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 REBUTTAL EVIDENCE OF DR MICHAEL JOHN CRAWSHAW GREER

ON BEHALF OF GREATER WELLINGTON REGIONAL COUNCIL

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

28th MARCH 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 read the evidence and statements of:

2.1 Transpower New Zealand Limited – Submitter S177

2.2 Horokiwi Quarries Limited – Submitter S2

2.3 NZFFA – Submitter S26

2.4 China Forestry Group – Submitter S288

2.5 Wellington International Airport Ltd – Submitter S101

2.6 Friends of Waiwhetu Stream – Submitter S284

2.7 Guildford Timber Company – Submitter S210

2.8 Winstone Aggregates – Submitter S206

2.9 Rosco Ice Cream – Submitter S220

2.10 Pat Van Berkel – Submitter S282

2.11 Forest & Bird – Submitter S261

2.12 Upper Hutt City Council – Submitter S225

2.13 Wellington City Council – Submitter S33

2.14 NZTA – Submitter S275

2.15 Te Rūnanga o Toa Rangatira – Submitter S216

2.16 Porirua City Council – Submitter S240

2.17 Wairarapa Federated Farmers – Submitter S193

2.18 Wellington Water Ltd – Submitter S151

2.19 Meridian Energy – Submitter FS47

2.20 Hutt City Council – Submitter S211

3 In preparing this rebuttal evidence, I have also reviewed;

3.1 The submissions relevant to the Section 42A reports on Objectives and Ecosystem Health and Water Quality Policies;

3.2 Ms Mary O'Callahan's S42A Officer's Reports[1]

3.3 The Statements of Primary Evidence of:

3.3.1 Dr Antonius Snelder[2];

3.3.2 Dr Amanda Valois[3];

3.3.3 Mr James Blyth[4,5];

3.3.4 Dr Peter Wilson[6];

3.3.5 Mr John Oldman[7]; and

3.3.6 Dr Megan Melidonis[8]

3.4 The Statements of Rebuttal Evidence of:

3.4.1 Ms Susan Jean Tyson Ira[9]

3.4.2 Dr Amanda Valois[10];

3.4.3 Mr James Blyth[11];

3.4.4 Dr Peter Wilson[12]; and

3.4.5 Dr Megan Melidonis[13].

[1] 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)
Plan Change 1 to the Natural Resources Plan for the Wellington Region Section 42A Hearing Report. Hearing Stream 2: Ecosystem Health and Water Quality Policies. Prepared by Mary O'Callahan for Greater Wellington Regional Council (dated 28th February 2025)
[2] Evidence of Antonius Hugh Snelder on Behalf of Greater Wellington Regional Council (dated 28th February 2025)
[3] Evidence of Amanda Elizabeth Valois 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] Evidence of James Mitchell Blyth on Behalf of Greater Wellington Regional Council (dated 28th February 2025)
[6] Evidence of Peter Stanley Wilson on Behalf of Greater Wellington Regional Council (dated 28th February 2025)
[7] Evidence of John Warwick Oldman on Behalf of Greater Wellington Regional Council (dated 28th February 2025)
[8] Evidence of Megan Clair Melidonis on Behalf of Greater Wellington Regional Council (dated 28th February 2025)
[9] Rebuttal Evidence of Susan Jean Tyson Ira on Behalf of Greater Wellington Regional Council (dated 28th March 2025)
[10] Rebuttal Evidence of Amanda Elizabeth Valois on Behalf of Greater Wellington Regional Council (dated 28th March 2025)
[11] Rebuttal Evidence of James Mitchell Blyth on Behalf of Greater Wellington Regional Council (dated 28th March 2025).
[12] Rebuttal Evidence of Peter Stanley Wilson on Behalf of Greater Wellington Regional Council (dated 28th March 2025)
[13] Rebuttal Evidence of Megan Clair Melidonis on Behalf of Greater Wellington Regional Council (dated 28th March 2025)

4 This rebuttal evidence does not attempt to address matters raised in submitter evidence that relate to specific rules in PC1. Those matters will be addressed in evidence prepared for Hearing Streams 3 and 4.

QUALIFICATIONS, EXPERIENCE AND CODE OF CONDUCT

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

RESPONSES TO SUBMITTER EVIDENCE

6 My evidence addresses:

6.1.1 Dr Antonius Snelder[i];

6.1.2 Dr Amanda Valois[ii];

6.1.3 Mr James Blyth[iii, iv];

6.1.4 Dr Peter Wilson[v];

6.1.5 Mr John Oldman[vi]; and

6.1.6 Dr Megan Melidonis[vii]

6.2 The Statements of Rebuttal Evidence of:

6.2.1 Ms Susan Jean Tyson Ira[viii]

6.2.2 Dr Amanda Valois[ix];

6.2.3 Mr James Blyth[x];

6.2.4 Dr Peter Wilson[xi]; and

6.2.5 Dr Megan Melidonis[xii].

7 This rebuttal evidence does not attempt to address matters raised in submitter evidence that relate to specific rules in PC1. Those matters will be addressed in evidence prepared for Hearing Streams 3 and 4.

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

QUALIFICATIONS, EXPERIENCE AND CODE OF CONDUCT

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

RESPONSES TO SUBMITTER EVIDENCE

9 My evidence addresses:

9.1 Technical matters raised in the evidence and statements lodged by the submitters to PC1 listed in paragraph 2.

RESPONSE TO MATTERS RAISED IN SUBMITTER EVIDENCE FROM PORIRUA CITY COUNCIL

Load reductions required to achieve the amended TAS for E. coli, dissolved copper and dissolved zinc

10 In her S42A Officer's Report[15], Ms Mary O'Callahan recommends amending the *E. coli*, copper and zinc TAS in Tables 8.4 and 9.2 for the following part-FMUs by making them more lenient, to acknowledge the achievability issues associated with the notified TAS:

10.1 *E. coli*:

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

10.1.2 Te Awa Kairangi urban streams (C to D);

10.1.3 Waiwhetū Stream (C to D);

10.1.4 Waiwhetū Stream (C to D);

10.1.5 Wainuiomata urban streams (C to D);

10.1.6 Kaiwharawhara Stream (C to D);

10.1.7 Wellington urban (C to D);

10.1.8 Pouewe (B to C);

10.1.9 Taupō (B to C);

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

[15] 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)

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

10.2 Dissolved copper:

10.2.1 Te Awa Kairangi urban streams (B to C);

10.2.2 Waiwhetū Stream (A to C);

10.2.3 Kaiwharawhara Stream (B to C); and

10.2.4 Wai-o-hata (A to B).

10.3 Dissolved zinc:

10.3.1 Te Awa Kairangi urban streams (B to C);

10.3.2 Waiwhetū Stream (B to C);

10.3.3 Kaiwharawhara Stream (A to B); and

10.3.4 Wai-o-hata (A to B).

Load reductions required to achieve the amended TAS for E. coli, dissolved copper and dissolved zinc

