

**BEFORE THE HEARINGS PANEL**

**IN THE MATTER** of hearings on  
submissions concerning  
the Proposed One Plan  
notified by the  
Manawatu-Wanganui  
Regional Council

---

**SUPPLEMENTARY EVIDENCE OF DR BARRY JOHN FRANKLYN BIGGS  
FOR THE WATER HEARING  
ON BEHALF OF HORIZONS REGIONAL COUNCIL**

---



## **1. PART ONE: INTRODUCTION AND EXECUTIVE SUMMARY**

1. I have prepared this report as supplementary evidence to my Section 42A report on the Proposed One Plan (POP). It has been compiled in response to evidence received from experts on behalf of submitters.
2. This evidence is in two parts:  
Part One: This Introduction and Executive Summary.  
Part Two: Issues raised by submitters experts and my responses.
3. I have read, and comment on here, the technical evidence of the following experts:
  - Dr Mike Scarsbrook on behalf of Fonterra Co-Operative Group Ltd
  - Mr Keith Hamill on behalf of Palmerston North City Council

## **2. EXECUTIVE SUMMARY OF SUPPLEMENTARY EVIDENCE AND REVISED RECOMMENDATIONS**

4. After consideration of the technical expert evidence, I would like to clarify some matters raised by these submitters' experts.
5. The key issues I am responding to relate to issues raised in their evidence regarding:
  - (i) the use of effects-based versus reference-based standards
  - (ii) periphyton growth and potential limiting nutrients
  - (iii) relative effects of natural versus land use associated enrichment of streams
  - (iv) application of the Ministry for the Environment Guidelines
  - (v) seasonal application of nutrient standards
  - (vi) application of the periphyton-nutrient model to Horizons' Region
  - (vii) uncertainty and adaptive management
  - (viii) seasonality of periphyton growth

6. I do not provide any revised recommendations as a result of my clarifications.

## **3. PART TWO: RESPONSE TO ISSUES RAISED BY TECHNICAL EXPERTS**

7. Table 2 below summarises the issues raised by submitters that I am responding to and outlines any explanation that is necessary.

8. I have focused on issues raised by submitters' experts that are not covered in my original evidence or require further explanation. Where issues are raised by submitters' experts that I consider are already covered by material in my original evidence I have attempted to minimise repetition by not commenting on it here. However, I am happy to address those issues in response to any questions the Panel may have.

**Table 2.** Summary table of matters raised by technical experts in evidence on the water provisions of the Proposed One Plan

Matter raised by submitters' experts	Expert	Degree of agreement	Explanation/ outcome
Effects-based standards versus reference-based standards	Dr M. Scarsbrook	Disagree	<p>Para #23 It would not be appropriate to disregard the whole POP approach to setting water quality standards because a limited number of situations (with natural enrichment) don't quite fit the framework. I believe that the appropriate, pragmatic, response is to revert to the reach incoming nutrient level as the default in situations where the catchment geology is such that high P levels occur, even though the vegetation cover is native vegetation (e.g. forest). This approach is recommended in my Section 42A report and that of Kate McArthur. The claim that the development of nutrient standards based on this model is inappropriate is discussed further below. It is also important to note, in relation to all of Dr Scarsbrook's queries, the issue of where nutrients are coming from (and natural background concentrations) is a regional issue and has no bearing on the validity of application of the wider ecosystem-derived ('values-based') approach to setting nutrient standards, nor to the application of the nutrient-periphyton biomass model of Biggs (2000).</p>
Growth limiting nutrient	Dr M. Scarsbrook	Disagree	<p>Para #28 I was involved in developing the Wilcock <i>et al.</i> (2007) recommendations and came to this conclusion as a specific recommendation for the POP after viewing regional water quality and catchment geology information which strongly suggested to me that it was likely that the limiting nutrient would switch (N to P, and vice versa) at any given site depending on the time of year and position in catchment. I have also found this to be the case in many other studies (e.g. Francoeur <i>et al.</i>, 1999). So, the recommendation in the POP (and Wilcock <i>et al.</i>, 2007) is an updated, region specific, application of understandings discussed in the background narrative to the periphyton guidelines. The recommendations of Wilcock <i>et al.</i> (2007) in relation to the need for year-round control of periphyton growth are also supported by the periphyton cover data presented in the supplementary evidence of Mrs McArthur. Graphs of periphyton total cover for several of the sites presented in Mrs McArthur's supplementary report indicate that periphyton growth and vigour, in catchments known to have elevated nutrient concentrations (e.g. the upper Manawatu catchment), are significant during May and June. The graphs presented show that periphyton recovers quickly, even after freshes exceeding the 20<sup>th</sup> percentile of flow, when the preceding cover has been high. This validated the assertion that upstream residual colony-forming material contributes to rapid recovery in the presence of elevated nutrients at the regional scale.</p>

