 In relation to mean annual flood:

- *MAF is expected to increase almost exclusively across all catchments and under all modelled scenarios of the Whaitua;*
- *Increases in MAF are predicted to be greater than 10 per cent in a large majority of reaches across all scenarios;*
- *The Hutt catchment and tributary rivers stand out as having the most modest changes while the southwest streams are predicted to increase by more than 40 per cent under moderate emission mid-century scenarios and 60 to 120 percent in the higher emission scenarios;*

Faecal source tracking data

39 During Hearing Stream 2, the Panels asked for information regarding previous faecal source tracking (**FST**) at sites listed in Tables 8.1A, 8.3, 8.4, 9.1A and 9,2 of PC1. I have been able to locate the FST results presented in Table 8 below. Please note that the FST metadata recorded by the Council is not consistent between samples. Hence some samples have the strength of different faecal sources noted in Table 8, while others do not.

Table 8: Faecal source tracking results for freshwater and coastal water in the TWT and TAoP Whaitua.

Whaitua	Part-FMU/water body	Site	Table in PC1	Date	Rainfall within previous 72 hr	Conclusion	Notes
TWT	Te Whanganui-a-Tara (Harbour and estuaries)	Rona Bay at N end of Cliff Bishop Park	Table 8.1A	4/02/2014	?	No source identified	Relative strength of different source unknown
				11/02/2014	?	Wildfowl	
	Wai Tai	Ōwhiro Bay		24/02/2014	?	Dog	
				18/03/2014	?	Human, wildfowl	
	Pākuratahi River	@Kaitoke Campground	Table 8.3	19/03/2025	Y	Ruminant	
	Wainuiomata River	@Richard Prouse Park		4/02/2014	N	Ruminant, wildfowl	Relative strength of different source unknown
				25/03/2014	N	Ruminant	
				1/04/2014	N	Ruminant	
	Kaiwharawhara Stream	Kaiwharawhara S. @ Ngaio Gorge	Table 8.4	19/03/2013	Y	Human, dog	Weak positive for dog
				12/02/2014	Y	Human, ruminant, dog	High levels of human contamination, weak positive for ruminant
				2/04/2014	N	No source identified	
	Wainuiomata River	@Richard Prouse Park		4/03/2014	Y	Ruminant	Relative strength of different source unknown
	Waiwhetū Stream	Waiwhetū S. @ Whites Line East		19/03/2013	Y	Human, ruminant, dog, wildfowl	Weak positive for ruminant, dog and wildfowl
				12/02/2014	Y	Human, dog, wildfowl	High levels of human contamination
				2/04/2014	N	Human, dog, wildfowl	High levels of human contamination
	Wellington urban	Karori S. @ Mākara Peak		19/03/2013	Y	Human, dog	Weak positive for dog
				11/04/2013	Y	Human	
				12/02/2014	Y	Human, ruminant, dog	High levels of human contamination, weak positive for ruminant
				2/04/2014	N	Human, dog, wildfowl	High levels of human contamination
TAoP	Open coast	Plimmerton at South Beach	Table 9.1A	4/02/2014	?	Dog	Relative strength of different source unknown
				4/02/2014	?	Wildfowl	
	Te Awarua-o-Porirua Harbour	Rowing Club		4/03/2014	?	Human, wildfowl	
	Pouewe	Horokiri S. @ Snodgrass	Table 9.2	27/10/2020	Y	Human, ruminant, dog, wildfowl	
	Taupō			11/02/2014	?	Human, wildfowl	

Whaitua	Part-FMU/water body	Site	Table in PC1	Date	Rainfall within previous 72 hr	Conclusion	Notes
		Taupō S. @ Plimmerton Domain		25/02/2014	?	Human, wildfowl	
				4/03/2014	?	Wildfowl	
				18/03/2014	?	Human, wildfowl	
				25/03/2014	?	Wildfowl	
	Te Rio o Porirua and Rangituhi	Porirua S. @ Milk Depot		19/03/2013	Y	Human, ruminant, dog	Weak positive for dog
				11/04/2013	Y	Human, wildfowl	Weak positive for wildfowl
				12/02/2014	Y	Human, ruminant, dog, wildfowl	High levels of human contamination
				2/04/2014	N	Human, dog	High levels of human contamination

Corrections to Table 4 of Statement of Primary Evidence

40 As noted at the beginning of my presentation in Hearing Stream 2, the formatting of the part of Table 4 on Page 59 of my Statement of Primary Evidence[1] is incorrect. A corrected version is provided in Table 9 below.