11 In her S42A Officer's Report[xiv], Ms Mary O'Callahan recommends amending the *E. coli*, copper and zinc TAS in Tables 8.4 and 9.2 for the following part-FMUs by making them more lenient, to acknowledge the achievability issues associated with the notified TAS:

11.1 *E. coli*:

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

11.1.2 Te Awa Kairangi urban streams (C to D);

11.1.3 Waiwhetū Stream (C to D);

11.1.4 Waiwhetū Stream (C to D);

11.1.5 Wainuiomata urban streams (C to D);

11.1.6 Kaiwharawhara Stream (C to D);

11.1.7 Wellington urban (C to D);

11.1.8 Pouewe (B to C);

11.1.9 Taupō (B to C);

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

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

11.2 Dissolved copper:

11.2.1 Te Awa Kairangi urban streams (B to C);

11.2.2 Waiwhetū Stream (A to C);

11.2.3 Kaiwharawhara Stream (B to C); and

11.2.4 Wai-o-hata (A to B).

11.3 Dissolved zinc:

11.3.1 Te Awa Kairangi urban streams (B to C);

11.3.2 Waiwhetū Stream (B to C);

11.3.3 Kaiwharawhara Stream (A to B); and

11.3.4 Wai-o-hata (A to B).

12 In paragraph 7.32 of Ms Rodgers Statement of Evidence (on behalf of Porirua City Council (PCC)), she notes that in relation to *E. coli* "[i]*t would have been more helpful if Dr Greer could provide the load reduction required for Pouewe and Taupo* [part-FMUs] *to achieve the recommended S42A TAS*". In response to this, I have recalculated the load reductions associated with Ms O'Callahan's[1] recommended amendments to the *E. coli*, dissolved copper and dissolved zinc TAS in Tables 8.4 and 9.2 of PC1. These are provided in Table 1 as updates to Table 18 of my Statement of Primary Evidence[xiii] (updates in red ~~mark~~up).

Note: *The modelling limitations described in the note to paragraph 91 of my Statement of Primary Evidence[xiii] also apply to these updated numbers.*

Table 1. Updated (from Table 18 of my Statement of Primary Evidence[xiii]) indication of the extent of the load reductions required to achieve the dissolved copper, dissolved zinc and *E. coli* TAS that seek an improvement in these attributes. Updates (in red ~~markup~~) account for Ms O'Callahan's[1] recommended amendments to the *E. coli*, dissolved copper and dissolved zinc TAS in Tables 8.4 and 9.2 of PC1. See Greer[1] for methodology.

Whaitua	Part-FMU	Attribute	Load reduction
TWT	Kaiwharawhara Stream	Copper	~~53% (38% - 68%)~~ 0%
		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%
		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%

Achievability of the amended TAS for E. coli, copper and zinc

13 In paragraph 7.30 to 7.31 of Ms Rodgers Statement of Evidence, she comments that without the load reduction estimates provided in Table 1 there is significant uncertainty around the achievability of Ms O'Callahan's[1] recommended amendments to the *E. coli*, dissolved copper and dissolved zinc TAS in Tables 8.4 and 9.2. In response to this, I provide updates to Table 22 of my Statement of Primary Evidence[xiii] in Table 2. These updates (in red ~~mark~~up) account for the revised load reduction estimates in Table 1.

Table 2: Updated (from Table 22 of my Statement of Primary Evidence[xiii]) description of the TAS in Tables 8.4 and 9.2 of PC1 that I consider will be difficult to meet without significant mitigation and/or land-use change that goes beyond what is required by the regulatory provisions of PC1. Updates (in red ~~markup~~) account for the required load reductions (see Table 1) associated with Ms O'Callahan's[1] recommended amendments to the *E. coli*, dissolved copper and dissolved zinc TASs in Tables 8.4 and 9.2.

Whaitua	Part-FMU	Attribute
TAoP	Pouewe	~~*E. coli*~~
	Taupō	*E. coli*
	Takapū	*E. coli*
	Wai-O-Hata	*E. coli*
		Dissolved copper
		~~Dissolved zinc~~
	Te Rio o Porirua and Rangituhi	*E. coli*
TWT	Ōrongorongo, Te Awa Kairangi and Wainuiomata small forested and Te Awa Kairangi forested mainstems	Fish community health
		Dissolved reactive phosphorus
	Te Awa Kairangi lower mainstem	Q/MCI
		Fish community health
	Te Awa Kairangi rural streams and rural mainstems	*E. coli*
	Te Awa Kairangi urban streams	*E. coli*
		~~Dissolved copper~~
		~~Dissolved zinc~~
	Waiwhetū Stream	*E. coli*
		~~Dissolved copper~~
		~~Dissolved zinc~~
		Dissolved reactive phosphorus
	Wainuiomata urban streams	Ammonia
		E. coli
	Wainuiomata rural streams	Q/MCI
	Parangārehu catchment streams and South-west coast rural streams	*E. coli*
		Suspended fine sediment
		Dissolved reactive phosphorus
	Kaiwharawhara Stream	*E. coli*
		~~Dissolved copper~~
		~~Dissolved zinc~~
		Q/MCI
		Dissolved reactive phosphorus
	Wellington urban	*E. coli*

14 In paragraph 7.31 of Ms Rodgers' Statement of Evidence, she states that she considers "it likely that achievement of State C for Pouewe and Taupo FMU areas as recommended in the s42A Report to be unaffordable and/or unachievable by 2040". As it relates to the wastewater network, I do not agree with Ms Rodgers' statement on this matter. While Table 1 suggests that the load reductions associated with Ms O'Callahan's[1] recommended

amendments to the TASs for these part-FMUs exceeds 50%, wastewater is a minor contributor to *E. coli* in these catchments (<5% see Table 4). Consequently, the cost of achieving the amended TASs would be expected to primarily fall on the predominant land-cover; rural land-use.

RESPONSE TO MATTERS RAISED IN SUBMITTER EVIDENCE FROM WELLINGTON WATER LIMITED

Potential to achieve dissolved copper and zinc TAS through retrofitted stormwater treatment devices

15 In paragraph 8.29 of Mr Foster's Statement of Evidence (on behalf of Wellington Water Limited (WWL)), he notes "[r]*etrofitting stormwater infrastructure into existing urban infrastructure, results in a series of compromises around the size, design and cost tend to mean that 100% performance is often not achieved*". In her Statement of Rebuttal Evidence (upon which I rely) Ms Ira concurs with Mr Foster's assessment, while noting that retrofitted devices can still provide significant treatment. This has implications for the achievability assessment presented in Table 2 above.

16 When considering the proportion of the existing urban area that will require treatment to achieve the dissolved copper and zinc TAS, I assumed 100% treatment performance from raingardens, swales and constructed wetlands. Given Mr Foster's and Ms Ira's confirmation that this assumption is unrealistic, the extent of the required stormwater treatment in existing urban areas to achieve these TAS may have been underestimated in my Statement of Primary Evidence[xiii]. Nonetheless, I consider this risk to be small for the notified TAS in PC1.

