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 JAMES MITCHELL BLYTH

ON BEHALF OF GREATER WELLINGTON REGIONAL COUNCIL

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

28 MARCH 2025

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INTRODUCTION

1 My full name is James Mitchell Blyth. I am a Director and Water Scientist at Collaborations.

2 I have read the evidence and statements of:

2.1 Mr Liam Foster on behalf of Wellington Water

2.2 Mr Eric Cairns on behalf of New Zealand Federated Forestry Association (**NZFFA**)

4QUALIFICATIONS, EXPERIENCE AND CODE OF CONDUCT

3 My qualifications and experience are set out in paragraphs 5 to 10 of my statement of primary evidence[i] for HS2 on visual clarity and load reduction targets. 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

4 My evidence addresses:

4.1 Mr Liam Foster's concerns in Section 3.10 of his statement that Wellington Water currently does not have access to the data or analytical tools required to assess the correlation between contaminant load out of a pipe and contaminant concentrations (i.e. the target attribute state or **TAS**) in the receiving environment.

4.2 Mr Eric Cairns' concerns on behalf of the Wellington Branch of NZFFA on pages 7 - 8 and pages 24 - 27 of his statement in relation to sediment loads, visual clarity and empirical relationships in the Mangaroa River.

MODELS OR TOOLS AVAILABLE TO WELLINGTON WATER

5 In addressing paragraph 4.1 above, when considering analytical tools, such as a model, I would agree that currently, there is no readily available tool at Wellington Water's discretion to assess stormwater loading and receiving environment concentrations around PC1 in respect of the TAS. While a number of models exist, as described in my primary evidence[ii], they were developed by the regional council for supporting the National Policy

Statement for Freshwater Management (**NPS-FM 2020**)[1] and setting of limits and targets within each Whaitua.

5.1 Wellington Water has access to some of these models, including requesting and then utilising Te Whanganui-a-Tara (**TWT**) Whaitua CLM to undertake a pilot stormwater load and treatment assessment of Black Creek catchment in Wainuiomata in 2022.

5.2 In addition, Source Model water quality files were also requested by Wellington Water in 2023 for Te Awarua-o-Porirua (**TAoP**) Whaitua.

6 It is also worth considering that Wellington Water have been stakeholders in each of the PC1 Whaitua processes, providing technical support, reports, data, and contributing to the drafting of the Whaitua Implementation Programme (WIP) recommendations where possible. Subsequently, for nearly 10 years (since the start of the first TAoP Whaitua process to give effect to the NPS-FM 2014 and 2017 amended version), Wellington Water have been aware of the requirements of the Council and that limits and targets are likely to be set through a plan change process, as identified in their Stormwater Management Strategy (2023)[iii] which details the hierarchy of obligations of Te Mana o te Wai as part of the NPS-FM 2020.

6.1 In my opinion, this is an adequate amount of time to have identified a need to develop a tool or model (supported by appropriate monitoring), or improve on those models already available, to support decision making processes in relation to stormwater contaminants.

6.2 In addition, TWT WIP (2021)[iv] published ~3.5 years ago recommendation 59 also alluded to the need for such a tool; *The relevant three waters agency* develops *a standardised tool (by 2025) that can be used to assess a development's potential contributions of contaminants and hydrological impacts and recommends potential options to mitigate these effects using site-appropriate WSUD green infrastructure*.

7 I do acknowledge that modelling of stormwater loading and concentrations in an urban environment is complex, due to nature of contaminant deposition and transport

[1] MFE (2020). National Policy Statement for Freshwater Management. https://environment.govt.nz/publications/national-policy-statement-for-freshwater-management-2020-amended-january-2024/

processes, where build up and wash off cycles are driven by short duration events. While some councils have attempted to model this complexity in 15-minute time steps (Auckland Council 2021[v]) this has not been without significant challenges in achieving satisfactory calibrations, and requires extensive event-based stormwater monitoring, multimillion dollar commitments and a long-term plan in place for continuous model improvement and enhancement. Subsequently, I am supportive of practical modelling applications with robust monitoring in order to track water quality changes and hopefully, improvements over time.

8 Recently (over several months), to support a Council assessment of PC1, the customised contaminant load models (**CLM's**) developed for TAoP and TWT Whaitua were amalgamated by Collaborations[vi] to provide an annual average load model for assessing some of the notified provisions in PC1. While the model is simplistic and doesn't model point source discharges, instead focussing on average annual contaminant yields from different surfaces, it can provide useful information about contaminant hot spots, and high-level effectiveness of treatment devices within a catchment or tributary.