Table 9: Update to section of Table 4 on page 59 of my statement of primary evidence (Current (as of 30 June 2024) state of river attributes in Tables 8.4 and 9.2 of PC1 compared to the TASs).

Whaitua			TAoP																	
Part-FMU			Taupō						Pouewe						Wai-O-Hata					
Site			Taupō S. @ Plimmerton Domain						Horokiri S. @ Snodgrass						Duck Ck @ Tradewinds Dr. Br.					
Parameter	Unit	Statistic	N	Current #	Current state	Target #	Target State	Target met	N	Current #	Current state	Target #	Target State	Target met	N	Current #	Current state	Target #	Target State	Target met
Periphyton biomass	mg chl-a/m^2	92nd %ile	0					?	27	122.8	C	≤120	B	×	15	31.8	A	≤120	B	✓
Ammonia (toxicity)	mg/L	Median	47	0.028	B	≤0.03	A	×	55	0.006	A	≤0.002	A	✓	22	0.011	A	≤0.03	A	✓
		Maximum		0.065		≤0.05				0.014		≤0.013				0.019		≤0.05		
Nitrate (toxicity)	mg/L	Median	47	0.04	A	≤1	A	✓	55	0.44	A	≤0.64	A	✓	22	0.66	B	≤1	A	×
		95th %ile		0.46		≤1.5				0.89		≤1.07				1.63		≤1.5		
Suspended fine	Black disc (m)	Median	46	1.43	A	≥0.9	A	✓	54	2.45	C	≥2.30	C	✓	22	1.99	A	≥0.93	A	✓
E. coli	/100mL	Median	47	260	D	≤130	B	×	55	260	D	≤130	B	×	22	230	D	≤130	C	×
		% >260/100 mL		49%		≤30%				49%		≤30%				41%		≤20%		
		% >540/100 mL		28%		≤10%				22%		≤10%				23%		≤34%		
		95th %ile		5240		≤1000				1400		≤1000				2580		≤1200		
Fish	Fish-IBI	Latest	1	46	A			?	1	42	A			?	0					?
Fish community health		Expert	0				B	?	0				A	?	0					?
Macroinvertebrates	MCI	Median	4	75.9	D	≥100	B	×	5	106.9	C	≥130	A	×	2	104.0	D	≥100	B	×
	QMCI	Median		3.5		≥5				5.0		≥6.5				4.3		≥5		
Macroinvertebrates	ASPM	Median	3	0.17	D	≤0.4	B	×	5	0.57	B	≥0.5	B	✓	2	0.34	C	≥0.4	B	×
Deposited fine	% cover	Median	29					?	45	8%	A	≤10%	A	✓	17	6%	A			?
Dissolved oxygen	mg/L	1-day	0					?	0					?	0					?
		7-day mean																		
Dissolved inorganic nitrogen	mg/L	Median	47	0.08		≤1.03 I		✓	55	0.45		≤0.64		×	22	0.67		M		?
Dissolved reactive phosphorus	mg/L	Median	47	0.018	D			?	55	0.013	C	≤0.011	C	×	22	0.021	D			?
		95th %ile		0.033						0.020		≤0.026				0.027				
Dissolved Copper	mg/L	Median	47	0.6	B	≤1.4	B	✓	0			≤1	A	?	22	0.6	A	≤1	A	✓
		95th %ile		1.6		≤1.8						≤1.4				1.2		≤1.4		
Dissolved Zinc	mg/L	Median	47	1.6	A	≤2.4	A	✓	0			≤2.4	A	?	22	2.5	C	≤2.4	A	×
		95th %ile		4.4		≤8						≤8				16.8		≤8		
Ecosystem metabolism	g O_2 m^{-2} d^{-1}		0					?	0					?	0					?