17 Of the notified dissolved copper and zinc TAS that require an improvement from current state, only those for the Wellington urban part-FMU were not considered to be difficult to meet in my Table 22 of my Statement of Primary Evidence[xiii]. The estimated load reductions required to achieve the TAS for this part-FMU are small (<10%) (Table 1) meaning that the performance of retrofitted devices could be up to 70% less than what was assumed in my Statement of Primary Evidence[xiii] and the presented assessment in Table 2 would still apply (i.e., treatment would not be required over >50% of the existing urban area[16]).

[16] Reducing the load reduction factor for raingardens from 60-75% (as per Easton *et al*.[2]) to 9-18% (i.e.,, by 70%) results in the estimated proportion of the part-FMU that requires treatment to meet the copper and zinc load reductions set out in Table 1 increasing from 13% to 45%.

18 In contrast, given Mr Foster's and Ms Ira's assessment of the performance of retrofitted stormwater treatment devices, there is a risk that the achievability of Ms O'Callahan's[1] recommended amendment to the dissolved zinc TAS for the Waiwhetū Stream part-FMU has been overstated in Table 2 of this evidence. The load reduction set out Table 1 for that TAS is estimated to require 49% of that part-FMU to be treated by rain gardens[17]. This is just 1% shy of the threshold used to determine whether a TAS will be difficult to achieve in Table 2 above (and Table 22 of my Statement of Primary Evidence[xiii]) Consequently, I consider it likely that the reduced performance of retrofit devices means that treatment could be required over 50% of the existing urban area in this part-FMU (this is accounted for in Table 6 in the conclusions section at the end of this statement).

Notes: *As set out in paragraph 7.29 of Ms Rodgers Statement of Evidence the threshold for a TAS being considered difficult to meet in Table 2 above, and in Table 22 of my Statement of Primary Evidence[xiii], is simplistic (see footnote 40 to my Statement of Primary Evidence[xiii]). Specifically, it does not account for physical or economic constraints. Rather it only identifies where the TASs impacts the majority of the stormwater or wastewater network in a part-FMU.*

Requests for additional information in relation to Policies WH.P4 and P.P4

19 In paragraph 9.4 of Ms Hunter's Statement of Evidence (on behalf of WWL), she notes "*Wellington Water requires additional information to understand the implications of these policies and tables for the consenting, planning and operation of the wastewater and stormwater networks*". Specifically[18]:

19.1 A detailed assessment of the implications of the TAS on a sub-catchment basis to determine the appropriateness of the requirements (in the context of a 2040 timeframe), and implications for sub-catchment prioritisation; and

19.2 Further assessments to address the uncertainty regarding the modelled correlation between sediment loads and visual clarity.

[17] Assuming load reduction factors of 60% and 70% for roofs and paved surfaces as per Easton *et al*.[2]

[18] Ms Hunter also requested information on how sediment load reductions will be measured in the future, how would proportionate contribution to sediment is be measured and any reduction in this contribution be measured. However, I understand that these are consenting matters and will be a topic for Hearing Stream 4.

20 My response to these information requests is:

21 In paragraph 9.4 of Ms Hunter's Statement of Evidence (on behalf of WWL), she notes "*Wellington Water requires additional information to understand the implications of these policies and tables for the consenting, planning and operation of the wastewater and stormwater networks*". Specifically[xv]:

21.1 A detailed assessment of the implications of the TAS on a sub-catchment basis to determine the appropriateness of the requirements (in the context of a 2040 timeframe), and implications for sub-catchment prioritisation; and

21.2 Further assessments to address the uncertainty regarding the modelled correlation between sediment loads and visual clarity.

22 My response to these information requests is:

22.1 Mr David Cameron (Stantec) has helpfully assigned a part-FMU to each of the WWL defined 35 hydrological sub-catchments in Appendix 1 to Mr Foster's Statement of Evidence. In Table 3 I rely on this part-FMU assignment to give an indication of the sediment load reduction required in each of these 35 sub-catchments based on the notified versions of Table 8.5 and 9.4 of PC1. I have also provided the equivalent amended sediment load reductions developed in Mr Blyth's Statement of Primary Evidence[iii] and recommended in Ms O'Callahan's S42A Officer's Report[1].

Table 3: Assignment of the PC1 Table 8.4 and 9.4 sediment load reduction to the WWL defined 35 hydrological sub-catchments set out in Appendix 1 to Mr Foster's Statement of Evidence. Both the notified version of Tables 8.5 and 9.4 and Ms O'Callahan's recommended amendments to these tables[1] are considered.

Whaitua	WWL Sub-catchment	Part-FMU	Sediment load reduction required as per notified PC1	Sediment load reduction required as per Ms O'Callahan's recommended amendments
TAoP	Duck	Wai-O-Hata	0%	0%
TWT	Waiwhetu	Waiwhetu Stream	0%	0%
TAoP	Taupō	Taupō	0%	0%
TWT	Hutt Hulls Creek	Te Awa Kairangi urban streams	0%[1]	0%[1]
	Lower Hutt North			
	Lower Hutt South			
	Stokes Valley			
	Upper Hutt North			
	Upper Hutt South			
	Kaiwharawhara	Kaiwharawhara Stream	0%	0%
	East Coast	Wellington urban	0%	0%
	Eastbourne			
	Evans Bay			
	Island Bay / Houghton Bay			
	Karori			
	Lambton / Northern CBD			
	Lyall Bay			

Whaitua	WWL Sub-catchment	Part-FMU	Sediment load reduction required as per notified PC1	Sediment load reduction required as per Ms O'Callahan's recommended amendments
	North Harbour / Ngaurang			
	Owhiro Bay			
TAoP	Horokiri	Pouewe	0%	0%
TWT	Hutt Akatarawa	Orongorongo, Te Awa Kairangi and Wainuiomata small forested and Te Awa Kairangi forested mainstem	0%[1]	0%[1]
	Hutt Headwater	Orongorongo, Te Awa Kairangi and Wainuiomata small forested and Te Awa Kairangi forested mainstem		
	Hutt Mangaroa	Te Awa Kairangi rural streams and rural mainstems	51%	17%[1]
	Hutt Pakuratahi	Orongorongo, Te Awa Kairangi and Wainuiomata small forested and Te Awa Kairangi forested mainstem	0%[1]	0%[1]
	Hutt Speedys	Korokoro Stream, Speedys Stream and Dry Creek	0%[1]	0%[1]
	Hutt Whakatiki	Orongorongo, Te Awa Kairangi and Wainuiomata small forested and Te Awa Kairangi forested mainstem	0%[1]	0%[1]
TAoP	Kakaho	Pouewe	0%	0%
TWT	Korokoro	Korokoro Stream, Speedys Stream and Dry Creek	0%[1]	0%[1]
	Lower Hutt North	Te Awa Kairangi lower mainstem	24%	25%
	Lower Hutt South			
TAoP	Pauatahanui	Takapu	0%	0%
	Porirua	Te Rio o Porirua and Rangituhi	0%	0%
	Porirua Coast			
TWT	Wainuiomata	Wainuiomata rural streams	A	0%
	Wainuiomata Black Creek	Wainuiomata urban streams	50%	50%
	Wainuiomata Iti	Wainuiomata rural streams	7%	8%
	Wainuiomata Morton	Orongorongo, Te Awa Kairangi and Wainuiomata small forested and Te Awa Kairangi forested mainstem	0%[2]	0%[2]

[1]To achieve the suspended fine sediment for the cited part-FMU larger (~25%) reductions required to achieve TAS in sub-catchments that contribute to water quality in the Te Awa Kairangi lower mainstem part-FMU
[2]To achieve the suspended fine sediment for the cited part-FMU larger (~8%) reductions required to achieve TAS in sub-catchments that contribute to water quality in the Wainuiomata rural streams

22.2 The assessment requested by Ms Hunter to further address the uncertainty regarding the modelled correlation between sediment loads and visual clarity has already been provided in paragraph 42 to 53 of Mr Blyth's Statement of Primary Evidence[iii]. I do not consider further assessment warranted as no new information on this topic has become available since Mr Blyth drafted this evidence.