MONITORING DATA AVAILABLE TO WELLINGTON WATER

9 In addressing paragraph 4.1, Mr Liam Foster identifies that Wellington Water does not have access to the data necessary to support its assessments of contaminant loads from a pipe relative to the target attribute state in the receiving environment. As I understand, there is substantial data available to Wellington Water from their own monitoring network and the Councils data, which is publicly available. While they may not have information on discharge quality at every pipe, this does not negate the presence of data to help inform a tool development (reaffirming my position in paragraph 6.1).

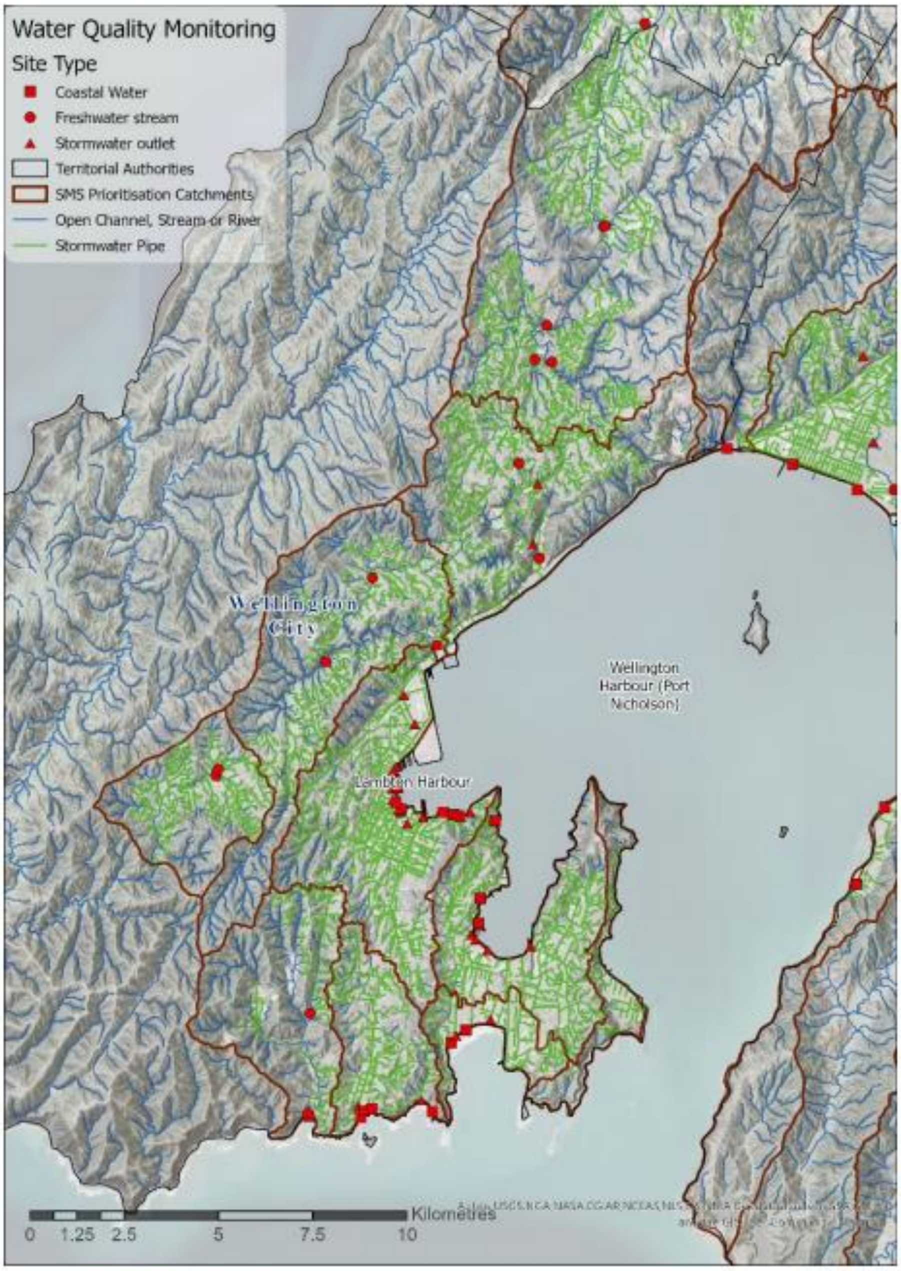
10 While I have not seen the extent of Wellington Water's monitoring network in recent years, I am aware that comprehensive water quality monitoring is undertaken as part of their global stormwater consent, which was broken into two stages[vii]. An example of this monitoring extent is presented in Figure 1. Particularly, stage 1 was a five-year process (November 2018 to November 2023[viii]) that focussed on data gathering and baseline stormwater quality data collection, while stage 2 (years 6 onwards) of this consent proposing a range of mechanisms to assess performance of stormwater improvements including:

10.1 Modelling to identify reductions in contaminants achievable by applying good practice measures.

10.2 Management practice commitments will be set and delivered on in Stormwater Management Strategies (**SMS**).

10.3 Monitoring stormwater and receiving water (as rationalised from Stage 1 monitoring) and using this data as a guide of the SMS programmes are effective in improving water quality.