Correction to paragraph 179 of my Statement of Primary Evidence

41 Through Hearing Stream 2, my understanding of the Pākuratahi River catchment was improved upon the receipt of the FST results presented in Table 8. Consequently, paragraph 179 of my Statement of Primary Evidence needs to be corrected as follows:

> *Of these only the Te Awa Kairangi/Hutt River @ Melling Bridge is impacted by the wastewater or stormwater network. Thus, this is the only site that needs to be prioritised by the network operators. The catchment upstream of the Pākuratahi River @ Kaitoke Campground site does not contain any of WWL managed wastewater network ~~has an upstream catchment almost entirely in native bush~~. If there is a human source of E. coli at this site, which is not supported by the limited faecal source tracking data, it presumably originates outside of the wastewater network ~~in the Council operated Kaitoke Regional Park Camp site~~. Similarly, the only wastewater network source Wainuiomata River @Richard Prouse Park is the pipe running between the water treatment plant and Richard Prouse Park. Even if that pipe is leaking into the Wainuiomata River, the E. coli concentrations in the discharge should not be sufficiently high to contribute to the TAS not being met (measured concentrations range from 0-250 cfu/100 mL – see link below[37]).*

Summary of compliance with notified and amended TASs

42 In Hearing Stream 2, the Panels requested that I compile a table showing which of the suspended fine sediment, *E. coli*, dissolved copper and dissolved zinc TASs are currently met. This is provided in Table 10 below for both the notified TASs and the amended TASs recommended in Appendix 2 of Ms O'Callahan Statement of Rebuttal Evidence[2].

Table 10: Assessment of which of the notified and recommended amended (as per Appendix 2 of Ms O'Callahan's Statement of Rebuttal Evidence[2]) suspended fine sediment, *E. coli*, dissolved copper and dissolved zinc TASs are currently met (as of 30 June 2024).

Whaitua	Part-FMU	Notified TAS				Amended TAS			
		Sus. fine sediment	*E. coli*	Dissolved Copper	Dissolved Zinc	Sus. fine sediment	*E. coli*	Dissolved Copper	Dissolved Zinc
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	×	×	?	?	×	×	?	?
	Te Awa Kairangi urban streams	✓	×	×	×	✓	×	✓	✓
	Waiwhetū Stream	✓	×	×	×	✓	×	✓	×
	Wainuiomata urban streams	×	×	✓	✓	×	×	✓	✓
	Wainuiomata rural streams	✓	×	?	?	✓	×	?	?
	Parangārehu catchment streams and South-west coast rural streams	×	×	?	?	×	×	?	?
	Korokoro Stream	✓	✓	✓	✓	✓	✓	✓	✓
	Kaiwharawhara Stream	✓	×	×	×	✓	×	✓	✓
	Wellington urban	✓	×	×	✓	✓	×	×	✓
TAoP	Taupō	✓	×	✓	✓	✓	✓	✓	✓
	Pouewe	✓	×	?	?	✓	×	?	?
	Wai-o-hata	✓	×	✓	×	✓	✓	✓	×
	Takapū	×	×	?	?	×	×	?	?
	Te Rio o Porirua and Rangituhi	✓	×	✓	✓	✓	×	✓	✓

Science input into the Insufficient Data Summary Table (dated 9th April 2025) tabled during Hearing Stream 2.

43 In the tabled amendments to Appendix 3 of her Statement of Rebuttal Evidence[2] (Insufficient data summary table) Ms O'Callahan has identified several points where she requires further science advice. I have liaised with Dr Valois to provide this advice which is set out in Table 11 below.

Table 11: Science advice requested in the amendments to Appendix 3 of Ms O'Callahan's Statement of Rebuttal Evidence[3] tabled during Hearing Stream 2.