Wastewater as a contributor to the E. coli TAS not being met

23 In paragraph 11.10 of Mr Hutchison's Statement of Evidence (on behalf of WWL) he raises concerns that it is not clear whether "*the source of the E.coli is solely or even predominantly from leaking public wastewater infrastructure*". Fortunately, the existing technical work conducted during the whaitua and PC1 development processes provides an indication of the part-FMUs where wastewater may be an important contributor to *E. coli* loads.

24 The relative contributions of rural and urban land cover to *E. coli* in the absence of wet weather overflows is considered and built in directly and indirectly (via the inputting Contaminant Load Model (CLM)[3]) to the calibrated eWater Source model developed for the TAoP Collaborative Modelling Programme[2,4]. That model had a very good *E. coli* calibration with low bias and a good predictive performance for event based loads and 95th percentile concentrations. The model was calibrated from the following inputs:

24.1 In the absence of wastewater overflows 77% of urban *E. coli* losses are generated by cross-connections (*E. coli* yield/m^2 with and without cross-connections = 80,000 and 18,000 *E. coli*/m^2/yr; derived from the CLM[3]).

24.2 Both wet and dry-weather *E. coli* yields from urban land-cover equate to 39% to 42% of the yields from sheep and beef farming (based on the Table 7.3 of Easton *et al*.[4]);

24.3 Ipso facto, wastewater leakage *E. coli* yields in urban areas equate to 30% to 32% of that from sheep and beef farming (i.e., 77% of a field that equates of 39% to 42% of that from sheep and beef farming).

25 When paired with land-cover data for each of the sites listed in Tables 8.4 and 9.2 of PC1 (extracted from Appendix B3 of Greer *et al*.[5] at the link below[19]) the values presented above can be used to provide a rough indication of the estimated relative contribution of wastewater leaks to the *E. coli* loads at different monitoring sites compared to rural land-use. These estimates are provided in Table 4 below.

[19] 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

Notes: *These values do not consider the impact of wastewater overflows and are, therefore, underestimates of the urban contributions to E. coli.*

The eWater source model was only run for the TAoP Whaitua and was not calibrated for TWT.

26 The results set out in Table 4 suggest wastewater leaks may be an important contributor (>20% relative to rural land-use) to *E. coli* loads in the following part-FMUs:

26.1.1 Te Awa Kairangi urban streams

26.1.2 Waiwhetū Stream

26.1.3 Wainuiomata urban streams

26.1.4 Kaiwharawhara Stream

26.1.5 Wellington urban

26.1.6 Te Rio o Porirua and Rangituhi

Table 4: Indicative contribution of wastewater leaks to *E. coli* load in different part-FMUs compared to rural land-use. Based purely on landcover data in Appendix B3 of Greer *et al*.[5] and the assumption that wastewater *E. coli* yields in urban areas equate to 30% to 32% of that from sheep and beef farming (i.e., 77% of a yield that equates of 39% to 42% of that from sheep and beef farming – See paragraph 16).

Whaitua	Part-FMU	Site	Urban land-cover (ha)	Rural land-cover (ha)	Estimated relative contribution to E. coli	
					Waste water leaks	Rural
TWT	Ōrongorongo, Te Awa Kairangi and Wainuiomata small forested and Te Awa Kairangi forested mainstems	Whakatikei R. @ Riverstone	15.4	522.3	1%	99%
	Te Awa Kairangi lower mainstem	Hutt R. @ Boulcott	2972.0	6412.4	13%	87%
	Te Awa Kairangi rural streams and rural mainstems	Mangaroa R. @ Te Marua	68.6	3178.0	1%	99%
	Te Awa Kairangi urban streams	Hulls Ck adj. Reynolds Bach Dr.	502.3	18.0	90%	10%
	Waiwhetū Stream	Waiwhetū S. @ Whites Line East	644.0	12.1	94%	6%

Whaitua	Part-FMU	Site	Urban land-cover (ha)	Rural land-cover (ha)	Estimated relative contribution to E. coli	
					Waste water leaks	Rural
	Wainuiomata urban streams	Black Ck @ Rowe Parade	474.9	137.8	52%	48%
	Wainuiomata rural streams	Wainuiomata River D/S of White Br.	586.4	1110.5	14%	86%
	Parangārehu catchment streams and South-west coast rural streams	Mākara S. @ Kennels	8.5	4610.3	0%	100%
	Korokoro Stream	Korokoro S. @ Cornish St. Br.	100.6	285.8	10%	90%
	Kaiwharawhara Stream	Kaiwharawhara S. @ Ngaio Gorge	554.1	49.9	78%	22%
	Wellington urban	Karori S. @ Mākara Peak	323.3	15.1	87%	13%
TAoP	Taupō	Taupō S. @ Plimmerton Domain	85.6	822.8	3%	97%
	Pouewe	Horokiri S. @ Snodgrass	0.0	1173.4	0%	100%
	Wai-o-hata	Duck Ck @ Tradewinds Dr. Br.	273.1	512.9	14%	86%
	Takapū	Pāuatahanui S. @ Elmwood Br.	3.4	2297.8	0%	100%
	Te Rio o Porirua and Rangituhi	Porirua S. @ Milk Depot	1143.1	1240.7	22%	78%

Relative import of dry-weather wastewater leaks and wastewater overflows to E. coli attribute states

27 In paragraphs 11.13 of his Statement of Primary Evidence Mr Hutchison notes that he expects "*the focus on achieving the E. coli target attribute states for the 95%ile criteria would rely heavily on work to reduce wet weather overflows*". I am not convinced that this is universally the case.

28 Statistically speaking, for overflows to impact the 95th percentile in-stream *E. coli* concentration they would need to occur/impact water quality for more than 5% of the time (i.e., over 18 days a year). I understand from Blyth[6] (Appendix A) and Easton et al.[2] (Appendix B) that:

28.1 Between 2018 and 2019 there were no more than 13 overflows per year (on average) at a single location across the TWT Whaitua. While the Wainuiomata River did receive 82 overflows over this period (41 per year on average), they were spread across 14 locations. On that basis there may have been as few as three discrete events per year on average when this river was impacted by overflows.