Figure 1: Stormwater monitoring locations for the Stage 1 Global Consent in Wellington City catchmentsiii



MANAGAROA RIVER SEDIMENT LOAD AND VISUAL CLARITY RELATIONSHIPS

11 When considering the statement from Mr Eric Cairns (paragraph 2.2), it is noted Mr Cairns references Dr Murray Hicks comments relating to a 2023 report, despite Dr Hicks highlighting a conflict of interest in his email. Mr Cairns also states:

11.1 Dr Hicks states that when calculating required reductions in sediment load, it is therefore crucial that visual clarity and total suspended sediment (**TSS**) are highly correlated at low flow conditions.

11.2 I have found no evidence this was stated by Dr Hicks, nor that there is a requirement for visual clarity and TSS to be 'highly correlated' at low flow conditions.

12 As detailed in paragraph 14 of my primary evidence[i], suspended sediment has a strong negative correlation with visual clarity, where at higher suspended sediment concentrations a declining clarity condition will be evident. The majority of sediment load is also delivered during *high flow events*, where it is important that there is adequate amounts of monitoring data capturing these events to better inform the TSS:visual clarity correlations to predict suspended sediment load reductions.

12.1 When revising the sediment load reductions required to meet the TAS or national bottom lines in my primary evidence, I attempted to reduce uncertainty discussed in paragraph 47 through a number of approaches, specifically detailed in paragraph 48[i], which helps improve confidence in site relationships.

12.2 In addition, I specifically address the importance of this approach for strengthening the power equation used to predict sediment load reductions to achieve TAS in paragraph 49[i].

12.3 Reductions in sediment over the long term can continue to be tracked through the monitoring of visual clarity and TSS concentrations. Accepting that monthly state of the environment (**SOE**) monitoring may miss some event based flows in the short term, resulting in a greater proportion of samples taken at lower flow conditions, supplemental event based samples (see paragraph 50[i]) will support the longer term (5-10 year) assessment of visual clarity trends.

13 I accept that the coloured dissolved organic matter (**CDOM**) measurements with visual clarity and TSS are limited (as presented in Dr Amanda Valois evidence[ix]), however, this reflects the best available information at the time for assessing the contributions of naturally occurring processes, aligning with Clause 1.6 of the NPS-FM (2020). Specifically, a local authority must not delay making decisions solely because of uncertainty about the quality or quantity of the information available.

UNCERTAINTY IN CALCULATING REDUCTIONS IN SEDIMENT LOADS

14 Mr Cairns highlights on pages 22 to 27 a number of points in relation to uncertainty in sediment load reductions.

15 Firstly, he provides a figure showing predicted sediment yield (in tonnes/year) versus observed yield for a range of sites around the country and relates this to dSedNet loads in PC1, particularly Mangaroa River. This figure is from Hicks *et al.* (2011)[x].

16 This figure (and paper) presents the predicted sediment yield from the Suspended Sediment Yield Estimator (**SSYE**) tool, not SedNetNZ or dSedNet, the latter which was developed in TAoP Whaitua and was calibrated to ~4 years of continuous flow and suspended sediment monitoring data[ii]. They are not readily comparable.

16.1 This figure also has no relationship to Mr Cairns statement "*This graph also emphasizes that it is very difficult to relate remedial actions, taken to limit suspended sediment, to the observed effects"*

16.2 The figure simply presents the SSYE's performance at predicting loads compared to observed (monitored data) across the country. It has no connection to monitoring or modelling of landuse change or mitigations (such as those that may be implemented in PC1) over time and the resulting improvement in suspended sediment and visual clarity data that can occur after these changes.

16.3 Modelling can be a very useful tool to predict improvement in loads and concentrations over time, as detailed in my primary evidence[ii] with suspended sediment load reductions due to landuse changes and implementation of mitigations on land extensively documented in a range of technical papers[xi, xii].

16.4 Many regions utilise models to predict long term changes in average annual sediment load reductions[xiii] and supplement this with SOE monitoring and event based auto-sampling/continuous monitoring. Greater Wellington Regional Council also adopt this approach, as expressed throughout PC1.

16.5 I have recommended further monitoring and model improvement for the Council to expand their suspended sediment knowledge in PC1[i], however, this implementation is dependent on many factors, for example, the level of service required to install and maintain many continuous flow and suspended sediment/turbidity monitoring sites may necessitate hiring additional monitoring officers and likely increase regional rates to cover the permanent long-term commitment to such sites.