Part-FMU	Insufficient data[11]	PC1 TAS / NBL	Conclusions/suggested approach for TAS with insufficient data	Combined Science Advise of Drs Greer and Valois
Ōrongorongo, Te Awa Kairangi and Wainuiomata small forested and Te Awa Kairangi forested mainstems	Periphyton biomass	A / C	Science team to confirm A setting is an appropriate setting here (I note this is a largely forested part-FMU)	No evidence an A state TASs is inappropriate based on periphyton cover data (see Table 1 of Dr Amanda Valois Statement of Rebuttal Evidence[12]
	Fish IBI	A	Science team to advise if monitoring is proposed and if so, provide advice to inform the appropriateness of this TAS setting	No evidence an A state TASs is inappropriate based on fishing data collected upstream (Fish IBI = 48)
	Copper and zinc	A	Recommend retaining, as while no current plan to monitor, I consider this is necessary for effective plan implementation; science team to comment on TAS setting (e.g. is it likely to be reflective of existing conditions based on current land use?)	No evidence an A state TASs is inappropriate given an absence of an obvious source of dissolved metals. The Council has initiated monitoring to confirm this.
Te Awa Kairangi lower mainstem	Fish IBI	A	Science team to advise if monitoring is proposed and if so, provide advice to inform the appropriateness of this TAS setting	No evidence an A state TASs is inappropriate as nearby sites are in the A-sate. Dr Valois has confirmed that the Council will monitor fish at representative sites in this part-FMU but not at the exact site specified in Table 8.4 as it is it too wide to effective fish across all habitat types.
Te Awa Kairangi rural streams and rural mainstems	Fish IBI	A	Science team to advise if monitoring is proposed and if so, provide advice to inform the appropriateness of this TAS setting	No evidence an A state TASs is inappropriate as upstream sites are in the A-sate. The Council will monitor this attribute at a representative site in this part-FMU.
	Copper and zinc	A	Recommend retaining, as while no current plan to monitor, I consider this is necessary for	No evidence an A state TASs is inappropriate given an absence of an obvious source of

[11] Excludes Fish IBI where TAS has been set as 'M', as TAS requires maintenance of existing state only, therefore this is expected to be achievable

[12] Rebuttal Evidence of Amanda Elizabeth Valois on Behalf of Greater Wellington Regional Council (dated 28th March 2025)

Part-FMU	Insufficient data[11]	PC1 TAS / NBL	Conclusions/suggested approach for TAS with insufficient data	Combined Science Advise of Drs Greer and Valois
			effective plan implementation; science team to comment on TAS setting (e.g. is it likely to be reflective of existing conditions based on current land use?)	dissolved metals. The Council has initiated monitoring to confirm this.
	Dissolved oxygen	A / C	Science team provide advice to inform the appropriateness of this TAS setting at the hearing because set more stringently than NBLs and no baseline to understand its impact or achievability	No evidence an A state TASs is inappropriate here given this river's cobble bed and the absence of macrophytes.
	Fish IBI	A	Science team to advise if monitoring is proposed and if so, provide advice to inform the appropriateness of this TAS setting	No evidence an A state TASs is inappropriate as it is achieved at nearby sites (Fish IBI > 40). The Council will monitor this attribute at a representative site in this part-FMU.
	Dissolved oxygen	A / C	Science team provide advice to inform the appropriateness of this TAS setting at the hearing because set more stringently than NBLs and no baseline to understand its impact or achievability	No evidence A state is not achievable through actions such as riparian planting to reduce water temperature and shade out macrophytes. Monthly spot data suggests site is potentially in the C state currently.
	Dissolved oxygen	A / C	Science team provide advice to inform the appropriateness of this TAS setting at the hearing because set more stringently than NBLs and no baseline to understand its impact or achievability	No evidence A state is not achievable through actions such as riparian planting to reduce water temperature and shade out macrophytes. Monthly spot data suggests site is potentially in the C state currently.
Wainuiomata rural streams	Fish IBI	A	Science team to advise if monitoring is proposed and if so, provide advice to inform the appropriateness of this TAS setting	No evidence an A state TASs is inappropriate. A state has been recorded nearby. The Council will monitor this attribute at a representative site in this part-FMU.
	Copper and zinc	A	Recommend retaining, as while no current plan to monitor, I consider this is necessary for effective plan implementation; science team to comment on TAS setting (e.g. is it likely to be reflective of existing conditions based on current land use?)	No evidence an A state TASs is inappropriate. However, Council have initiated monitoring to confirm baseline state. The resulting data should provide some indication of achievability by the integration hearing.
Parangārehu catchment streams and South-west coast rural streams	Dissolved oxygen	A / C	Science team provide advice to inform the appropriateness of this TAS setting at the hearing because set more stringently than NBLs and no baseline to understand its impact or achievability	No evidence A state not achievable here given this river's hydrology, bed-substrate and plant composition.