28.2 Similarly, for TAoP while some rivers were subject to thousands of overflows between 2004 and 2014 (7950 for Porirua Stream), the number of locations (57 for Porirua Stream) means it is possible that no one river was subject to more than 9 discrete overflow events per year. On that basis, I consider it likely that the most effective way of achieving the *E. coli* TAS in urban areas is to prioritise the repair of dry-weather leaks.

Note: *this opinion only relates to the achievement of the TAS not the management of human health effects.*

29 Regardless of the most effective way of achieving the *E. coli* TAS, I note that Schedule 32 of PC1 does not actually require WWL to target works to achieve this outcome. Instead, I understand it requires them to achieve *a reduction in load* commensurate with what is required by the TAS. To be consistent with that schedule it would make sense for WWL to prioritise actions that result in the largest reductions in *E. coli* load for least cost, regardless of whether that load contributes to the *E. coli* TASs not being met, but that is an issue for WWL to determine.

RESPONSE TO MATTERS RAISED IN SUBMITTER EVIDENCE FROM NZ TRANSPORT AGENCY WAKA KOTAHI (NZTA)

Freshwater discharges from the State Highway network

30 In paragraph 6.13 of Ms Heppelthwaite's Statement of Evidence (on behalf of NZ Transport Agency Waka Kotahi (NZTA)), she states "[T]*he majority of the state highway network will discharge to freshwater environments which are likely considered deteriorated (relative to Copper and Zinc).*" This is not the case.

31 Geospatial analysis of the State Highway Network and the part-FMU boundaries for the TAoP and TWT Whaitua indicate that:

31.1 43% of the total State Highway network in the TWT and TAoP Whaitua lies within part-FMUs where an improvement from current state is required to achieve the notified TASs for dissolved copper and/or zinc[20] (Table 5). However, much of the State Highway network discharges direct to the coast. Once this is accounted for[21], just 35% of the State Highway network discharges to freshwater environments in part-FMUs where an improvement in dissolved copper and/or zinc is required (Table 5).

31.2 21 % of the State Highway network lies within part-FMUs where an improvement from current state is required to achieve the amended dissolved copper and zinc TASs recommended in Ms O'Callahan's S42A Officer's Report[1] (Table 5). This reduces to just 14% once direct discharges to the coast are accounted for[21].

Table 5: Analysis of length of State Highway network in part-FMUs that require an improvement (from current state) to meet the notified dissolved copper and zinc TAS in PC1 and Ms O'Callahan's recommended amendments to those TAS[1]. Separate analyses are also provided that only considers the part of the network that discharges to freshwater.

Part-FMU	Total length of SH network (km)	Length of SH network that discharges to freshwater (km)
Kaiwharawhara Stream	0.7	0
Te Awa Kairangi urban streams	27.8	27.8
Wai-o-hata	4.8	4.4
Wellington urban	22.7	13.7
Total length of SH network	**131.2**	
%age of SH network in part-FMUs not meeting notified metal TAS	**43%**	**35%**
%age of SH network in part-FMUs not meeting amended dissolved metal TAS	**21%**	**14%**

Applicability of dissolved copper and zinc TAS as end of pipe receiving environment standards for stormwater discharges.

32 In paragraph 6.22 of her Statement of Evidence, Ms Heppelthwaite's position is that the dissolved copper and zinc TAS in Tables 8.4 and 9.2 should apply at the "*objective / policy level as regional goals [and] the individual parameters must not become 'values' for*

[20] See Table 4 of my Statement of Primary Evidence for identification of where TAS are not currently met

[21] Determined through a conservative approach whereby only sections of the State Highway network immediately adjacent to the coastline were considered to discharge direct to coast. This will have resulted in an underestimate as some of the inland network will also discharge direct (i.e., not via an open stream or river) to coast via a pipe.

assessing either a consent application or imposed as consent conditions". Mr Bosworth and Ms Lockyer (also on behalf of NZTA) build on this in their shared Statement of Evidence; noting between paragraph 6.2 and 6.5 that the "*stormwater outfall and downstream receiving environment monitoring results should not be compared to TAS*". I agree with Ms Heppelthwaite, Mr Bosworth and Ms Lockyer on this matter.

33 It is my understanding that the dissolved copper and zinc TAS in Tables 8.4 and 9.2 of PC1 are primarily focused on managing cumulative effects at a part-FMU scale, rather than direct effects of point source discharges at a local scale. Dissolved metal concentrations at the TAS sites can be seen as a reflection the average impact of contaminant discharges from the entire upstream catchment. Achieving the TAS that require an improvement at these sites can, therefore, be achieved by:

33.1 Requiring that all streams meet the TAS set for the downstream site, thereby driving improvements at just those stormwater outfalls that discharge contaminants to a primary receiving environment with water quality in a more degraded state than the TAS; or

33.2 Requiring all emitters to improve regardless of water quality in their primary receiving environment so that the TAS is achieved at the specified sites while allowing for some '*under and overs*' in their upstream catchment.

34 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 TAS. Accordingly, I consider that network operators should primarily focus on reducing their contribution to the TAS not being met at the specific sites referenced in Tables 8.4 and 9.2 of PC1 rather than after reasonable mixing in the immediate receiving environment.

RESPONSE TO MATTERS RAISED IN SUBMITTER EVIDENCE FROM WINSTONE AGGREGATES

Issues with the wording of Objectives WH.O9 and P.O6

35 In paragraphs 7.8 to 7.12 of Mr Horrell's Statement of Evidence (on behalf of Winstone Aggregates (Winstone)), he raises issues with the wording of clause (c) of Objectives WH.O9 and P.O6 of PC1. Specifically, he considers that the wording requires an understanding of water quality data throughout the entire river network that simply does not exist. He also correctly notes that the applicability of the clause will vary through time

due to natural variability in water quality. I agree with Mr Horrell that the wording of the Objectives WH.O9 and P.O6 could be improved. Specifically, I consider clause (c) to be redundant as clause (a) and (b) already require that all attributes in all river reaches are at least maintained; which is the outcome sought by (c). Consequently, I consider deleting this clause is scientifically more appropriate than the amendment recommended under paragraph 7.12 of Mr Horrell's Statement of Evidence.

RESPONSE TO MATTERS RAISED BY MR PAT VAN BERKEL

Need for a benthic cyanobacteria TAS to ensure ongoing monitoring of the attribute

36 In Topic 6 of his Comments on the GW Objectives S42A report, Mr Pat van Berkel notes that "*if there is no measure* [of benthic cyanobacteria] *then GW state of the environment reporting will be blind to its existence and seriousness*". I do not agree with this statement for the following reasons:

36.1 The Council monitors cyanobacteria at primary contact sites over summer due to the requirements of the Section 23 of the Health Act (1956)[8] which directs local authorities to "*cause inspection of its district to be regularly made for the purpose of ascertaining if any nuisances* [e.g., cyanobacteria*], or any conditions likely to be injurious to health or offensive, exist in the district*". Thus, the NRP is not the primary driver of this monitoring; and

36.2 Benthic cyanobacteria is a component of periphyton, and will therefore continue to be monitored by the Council in its monthly assessments of periphyton cover at all State of the Environment (SoE) sites, regardless of whether it is included in PC1 or not.