Matter raised by submitters' experts	Expert	Degree of agreement	Explanation/ outcome
Relative effects of natural enrichment (from siltstone) versus farm derived enrichment	Dr M. Scarsbrook	Disagree	Para # 29 This is an oversimplification of the contribution of P-rich siltstones. As found by Biggs (1989), while P-rich rocks in a catchment can result in moderate to high periphyton biomass during extended periods of low flow, it is the combination of intensive land use and siltstone in the catchment that causes the highest levels of enrichment and most undesirable periphyton blooms, as described in Biggs (1995) (i.e. those that the POP is attempting to avert). There is also the issue of avoiding nutrient effects on downstream receiving environments. So, managing land development in siltstone catchments is still a valid objective that will benefit stream ecosystems and water quality.
Application of Ministry (MfE) for the Environment Guidelines	Dr M. Scarsbrook	Disagree	Para # 30 It is incorrect to assert that the primary driver for the MfE Guidelines was protection of life supporting capacity. There are several different values for which nutrient-periphyton guidelines have been developed (within the context of the flow regime). The outcome being sought by Horizons varies according to the Water Management Sub-zone and it is also incorrect to claim that protection of native aquatic ecosystems is the only outcome being sought in the POP (i.e. trout are not native species and the most restrictive benthic biodiversity criteria are only used in the POP in a few limited, and appropriate, situations). Also, there is no reason to suggest that Horizon's Region is any different to elsewhere in NZ (or the world for that matter) in terms of the link between periphyton/algal blooms and ecosystem health.
Seasonal application of Guidelines	Dr M. Scarsbrook	Disagree	Para # 31 While the worst blooms have been recorded in summer, observations show that periphyton blooms can occur at any time of year in the Region's rivers, providing there is an extended period of stable flows in the rivers (see Mrs McArthur's evidence). The WMZs are not just being managed for aesthetics/recreation.
Growth limiting nutrient	Dr M. Scarsbrook	Disagree	Para # 32 The fact that so many of the catchments contain significant amounts of siltstone, which increase background P concentrations, supports an approach that focuses on both N and P. Also, switching often occurs between N and P as the limiting nutrient, depending on time of year, size of the mat, extent of uptake/depletion of nutrients in the water column, and the type of periphyton growing at the site.
Effects-based standards versus reference-based standards	Dr M. Scarsbrook	Disagree	Para # 34 The suggestion of changing to a "reference-based" approach is something that Dr Scarsbrook has introduced. This is NOT the approach being adopted in the POP in relation to nutrient standards. Reverting to WMZ inflow nutrient concentrations in situations where there are naturally elevated P levels is designed to be a pragmatic and sensible modification of the values-based

Matter raised by submitters' experts	Expert	Degree of agreement	Explanation/ outcome
			approach to accommodate a few, uncommon, exceptions. I don't agree that the accommodation of these uncommon situations brings into question the validity of the overall approach and transferability of the standards.
Application of the periphyton nutrient model to Horizons' Region	Dr M. Scarsbrook	Disagree	Para # 36 I reject the tenet of this paragraph. Sufficient information is available on the Region's streams and rivers to commence the programme of nutrient management, as outlined in the POP. The nutrient periphyton model was developed using a very extensive dataset from throughout NZ (including a number of rivers from Horizons' and near-by Hawke's Bay regions) and there is no reason to suggest at present that the model does not apply to this region. The claim that the case for nitrogen control is weak is baseless: particularly given the presence of significant areas of siltstone in 52% of the catchments which will elevate P levels naturally; this places more emphasis on the need to control N, which is mainly derived from farming activities.
Compounding uncertainty and adaptive management	Dr M. Scarsbrook	Disagree	Para # 37 I reject the over interpretation of my qualifying statement and particularly the last sentence.
Effects-based standards versus reference-based standards	Dr M. Scarsbrook	Disagree	Para # 40 See comments related to Para # 34
Uncertainty and adaptive management	Dr M. Scarsbrook	Part Agree	Para # 63 There is uncertainty in the predictions if an accurate depiction of specific end-point maximum biomass is required. However, we are certain of the direction and magnitude of change, and this is the critical issue at the planning stage. Also, this is the best science available on this area at present. Back-up monitoring has been recommended, and is being carried out, which will feed into adaptive management to more closely achieve nominated outcome values in future years.
Seasonality in periphyton growth	Mr K. Hamill	Part agree but no change recommended	Sections 5.21-5.41 This is a useful analysis that uses existing data to show the variability in periphyton cover throughout the year, and the way that this varies spatially. However, what Mr Hamill has not done is to overlay the hydrographs which show that the winter-autumn seasons have the majority of the flood events; while the actual high flow which sloughs excess growth from the bed may only last for a few days, the effect on the periphyton can continue for many weeks, as it takes this long to grow back. Should the high flows not occur frequently in any given year, then the opportunity exists for a bloom to still develop.

#### 4. REFERENCES

- Biggs, B.J.F. 1995. The contribution of flood disturbance, catchment geology and land use to the habitat template of periphyton in stream ecosystems. *Freshwater Biology* 33, 419-438.
- Biggs, B.J.F. 1989. Biomonitoring of organic pollution using periphyton, south branch, Canterbury, New Zealand. *New Zealand Journal of Marine and Freshwater Research* 23, 263-274.
- Biggs, B.J.F. (2000). New Zealand periphyton guidelines: Detecting, monitoring and managing enrichment of streams. A report prepared for the Ministry of the Environment, Wellington, New Zealand.
- Francoeur, S.N., Biggs, B.J.F., Smith, R.A., and Lowe, R.L., 1999. Nutrient limitation of algal biomass accrual in streams: Seasonal patterns and a comparison of methods. *Journal of the North American Benthological Society* 18, 242-260.
- Wilcock, B., Biggs, B.J.F., Death, R.G., Hickey, C.W., Larned S. and Quinn, J.M. (2007). Limiting nutrients for controlling undesirable periphyton growth. A report prepared for Horizons Regional Council. *NIWA Client Report No: HAM2007-006*.

Barry Biggs

November 2009