Part-FMU	Insufficient data[11]	PC1 TAS / NBL	Conclusions/suggested approach for TAS with insufficient data	Combined Science Advise of Drs Greer and Valois
	Copper and zinc	A	Recommend retaining, as while no current plan to monitor, I consider this is necessary for effective plan implementation; science team to comment on TAS setting (e.g. is it likely to be reflective of existing conditions based on current land use?)	No evidence an A state TASs is inappropriate. However, Council have initiated monitoring to confirm baseline state. The resulting data should provide some indication of achievability by the integration hearing.
Korokoro Stream	Periphyton biomass	B / C	Science team to complete 'existing state' numeric for Table 8.4 based on data now available and provide advice to inform the appropriateness of this TAS setting	No evidence TASs inappropriate. Nutrient criteria have been set to be consistent with achievement and suggest no action other than shading necessary.
	Dissolved oxygen	A / C	Science team provide advice to inform the appropriateness of this TAS setting at the hearing because set more stringently than NBLs and no baseline to understand its impact or achievability	No evidence an A state TASs is inappropriate here given this river's hydrology and bed-substrate.
Kaiwharawhara Stream	Dissolved oxygen	A / C	Science team provide advice to inform the appropriateness of this TAS setting at the hearing because set more stringently than NBLs and no baseline to understand its impact or achievability	No evidence an A state TASs is inappropriate here given this river's hydrology and bed-substrate.
Wellington urban	Dissolved oxygen	A / C	Science team provide advice to inform the appropriateness of this TAS setting at the hearing because set more stringently than NBLs and no baseline to understand its impact or achievability	No evidence an A state TASs is inappropriate here given this river's hydrology and bed-substrate.

Contribution of the freshwater E. coli TASs to the coastal Enterococci objectives

44 I have been asked to summarise the extent to which the freshwater *E. coli* TASs will achieve the coastal enterococci objectives. I note that in Table 2 of Statement of Primary Evidence Dr Peter Wilson demonstrates through interrogation of the CREST modelling described in Mr John Oldman's Statement of Primary Evidence that:

44.1 The notified *E. coli* TASs in the Porirua part-FMU are consistent with the load reductions required to achieve the notified coastal Enterococci objectives at all sites in the Porirua Harbour.

44.2 The amended *E. coli* TASs are consistent with the load reductions required to achieve the notified coastal Enterococci objectives at all sites in the Porirua Harbour except Waka Ama;

44.3 The amended *E. coli* TASs are consistent with the load reductions required to achieve the amended coastal Enterococci objectives at all sites in the Porirua Harbour based on the minimum required improvement:

44.3.1 Achieving the coastal objectives at all sites except Waka Ama; and

44.3.2 Achieving a greater improvement in 95th percentile Enterococci concentrations at the Waka Ama site than what is required by the amended objectives (71% improvement towards meeting 500/100mL compared to the amended objective of a 50% improvement towards meeting 500/100mL).

45 The absence of coastal modelling data, it is not possible to confirm the load reductions required to achieve the TAoP Open Coast Enterococci objectives or any of the TWT coastal Enterococci objectives that require an improvement. It is also not currently possible to identify the extent to which the freshwater *E. coli* TASs will contribute to those load reductions. Working out the load reductions required by those objectives under Schedule 32 (Wastewater Network Catchment Improvement Strategy) will therefore need to be undertaken as part of the wastewater overflow network consenting process.

DATE: 14th May 2025

PRINCIPAL SCIENTIST, DIRECTOR

TORLESSE ENVIRONMENTAL LIMITED

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