37 That benthic cyanobacteria does not need to be referenced in PC1 to be confident that the Council will continue to monitor it is evident from the previous monitoring record. Specifically, cyanobacteria has been monitored in some form at all SoE sites since 2004, and at all primary contact sites since 2009[9]. This is despite cyanobacteria not being included in a relevant regional plan until the NRP was first notified in June 2015.

RESPONSE TO MATTERS RAISED IN SUBMITTER EVIDENCE FROM WAIRARAPA FEDERATED FARMERS

Absence of good information about the attributes where an improvement is required

38 In paragraphs 4.5 of Mr Matich's Statement of Evidence (on behalf of Wairarapa Federated Farmers (WFF) he mentions an "*absence of good information about what needs improvement*" under PC1. I do not consider this an accurate representation of the water quality data available for the TAoP and TWT Whaitua. As stated in paragraph 100 to 105 of my Statement of Primary Evidence[xii], an indication of "*insufficient data*" in Tables 8.2, 8.4 and 9.2 of PC1 a footnote referencing "*based on limited data*" is not generally a reflection of current data quality or quantity, rather it reflects data limitations that existed in September 2017 but may no longer exist. As set out in that evidence, the attributes and sites where measured or robust modelled state data remains sparse is limited to:

38.1 Dissolved oxygen at all sites;

38.2 Periphyton biomass at some sites;

38.3 Dissolved copper and zinc at non-urban sites;

38.4 Fish-IBI at most sites; and

38.5 All attributes in the Korokoro and Wai-O-Hata part-FMUs.

39 How future monitoring will fill the knowledge gaps around the state of the dissolved oxygen, periphyton , dissolved copper and dissolved zinc attributes is set out in Dr Amanda Valois Statement of Rebuttal Evidence[ix]. However, I note that Ms O'Callahan is seeking advice on the impacts of removing the dissolved oxygen attribute from Table 8.4 and 9.2 due to:

39.1 The current lack of monitoring data; and

39.2 The potential for future monitoring to be postponed until operational issues associated with deploying expensive continuous sensors in highly accessible and flood prone rivers are resolved.

40 In my opinion the removal of the dissolved oxygen attribute is unlikely to significantly change how aquatic ecosystem health is managed under PC1. Dissolved oxygen is already managed in most rivers via the periphyton TAS in Tables 8.4 and 9.2, the meeting of which relies on implementation of riparian planting and achievement of the associated nutrient outcomes (see paragraph 42 to 49 of my Statement of Primary Evidence). However, this

does not apply where the plant community is dominated by macrophytes not periphyton (e.g., the Taupo and Waiwhetu part-FMUs). Nevertheless, in the absence of specific dissolved oxygen TAS it is likely the Council will still need to manage oxygen in these rivers through Freshwater Action Plans, should other monitoring (macrophyte, macroinvertebrate and spot (one-off) dissolved oxygen) indicate it contributes to the non-achievement of the macroinvertebrate or fish TAS in Tables 8.4 and 9.2.

Riparian planting unlikely to improve visual clarity in soft-bottomed streams

41 In paragraph 5.9 of Mr Matich's Statement of Evidence he notes that there is a "*a question over how effective riparian planting actually is in achieving water quality improvements where other factors affect water pollution. In this regard, the increased likelihood of silt disturbance in soft-bottom stream beds is unlikely to be overcome by riparian planting*". I do not see a scientific basis for this assertion.

42 Of the rivers that have TAS that require an improvement in visual clarity to meet the suspended fine sediment TAS, only the Pāuatahanui and Mākara Stream have a soft bottom (see Table 4 of my Statement of Primary evidence of the current state of suspended and deposed fine sediment). Expanding on paragraph 152 and 153 of my Statement of Primary, neither of these streams meet the definition of a naturally soft-bottomed under the NPS-FM 2020 and it is my opinion that their present bed composition is likely a symptom of the same factors driving their poor visual clarity; i.e., elevated sediment input. The evidence base that riparian planting reduces sediment inputs through stripping particulates from overland flow and reducing bank erosion is too comprehensive. A recent review by Fenemor & Samarasing[10] provides a summary of the available literature, from which they conclude a 10 metre set back removes > 80% of sediment from overland flow while simultaneously increasing bank stability.

RESPONSE TO MATTERS RAISED IN SUBMITTER EVIDENCE FROM WELLINGTON BRANCH OF NEW ZEALAND FARM FORESTRY ASSOCIATION

State of deposited fine sediment in the Whakatikei River

43 On Page 7 of his Statement Mr Cairns (on behalf of Wellington Branch of New Zealand Farm Forestry Association (NZFFA)) notes that "*Table 8.4, lists the baseline state for Deposited Fine Sediment for Whakatikei River as grade C (25% cover). We understand that this figure was based on limited data. The current data for Whakatikei River from the GW website (March 2025) shows a median cover of 8.25% based on 11 samples. Lest the grade C*

category be used to justify land use changes for forestry in this catchment, could you please update the river state to grade A".

44 As set out in paragraph 95 and 96 of my Statement of Primary Evidence[xii] the NPS-FM 2020 defines the baseline state as "*as the best state out of the following:*

44.1 *the state of the attribute on the date it is first identified by a regional council under clause 3.10(1)(b) or (c)*

44.2 *the state of the attribute on the date on which a regional council set a freshwater objective for the attribute under the National Policy Statement for Freshwater Management 2014 (as amended in 2017)*

44.3 *the state of the attribute on 7 September 2017*"

45 For the compulsory attributes in the NPS-FM 2020, this definition limits the baseline state to the state of the attribute on 7 September 2017, as those attributes:

45.1 Were not developed by the Council under clause 3.10(1)(b) or (c) of the NPS-FM 2020; and

45.2 Did not have freshwater objectives set under the NPS-FM 2014 (as amended in 2017).

46 Consequently, I consider that the notified version of Table 8.4 includes the best available estimate of the baseline (not current) state of the Whakatikei River as defined by the NPS-FM 2020 (Te Awa Kairangi and Wainuiomata small forested, Te Awa Kairangi forested mainstems and Ōrongorongo part-FMU).

Over statements regarding the veracity of the water quality analyses presented

47 Throughout his Statement Mr Cairns presents over simplified analyses of the available water quality data to provide quasi scientific backing to statements made regarding the source and fate of sediment and colour in freshwater environments. Most, if not all, of these analyses in my opinion, do not provide an evidential basis for his conclusions. For example:

47.1 On page 9 he notes:

47.1.1 That in relation to the Mangaroa river "*that are clear seasonal fluctuations that are not readily explained*"

47.1.2 It is his "*hypothesis that Mangaroa Peatlands act as a massive sponge that delays water release*".

47.1.3 "*Another possibility might relate to effects of frost. Mangaroa Peatlands are a frost hollow, and conceivably winter frost (heave) might dislodge peat particles at the surface that can then enter Black Creek. Investigation as to the nature (organic/mineral) and particle size of sediment would help unbundle this scenario*".