17 On page 24 of Mr Cairns evidence, he highlights aspects of the power equation developed for the Mangaroa River based off correlations with TSS and visual clarity. Specifically, the alpha coefficient (-0.561) and the r^2 correlation (0.65).

18 When considering the r^2 correlation, I have the following comments:

18.1 Mr Cairns opinion (derived from his analytical chemistry background) on the 'terrible performance' of the r^2 value correlating TSS and visual clarity is not appropriate for consideration of a naturalised model.

18.2 This empirical relationship between these two variables is being applied as a simple model to predict suspended sediment load reductions.

18.3 Moriasi *et al.* 2007[xiv] and Moriasi *et al.* 2015 are the most comprehensive international papers detailing expected model performance for a range of contaminants, including suspended sediment. Specifically, they identify that watershed scale sediment models on a monthly temporal scale would be considered to have a 'good' fit with an r^2 of 0.65 to 0.8, and satisfactory from 0.4 to <0.65. In addition, Hicks *et al.* (2019)[xv] also describe national TSS:visual clarity random forest models as performing 'well' with an r^2> 0.6.

18.4 Mangaroa River empirical relationship of TSS and visual clarity being used to predict load reductions would therefore be considered a 'good' fit.

19 When considering the alpha coefficient (-0.561) at Mangaroa River, Mr Cairns highlights this "*is at the extreme end of the range for all rivers sites calibrated. One needs to ask why it is so different, and whether the value is valid"*.

19.1 I argue that the alpha coefficient is valid, proven through a 'good' fit in the r^2 correlation (see paragraph 18), derived off 43 paired samples above detection limit, with 13 of these at higher TSS concentrations (>10 mg/L)[i], collected during higher flow events.

19.2 The alpha coefficient will vary between sites based on local conditions (geology, climate, erosion processes, land management and naturally occurring processes such as CDOM). CDOM contribution at this site has been considered with recent monitoring data, resulting in the Council adopting a method that corrected the load reduction through revising the site based bottom line from 2.22 m to 1.67 m, rather than modifying every paired TSS:visual clarity sample[ix, i].

19.3 This approach reduces the requirement for technical measurement and analysis and correction of SOE monitoring data following each sampling round, to refine the visual clarity measurement to account for CDOM contributions at lower TSS concentrations.

19.4 These corrections would only be significant at lower TSS concentrations, as my colleague Dr Valois has shown in paragraph 26 of her primary evidence[ix] there is a low contribution of CDOM during higher flows (2-4%), when most sediment is delivered. 18.319.1

19.5 Subsequently revised suspended sediment load reductions to meet the Site Bottom Line TAS for Mangaroa River are now -17% (with one standard deviation resulting in variance from 15 to 20%)[i] following the Councils adopted method.

19.6 Hicks *et al.* (2019)[xv] showed when assessing 77 monitoring sites as part of the National River Water Quality Monitoring Network (NRWQN) that the alpha coefficient (called *d*) varied from -0.38 to -1.07 with a national average of -0.76. This shows the national variability in site-based relationships of fine suspended sediment to visual clarity, and highlights the importance of using a sites monitored data to inform a relationship rather than a regional level value, if the data is available as detailed in MFE (2022)[xvi].

19.7 I therefore continue to recommend the TSS:visual clarity relationship detailed in paragraph 19.1 is appropriate for Mangaroa River for predicting sediment load reductions, to achieve the CDOM adjusted revised bottom line.

20 I understand that rebuttal to other aspects of Mr Cairns evidence (for example, Appendix 1 and 2) will be addressed in a more appropriate hearing stream (HS3).

CONCLUSIONS

21 Paragraphs 5 to 10 consider the modelling information and data available to Wellington Water to support their management of stormwater contaminants entering the receiving environment. This identifies that while it may not have a specific tool presently to assess point source loads and the contributions to a catchment specific TAS, it has been actively involved in both Whaitua processes for the last 10 years, have access to some models, and have extensive monitoring data collected under the Stage 1 stormwater global consent, which could have been used to develop such supporting tools.

22 Paragraphs 11 to 19.7 consider that some of Mr Cairns assumptions about the Mangaroa River TSS:visual clarity relationship used to predict suspended sediment load reductions are unfounded when compared against national literature and MFE guidance. The Mangaroa River TSS:visual clarity empirical model is considered a 'good fit' with an r^2 of 0.65. With the adjustment of the site based visual clarity target for CDOM as adopted by the Council, rather than individually correcting each SOE visual clarity measurement for CDOM, this reflects a suitable and practical method to predict the catchment suspended sediment load reductions (a median of -17%) in the absence of more detailed modelling or greater amounts of suspended sediment and visual clarity monitoring.

DATE: 28 March 2025

James Mitchell Blyth

Director and Water Scientist

Collaborations

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