48 None of these statements are correct. Seasonal fluctuations are very easily explained by reasons other than those speculated on by Mr Cairns. Specifically, it is driven by flow. This is evident from Mr Cairn's own Figure 1, and is made clear from the statistically significant (R2 = 0.862 P < 0.001) regression relationship between measured daily mean flow and visual clarity at the Mangaroa R. @ Te Marua monitoring site (see Figure 1).

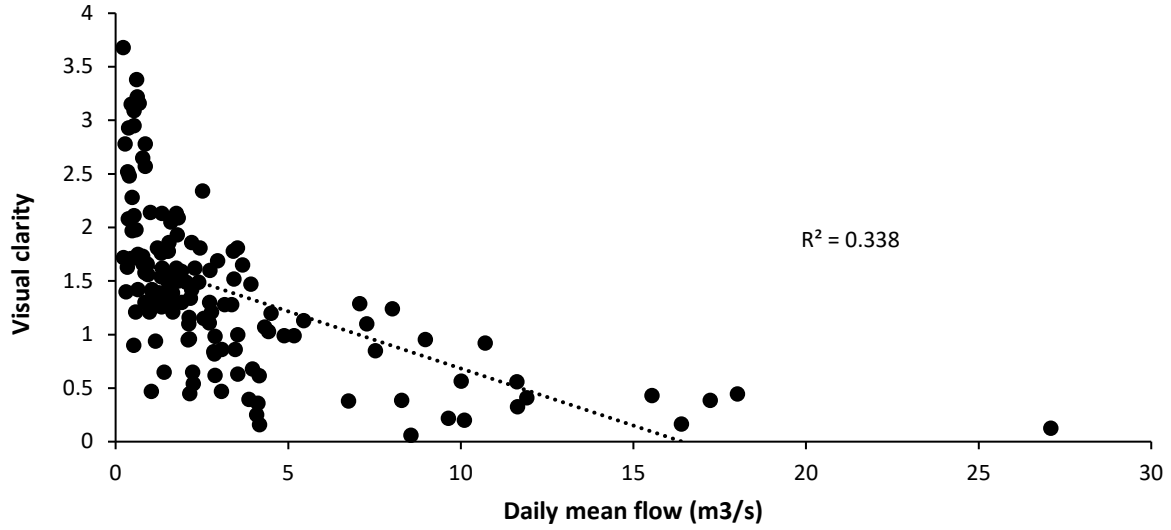

Figure 1: Relationship between visual clarity and flow at the Mangaroa R. @ Te Marua monitoring site (based on data analysed by Greer & Ausseil[11].

49 On pages 11 to 12 Mr Cairns states "Horokiri Stream VC data is an example of the lack of impact that forestry harvesting has on water clarity (at best, only a minor impact)". This is an over-simplification of the visual clarity data he considers when coming to this conclusion. There are none of the elements of robust scientific design in his data analysis, specifically there are no control sites or any replication. Without a structured before-after-control-impact design (BACI) there is no way to interpret the data from a single site in the way done by Mr Cairns. Of note, Mr Cairns analysis is contrary to the findings of numerous scientific studies on the impact of forest harvesting on in-stream sediment loads[12,13,14]

50 On page 20 Mr Cairns records that "Black Stream itself was full of suspended sediment (presumably organic peat debris) as well as CDOM, so could be regarded as a valid natural suspended sediment source". He then goes on to note that "Black Stream is also a significant contributor of "natural" suspended sediment". It is not possible to draw robust conclusions regarding the composition (organic vs inorganic) of suspended sediment in Black Stream, or its contribution to sediment loads in the Mangaroa River, from the limited data presented by Mr Cairns. Furthermore, the catchment of Black Stream is heavily developed. Thus, there is no scientific justification for stating that the sediment discharged from that catchment is 'natural'.

51 On page 21 Mr Cairns states "[t]he vast bulk of sediment comes in flood events and landslides, so short pulses of murky water, which might have minor effects on stream ecology, have only a low probability of being picked up at monthly sampling. It is infrequent flood events (and associated land slips and bank erosion) that delivers the vast majority of sediment to harbours and estuaries. Since the ultimate standard is median visual clarity (60 readings over 5-6 years), we should not be alarmed by pulses of murky water, provided discharges are minor and less than say 5% of the time". This statement is contrary to the scientific understanding of how sediment moves through freshwater systems. While a pulse discharge of sediment may only directly impact visual clarity for a short period, the sediment discharged will be continually deposited and resuspended in the downstream receiving environment[15] until it is ultimately discharged to the coastal environment. It is through that process that pulsed sediment discharge contribute to visual clarity during baseflows.

Representatives of TAS sites in the Mākara and Mangaroa catchments

52 On page 13 Mr Cairns sets out his agreement with other submitters that "*the official monitoring stations for water quality (especially at Mangaroa and Makara Stream) are not representative of all that goes on*". This is incorrect. The TAS site network in PC1 has been specifically designed with the cumulative effects of all activities in mind. Sites were 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*.[5] at the link below[22]). Importantly,

[22] 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

monitoring sites on both the Mangaroa River and Mākara Stream capture the effects of land-use of over 90% of their respective catchments.

CONCLUSIONS

53 As requested by Ms Rodgers (on behalf of PCC):

53.1 I have recalculated the load reductions required for all of Ms O'Callahan's[1] recommended amendments to the *E. coli*, dissolved copper and dissolved zinc TAS in Tables 8.4 and 9.2 of PC1; and

53.2 Provided an update to Table 22 of My Statement of Primary Evidence[xiii] that assesses which of the TAS in Tables 8.4 and 9.2 of PC1 will be difficult to meet once Ms O'Callahan's[1] recommended amendments to the *E. coli*, dissolved copper and dissolved zinc TASs are accounted for. This table is replicated below (Table 6).

Table 6: Final updated (from Table 22 of my Statement of Primary Evidence[xiii]) description of the TASs in Tables 8.4 and 9.2 of PC1 that I consider will be difficult to meet without significant mitigation and/or land-use change that goes beyond what is required by the regulatory provisions of PC1. Updates (in red ~~mark~~up) account for the required load reductions (see Table 1) associated with Ms O'Callahan's[1] recommended amendments to the *E. coli*, dissolved copper and dissolved zinc TASs in Tables 8.4 and 9.2 of PC1 and the reduced performance of retrofitted stormwater devices (as discussed in Mr Foster's Statement of Evidence.

Whaitua	Part-FMU	Attribute
TAoP	Pouewe	~~*E. coli*~~[1]
	Taupō	*E. coli*[2]
	Takapū	*E. coli*[2]
	Wai-O-Hata	*E. coli*
		Dissolved copper
		~~Dissolved zinc~~
	Te Rio o Porirua and Rangituhi	*E. coli*
TWT	Ōrongorongo, Te Awa Kairangi and Wainuiomata small forested and Te Awa Kairangi forested mainstems	Fish community health
		Dissolved reactive phosphorus
	Te Awa Kairangi lower mainstem	Q/MCI
		Fish community health
	Te Awa Kairangi rural streams and rural mainstems	*E. coli*
	Te Awa Kairangi urban streams	*E. coli*
		~~Dissolved copper~~
		~~Dissolved zinc~~
	Waiwhetū Stream	*E. coli*
		~~Dissolved copper~~
		Dissolved zinc
		Dissolved reactive phosphorus

Whaitua	Part-FMU	Attribute
	Wainuiomata urban streams	Ammonia
		E. coli
	Wainuiomata rural streams	Q/MCI
	Parangārehu catchment streams and South-west coast rural streams	*E. coli*
		Suspended fine sediment
		Dissolved reactive phosphorus
	Kaiwharawhara Stream	*E. coli*
		~~Dissolved copper~~
		~~Dissolved zinc~~
		Q/MCI
		Dissolved reactive phosphorus
	Wellington urban	*E. coli*

[1]Wastewater water network upgrades not considered in assessment due to low relative impact or urban landcover to E. coli (see Table 4)
[2]Primarily due to rural, rather than urban *E. coli* sources

54 I agree with Ms Rodgers (on behalf of PCC) that the amended *E. coli* TAS recommended by Ms O'Callahan's[1] will still be difficult to meet in the Pouewe and Taupō part-FMUs.

55 Mr Foster's Statement of Evidence (on behalf of WWL) on reduced performance of retrofitted stormwater devices is supported by the Council's own expert; Ms Ira. Accordingly, I have factored this into the assessment provided for the dissolved zinc TAS for the Waiwhetū Stream part-FMU in Table 6 above.

56 A detailed assessment of the implications of the suspended fine sediment TAS has been provided for WWL's hydrological sub-catchment as requested by Ms Hunter (on behalf of WWL).

57 As requested by Mr Hutchison (on behalf of WWL) I have identified that wastewater leaks may be an important contributor (>20% relative to rural land-use) contributor to *E. coli* loads in the following part-FMUs:

57.1 Te Awa Kairangi urban streams

57.2 Waiwhetū Stream

57.3 Wainuiomata urban streams

57.4 Kaiwharawhara Stream

57.5 Wellington urban

57.6 Te Rio o Porirua and Rangituhi

58 Contrary to Mr Hutchison's Statement of Evidence, I consider it likely that the most effective way of achieving the *E. coli* TAS in urban areas is to prioritise the repair of dry weather leaks as there appears to be a low risk of wastewater overflows impacting 95th percentile *E. coli* concentrations in rivers.

59 Ms Heppelthwaite's Statement of Evidence (on behalf of NZTA) is incorrect in stating that "[t]*he majority of the state highway network will discharge to freshwater environments which are likely considered deteriorated (relative to Copper and Zinc).*"

60 I agree with Ms Heppelthwaite, Mr Bosworth and Ms Lockyer (on behalf of NZTA) that the TAS for dissolved copper and zinc should not be applied as end of pipe standards for stormwater outfalls.

61 I agree with Mr Horrell (on behalf of Winstone) that the wording of the Objectives WH.O9 and P.O6 could be improved for clarity. Specifically, I consider clause (c) to be redundant and should be struck through as the outcome it seeks is already provided for by clauses (a) and (b).

62 I do not agree with Mr Pat van Berkel that a TAS needs to be set for benthic cyanobacteria to ensure monitoring for this attribute continues. There are multiple drivers for monitoring of this attribute outside of PC1 and this is evidenced by the Council monitoring it for twelve years prior to it being included in a regional plan.

63 I do not consider Mr Matich's (on behalf of WFF) statement that there is an "*absence of good information about what needs improvement*" under PC1 to be an accurate representation of the water quality data available for the TAoP and TWT Whaitua.

64 In my opinion the removal of the dissolved oxygen attribute from Tables 8.4 and 9.2 due to the operational issues associated with deploying expensive continuous sensors in highly accessible and flood prone rivers is unlikely to significantly change how aquatic ecosystem health is managed under PC1.

65 I do not see a scientific basis for Mr Matich's (on behalf of WFF) assertion that there is "*a question over how effective riparian planting actually is in achieving water quality improvements where other factors affect water pollution. In this regard, the increased likelihood of silt disturbance in soft-bottom stream beds is unlikely to be overcome by riparian planting*".

66 Throughout his Statement Mr Cairns presents over simplified analyses of the available water quality data. Most, if not all of these analyses in my opinion, do not provide an evidential basis for his conclusions.

67 I do not agree with Mr Cairns that the monitoring sites on both the Mangaroa River and Mākara Stream are not representative of the land-use in those catchments.

DATE: 28th MARCH 2025

DR MICHAEL JOHN CRAWSHAW GREER

PRINCIPAL SCIENTIST, DIRECTOR

TORLESSE ENVIRONMENTAL LIMITED

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[i] Evidence of Antonius Hugh Snelder on Behalf of Greater Wellington Regional Council (dated 28th February 2025)
[ii] Evidence of Amanda Elizabeth Valois on Behalf of Greater Wellington Regional Council (dated 28th February 2025)
[iii] Evidence of James Mitchell Blyth on Behalf of Greater Wellington Regional Council (dated 28th February 2025).
[iv] Evidence of James Mitchell Blyth on Behalf of Greater Wellington Regional Council (dated 28th February 2025)
[v] Evidence of Peter Stanley Wilson on Behalf of Greater Wellington Regional Council (dated 28th February 2025)
[vi] Evidence of John Warwick Oldman on Behalf of Greater Wellington Regional Council (dated 28th February 2025)
[vii] Evidence of Megan Clair Melidonis on Behalf of Greater Wellington Regional Council (dated 28th February 2025)
[viii] Rebuttal Evidence of Susan Jean Tyson Ira on Behalf of Greater Wellington Regional Council (dated 28th March 2025)
[ix] Rebuttal Evidence of Amanda Elizabeth Valois on Behalf of Greater Wellington Regional Council (dated 28th March 2025)
[x] Rebuttal Evidence of James Mitchell Blyth on Behalf of Greater Wellington Regional Council (dated 28th March 2025).
[xi] Rebuttal Evidence of Peter Stanley Wilson on Behalf of Greater Wellington Regional Council (dated 28th March 2025)
[xii] Rebuttal Evidence of Megan Clair Melidonis on Behalf of Greater Wellington Regional Council (dated 28th March 2025)
[xiii] Evidence of Michael John Crawshaw Greer on Behalf of Greater Wellington Regional Council (dated 28th February 2025).
[xiv] 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)
[xv] Ms Hunter also requested information on how sediment load reductions will be measured in the future, how would proportionate contribution to sediment is be measured and any reduction in this contribution be measured. However, I understand that these are consenting matters and will be a topic for Hearing Stream 4.